girls, dancing & ball games. He is also really a friend of my brothers but I can get to appreciate him & thought the process would be necessarily slower. A coincidence in the fact that U grad was also from N.H. with his brother Jerome Hall (Jerry) in 1928. Jerry is now working in the research dept. in the Lab. Res. in the Sun. Par dept. in N.Y.

1 6/3/50
216
270

Item #2

DANIEL KLINE

I was unsuccessful in my efforts to see DANNY this week. As I did not wish to seem to force my friendship upon young KLINE, I suggested to my brother that he call him and that we all go to the baseball game together; this was over the holidays when my brother was not working. Unfortunately KL. had already made arrangements to take an automobile trip so the plan fell through. My brother works till about 9 or 10 o'clock every night during the week and was naturally unable to go anywhere and thought it would be best not to call KL. personally. I shall try again this week end.

MHC
MAH:HKF
65-1307

Daniel Klein 6/2/50

I was unsuccessful in my efforts
~~I have been~~ able to see Danny this week
as I did not wish to seem to force my
~~friendship~~ friendship upon young Klein
~~who~~ suggested to my brother that he
call him & that we all go to the
baseball game together; This was when
the holidays within my brother was not
working. Unfortunately Kl. had
already made arrangements to take an
automobile trip & the plan fell thru.
My brother works till about 9 or 10 o'clock
every night during the week and was
naturally unable to go anywhere & I
thought it would be best not to
call Kl. personally. I will try again
Possibly next
This week. end.

Item #29

DANIEL KLINE

I called Kl. Monday afternoon (he is done work at 4:20) and told him I had passes for the prize fights at the Cambria outdoor arena that night and as JOE (my brother) could not go, it would be a shame to waste them. Actually I had purchased the tickets in advance. He jumped at the opportunity and so we went to the fights. They were somewhat disappointing to me but young Kl. appeared to enjoy himself.

When we were driving home - DANNY had called for me in his car - he had mentioned that he was very thankful but I told him it was nothing, that I had often received passes from my friend, DOUGHERTY -- this is actually so. He said that he would like to return the favor and that he wanted me to go to the Hedgerow Theatre in Moylan, Rose Valley, near Philadelphia. This is a famous organization of actors who lived all year round in this community of their own and who have entirely built their own theatre and who have a repertoire of over 100 plays which they produce themselves. I said that I would be very glad to go and DANNY said he would work out and set the date this week end.

RHG
Beth:HKF
65-4307

6/3/50 Daniel Klein (see ...) date

I called Kl. — Monday ~~[illegible]~~ & told him I had passes for the prize fights at the outdoor Cambria ~~[illegible]~~ arena that night & my ~~[illegible]~~ for (my brother) could not go in ~~[illegible]~~ to watch them. He ~~[illegible]~~ would be a shame ~~[illegible]~~ (actually I had purchased the tickets in advance) ~~[illegible]~~ at the opportunity ~~[illegible]~~

I so we went to the fights. They were somewhat disappointing to me but young Kl. appeared to enjoy himself.

~~[illegible]~~ home - Danny took me when we were driving ~~[illegible]~~ in his car - he mentioned that called for me in his ... but I told him that he was very ... that I often ... it was nothing, that I often obtained passes from my friend Dougherty ... that he would like ... is actually so. He said that he wanted to return the favor & that he wanted to go to the Hedgerow Theater in ... Rose Valley, near Philadelphia. This is a famous organization of actors who have ~~built entirely ... produced the plays~~ ... in their ~~[illegible]~~ ... & who had ... ~~[illegible]~~ of their own theater & ~~produced~~ who have a repertoire of ~~the plays~~ over 100 plays which they produce themselves ~~[illegible]~~ ... (I ... the)

Item #24

1.

D. K.

On Wednesday we listened to the Louis-Schmeling fight on the radio. We were both pleased to see Schmeling beaten and agreed that it would be a tremendous blow to the myth of Aryan supremacy. I went on from there to point out the danger to the Jews in this country on the spreading of the very harmful propaganda by Hitler's emissaries and the great willingness which many people here (especially those of non-German ancestry) would accept such a doctrine. He said that he did not think the threat would ever really amount to anything in this country, but I pointed out that Hitler and his brown shirts right up until 1933, had been laughed at by most Jews in Germany and that there was a great danger in refusing to take this threat seriously.

My mother joined in and said that she knew what a gentle and law-abiding people the Germans had been when she was in Berlin and how they had been changed by the combination of propaganda and brutality.

I saw K.B. Friday again. We went to the Robin Hood Dell in Fairmount Park where the Philadelphia Orchestra gives outdoor concerts and opera performances.

RHE:mtp
65-4307

(1)

Wed. O.K. 6/7/50

K and I were listening to the Louis - Schmeling fight on the Radio. We were both pleased to see Schmeling beaten & agreed that it would be a tremendous blow to the myth of Aryan supremacy. I went on from there to point out the dangers to the Jews in this country on the spreading of the very great propaganda by Hitler's emissaries & the willingness which many people have (especially those of German ancestry) to accept such a doctrine. He said that he did not think the threat would ever really amount to anything in this country but I pointed out that Hitler & his Brown Shirts had been laughed at by most Jews in Germany 1933 & that there was just as great danger in refusing to take this threat seriously.

My mother joined in & said that she knew what a gentle & law abiding people the Germans had been when she was in Berlin & that they had been changed by the combination of propaganda & brutality.

When Kl. again [illegible] we went to the Robin Hood Dell in Fairmount Park where the Philadelphia orchestra gives outdoor concerts & opera & ballet soloists are presented all

Item #29

[redacted] [redacted]

Summer. During the intermission I mentioned that the works of Mendelssohn were forbidden in Germany. After the performance we talked of how terrible it must be in Germany with a Minister of Culture to judge what music should be played and by whom. This point went home as Danny is truly and passionately fond of good music.

We went to the Dell again Saturday as we both wanted to hear the orchestra as conducted by Alfred Wallenstein and it was well worth it. I thought it would be best to ease up on the pressure and mention nothing of the subject of the persecution of the Jews. We talked of girls and Danny said that he felt he was too young to attach himself permanently to any one. He wanted to be free to do as he pleased for some time yet. I agreed with him.

Danny came over Monday in spite of the rain. He had brought the fellow who had a half — in his automobile and we played cards all evening.

Wed we played tennis
(left out)

[redacted] [redacted]

RHO:mtp
65-4307

summer. During the afternoon
I met twice & that the women
forbidden in Germany & after the perfor-
& we talked of some tunes that must be
in Germany with a minister of Culture
to find what ~~was~~ music should be played
by whom. This point went round
as Danny - Tuley & personality found
of good music

6/3/50
No Bon

We went to the Ball again Saturday
as we both wanted to hear the
orchestra as conducted by Alfred Wallenstein
& it was well worth it. I don't it would
be sent to sea as on the previous ~~occasion~~
~~meeting~~ of the subject of the pronunciation
of the Jews. We talked of girls & Danny
said that he felt he was too old to
attach himself permanently to any one
& wanted to be free to do
as he pleased for some time yet. I
agreed with

Danny came over a row in spite of
the rain & ~~was~~ ~~invited~~ ~~for~~
~~a ride~~ We had brought the fellow
who had a share of that in his automobile
& had played cards all evening

We & ~~we~~ played tennis

Item #29

[redacted] [redacted]

At some courts close to where Danny lives - it was the first time in 2 years for me but I enjoyed it in spite of carrying my weight over the court for two hours. We cooled off with a long ride afterward and I told Danny jokingly that if Fascism ever came to this country we would have to give up tennis, as Jews would probably be barred from all places of amusement. He said quite seriously that he did not think it was such a joke and I saw then that he was coming around to the proper viewpoint. I did not press the point but let him do most of the talking.

I saw Danny again Thursday - by this time we had become so friendly that we would call every other time we wanted and we went to the movies. Our talk was again on the same subject and I gave our friend actual incidents which had occurred to people I knew showing the very open character of anti-Semitism. He said that I was right and wondered what could be done about it. I told him that the question had often troubled me and we left it at that.

[redacted] [redacted]

REG:mtp
65-4307

at work [illegible] close to where D was living - it was the first time in two yrs. for me that I engaged in it in spite of [illegible] my mind. over the coast for a day. We walked off with a day ride afterward & I told D my [illegible] if Fourier were [illegible] to this room he would want to quit his [illegible] from well places of amusement. He would quite seriously that he did not think it was such a joke & would [illegible] the [illegible] around to the proper viewpoint. I did not press the point but left him [illegible] 6/3/50 talking.

I saw D very again Tues. night. by this we had become so friendly that I [illegible] suggested [illegible] & then my [illegible] our Talk & [illegible] I met him at the [illegible] was again [illegible] the same subject & I [illegible] [illegible] on first [illegible] actual incidents which had occurred to [illegible] people & things of [illegible] the only open channels by which [illegible]. He said that I was right [illegible] & wondered what could be done about it. I told him that [illegible] the question [illegible] of the [illegible] & we left it at that.

O.K. 6/3/50 BKR BTD

I saw D. at. end. for. 9. [illegible] it was my
duty and brought all. by going to Rend. Docks for
a swim. We talked of the dept & things in
general. I avoid if the more sick the record of
go to movies in canada during the summer
[illegible] during the winter, what is
and don't see reason for him to work. in a shifting
dept. during the summer. the mind, or talent
and under better of whom the pple in the
small crowded stes of the slums
who did not even have the facilities or the
vs cents to go to a pool. I replied that what
was just the example, that most of the
middle class were apt to be grateful for the
small favors granted us, and caring. [illegible]
for girl since that is a larger sense, capitalizing
on it — to the very poor, [illegible] the solution
to the prob: is [illegible] is a long way off.
We went for. a quiet Wed. [illegible]
conv. around to the subj. of the prov. meth., two
of pointing out to & said that I did. not think
point a question or not it was well [illegible]
[illegible] the mind other than mere dis
ussion of ways & means to the end; also further, that
he would be glad to [illegible] the any small contrib
[illegible] to help [illegible] the all to get this book
released over the months ahead, that he
[illegible] had an strained feeling [illegible] not entering
whole heartedly into the matter upon any
merits of the prov. meth.

I was sent with N. H. Smith X
to N. H. [illegible]
[illegible]

Item #29

15

[redacted]

D. K.

[redacted]

D. was at my house Monday but spent most of the time with my brother talking about a party that they and some other boys were going to give for one of their group who was graduating from Temple University. I did arrange with our friend to go to the H. Theater on Thursday. My brother was unable to go on account of his late hours.

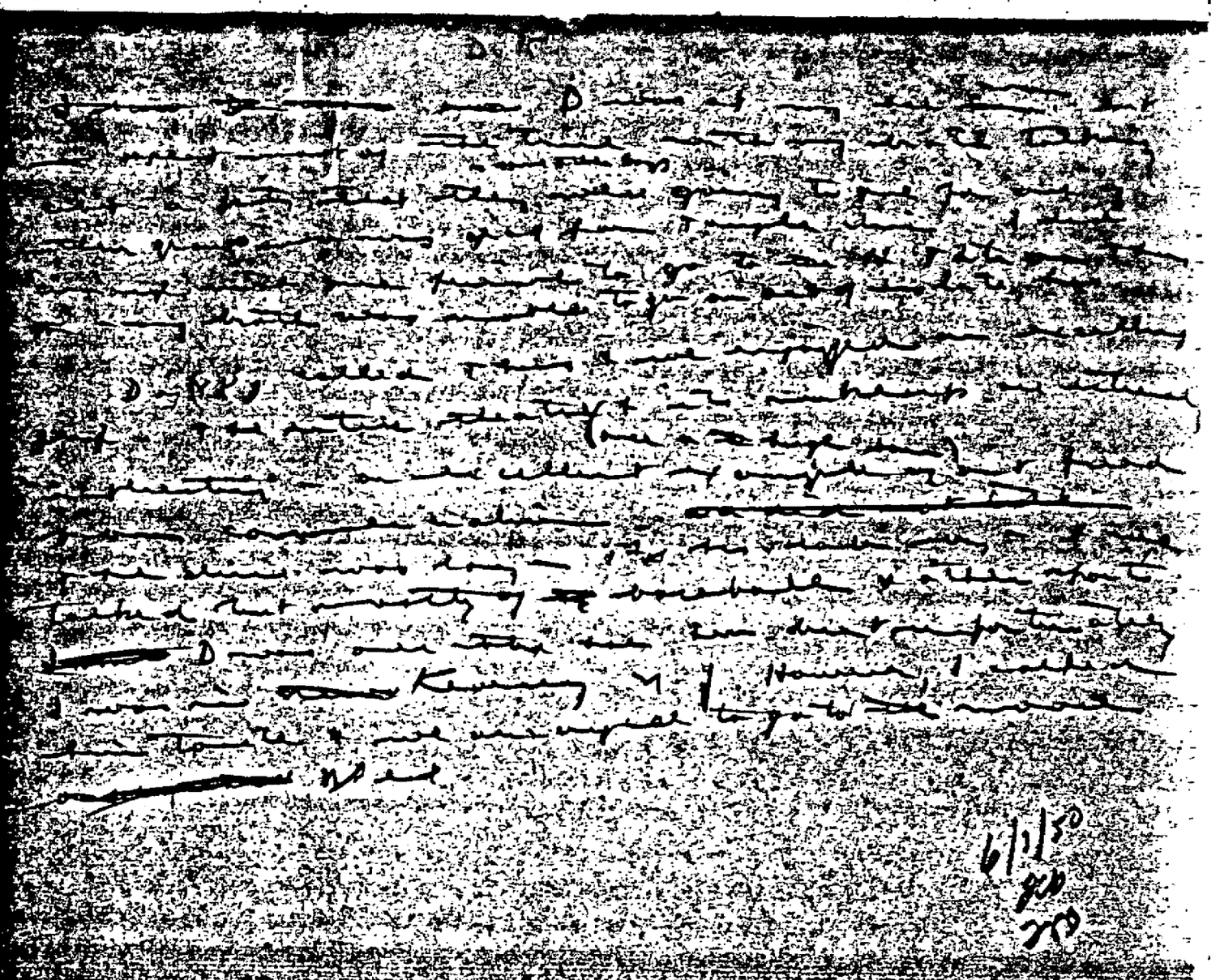
Y. K. called Thursday and we enjoyed an excellent performance. The entire theater (once a huge barn) and its make-up, are extremely interesting - an excellent example of art freed from commercialism. The drive was long, one and one-half hours each way, and we talked but mostly of baseball and other sports. D. was over at the house Sunday but unfortunately I was in Kenmay, N. J., however I called him tonight and we arranged to go to the movies. w/

[redacted]

[redacted]

RHD:mtp
65-4307

(2)



Item #24
FH 65-4307

D.K.

I spoke
First ~~V. publ.~~ of the heroic work of the Int. Brigade in Spain and how they were ready to die for a cause.

I saw D. Tuesday and proceeded straight to the point. Then asked him whether he was willing to further the cause of Democracy in its battle against Fascism, particularly I said it was necessary to strengthen the Soviet Union as the only bulwark against the encroaching horror and I reminded him that he several times mentioned he was willing to aid. What was he willing to do?

He said he really didn't know but he would make contributions within his means to. I told him that was good, but what was really wanted was information on the N. Yd. of a sort that would be valuable. He said that he could not do that under any circumstances and was very dangerous and besides it was against his principles. I told him he had the wrong idea, he was not going to loot the whole Navy Yard. I continued and told him that I knew for a fact that books and periodicals could be taken from the Naval Library by any employee, and that the apprentices did so all the time to aid them in their studies. A systematic study of such periodicals might yield some facts of interest. Another thing of use were plans of various buildings and names of Naval Officers that he know. There was certainly nothing inimical to the U.S. in such info, and it would be a great help in other places.

He continued to protest that he could not do such a thing. It was against his ethics, that he still thought it was dangerous and any slight hint of irregularity would be investigated. I said to remember that all the Fascist countries in the world were built up against the Soviet Union, that help in the direction I had mentioned was very necessary. If Fascism conquered he did not have to be told what it meant to the Jews in the world. Further, Further, I said his view was exaggerating the value of the work to be done.

DANNY continued obdurate and I saw that nothing could be done. I said in such a case we could forget the whole thing, but I was sure that sooner or later he would come to me and say that I was right. He seemed quite relieved and we parted on amicable terms.

I saw him again Thursday (August 4) and we went for a drive to escape the

(From here on - on back of page 2 ltr)

WRB:obn

Item #29
FBI 65-4307

boat. He appeared afraid that I would mention the subject again and he made the conversation and spoke of everything, also sports, girls, the boat, automobiles, etc. I tried to appear more friendly than usual and talked of future plans for going places, so we are still good friends.

First I determined from EPSTEIN and from a pamphlet issued by the N. Yd. in their apprentice system for training artisans that D. had not told the truth when he said no books or periodicals could be taken from the Naval Library. There is a circ. Lib. of 100 text books (both elementary and specialised) and 300 magazines (not all technical) and the men are encouraged to study the above themselves. The idea is to insure a steady supply of skilled workers for the future.

6/3/50 [illegible]

during [illegible] [illegible] that sooner or later he would come to me & say that I was right. He seemed quite at ease & we parted on amicable terms.

I saw him again [illegible] (August 4?) [illegible] [illegible] [illegible] [illegible] [illegible] [illegible]. He appeared [illegible] that I would mention the subject again [illegible] & he [illegible] the conversation & spoke of everything else — sports, girls, [illegible], automobiles, etc. He tried to appear more friendly than usual and talked of future plans for going places so we are still good friends.

Finished details from Captain [illegible] from a pamphlet [illegible] [illegible] in their apprentice system for training future artisans, that he had not told the truth. He said no books or periodicals could be taken from the main library, there is a min. lib. of 1100 [illegible] and 300 magazines ([illegible] technical) (both elementary & advanced) & the men are encouraged to study & advance themselves. The idea is to [illegible] a steady supply of skilled workers for the future.

Item #29

D.K. 27 E.E. 20

I saw KL. Monday, 2 p.m. and covered same general plan that had previously been followed. We spoke of the Kansas minister who was becoming a power in politics there by his advocacy of the principles of Hitler. D. said that he had never heard of him till lately. I replied that this preacher of hatred had been unknown till he made a trip to Germany in 1935 and on his return blossomed forth with a tremendious propaganda machine. What was the source of the money for such a campaign? I said the answer was obvious. I emphasized that this menace of brutal Fascism consequences must be fought and now. When we met again Tuesday I proceeded to carry out the proposed method on KLEE and I mentioned my hopes for getting ahead in the world and then said that he too should begin planning. We were speaking of my work at the PIC. He said that all examinations in his line were closed to him for three years as he had already had two promotions in less than a year, and I told him that this sitting back was exactly the wrong attitude, that as long as he was in the Civil Service he should cast about for a job requiring greater skill and which would naturally pay more; if he could combine his present administrative knowledge with that of a more technical nature, he would be in an enviable position as far as qualification for advancement. D. said that most jobs of this nature were filled by Naval officers. I said that from what he had told me that those men did not exert themselves too greatly and the active work was probably delegated to civilian employees who would need a similar knowledge to carry on their jobs. I said that we should begin at once to survey the field and thought that the best way to do this would be to tell the commanding officer in his department of his aim and to ask him what periodicals and books were available in the Naval library which would be of aid. With these we could make a thorough study of the matter and decide what would be most suitable for him. Further I said that I could

RHG
HKF
65-1307

O.K. (W). W.L. (W) 4/3/50

I saw Kl ~~this~~ [illegible] and pointed out that this procedure followed. We spoke of the Korean minister who [illegible] was showing a tendency to [illegible] by his adoption of the principles of Hitler. I pointed out to the Kl that by this Hitler method they could [illegible] attempt to start in 1955 [illegible] forth with a tirade of pro-fascist propaganda. [illegible] What was the answer? I said the answer was [illegible] for such a campaign. I said the answer was [illegible] I emphasized that this course of action [illegible] a campaign must be fought & won

[illegible] I proceeded to [illegible] that we must make a quick start. I said [illegible] saying that we proposed to check on [illegible] for getting ahead in the [illegible] that he too should begin [illegible] I was speaking of my work as Asst Sec for the future. He said that all communications in this line must be closed to him for about 4 yrs. as he had already had two prosecutions in less than a yr. I told him that this, although [illegible] was wrong attitude that on long as he was in the Civil Service he should work about for a [illegible] for one requiring greater skill & which would eventually [illegible] with the end in view of [illegible] the present administration [illegible] I said that [illegible] for advancement when [illegible] I said that [illegible] matter was filled by some of them. I said that [illegible] from which selection was made [illegible] the actual work was probably delegated to [illegible] principles who would act in similar capacity in his employment. I said that he thought he was at present [illegible] to carry out this [illegible] I said that the best way to do this would be to [illegible] the field & that the best way to [illegible] be to seek the corresponding officer in the Dept. of State [illegible] & to ask him what periodicals he deems most valuable [illegible] would be of aid. [illegible] With these we could make an [illegible] thoroughly study of the matter & decide what would [illegible] best suitable for him. I further said that I could

Item #24

[redacted] [redacted]

Be of great aid to him in technical studies such as math, physics, and engineering subjects.

D. thanked me for the offer but there was however, a growing reluctance on his face. Here, I continued, was also an opportunity for him to aid the cause of democracy and combat Fascism by strengthening the Soviet Union. There might possibly be in this literature, some valuable bits of information which one could not turn down for future use. Danny said that he would make inquiries the next day at work.

When I saw him Thursday, he said that he had found out that no periodicals or books or material of any kind could be taken out of the Yard - there was a rigid law to that effect. I told him this was of no great moment and could lay out a plan of study without it. At this he seemed obviously relieved. I then detailed for his schedule, the systematic study of higher mathematics and showed him how, by setting aside certain definite hours each week, he could easily master this beautiful science.

As regards his story about the regulations at the Navy Yard, I do not believe it, as the majority of the periodicals and texts are available at the Public Library. In fact, I once compiled a list of such magazines for our use. I think that he has some vague idea that by letting me see any material from the Yard, that he may compromise himself in some way. He had already told me that his mind had no real trend toward scientific knowledge.

I am greatly disappointed but I do not believe that the matter should be dropped. Our friend is young and much can yet be done toward forming his concepts and ideals.

[redacted] [redacted]

RHD:mtp
65-4307

we agreed to do this in ~~[illegible]~~ technical ~~[illegible]~~ and chemical ~~[illegible]~~ & engineering subjects.

Next, I continued, was the opportunity for him to visit the coast by observing & the conduct of fishing by steam trawlers. ~~[illegible]~~ I told him I should possibly be in this country a little more than a week & would like to get information which we could use for future work.

Dr. Murray said he would make arrangements ~~[illegible]~~ for me.

When I came to the periodicals & books, he said that we had a number of ~~periodicals & books~~ on the subject — which were a gift from the Admiralty & some of the officers

I told him this was of great assistance to us & ~~[illegible]~~ and we could carry out a piece of study with them. ~~[illegible]~~ This he promised obviously relished. I then ~~[illegible]~~ the schedule for the systematic study of the fish ~~[illegible]~~ & showed him how by setting aside certain ~~[illegible]~~ points, each of which could easily be ~~[illegible]~~ a beautiful whole.

As regards this story about the regulations & the way you & I do not subscribe to the ~~[illegible]~~ periodicals & ~~[illegible]~~ but to make available at the public library — in fact, I once compiled a list of such ~~[illegible]~~ for our use. I do not ~~[illegible]~~ think we do sound a good idea about by letting us all enjoy material from the yard, that the many ~~[illegible]~~ would ~~[illegible]~~ & ~~[illegible]~~ in some way. He had already told me about his ~~[illegible]~~ & ~~[illegible]~~ towards ~~[illegible]~~ & ~~[illegible]~~ knowledge.

I am greatly disappointed, but I do not believe that the matter should be dropped; our friend is young & much can yet be done towards ~~[illegible]~~ forming his concepts & ideals.

6/3/50 gp

Item #29

D.K.

I saw D. Saturday before he left on his trip. We spoke of the handling of British merchant men and from there went on to the discussion of governmental setup in Italy. I showed him the similarity in the dictatorships in Germany, Italy and Japan. Against this I cited the brave stand against overwhelming odds being made by Spain and China but I particularly stressed the aid given these unfortunate countries by Russia, the only true democracy in the world, and I contrasted this with the two-faced policy of Britain. All this seemed quite a new attitude to D. He said it was true but he had never thought of it before.

When we met again on Wednesday I began by a discussion of the McN investigation. I cited the searching questions of the Senator and the straightforward answers of EARL BROWDER. I showed how they dispelled many of the popular illusions of the big bad bogy of Communism. BROWDER's answers revealed the real purpose of the Communist Party in America as the preservation and the furtherance of real democracy. Against this I spoke of the answers given by F.K., especially where he stated that every Jew was an enemy of the U.S. and I interjected here that Soviet Russia is the only country in the world where anti-Semitism is a crime against the state. D. said that this was new to him. I went on from there to talk of the farewell dinner given Ambassador DAVIES in Moscow and of the address

(On back of page)

Incidentally I uncovered that he has charge of checking the receiving office's reports of welding supplies against the orders for the same to see if the quantities correspond.

RHC:HKF
65-4307

D. K.

I saw D. K. [illegible] in Turin [illegible] of an evening of Italian and American films. I then went on to the discussion of the governmental set-up in Italy [illegible] Turin I attended since the similarity in the U.S.A. of the U.S.A. to Japan the against which I acted was [illegible] against accumulating added [illegible] made by Spain & China. [illegible] particularly attacked the aid given [illegible] by Russia [illegible] the only true democracy in the world and I [illegible] with the two-third policy of Britain. [illegible] seemed quite a [illegible] to D. K. said that it was true but he had [illegible] of it before.

When we met again the next day [illegible] of our N.C.W. in which [illegible] the four [illegible] of the Executive and answers of each member. I also [illegible] of the big book copy of [illegible]. Miserable's answers revealed the real purpose of the Communist Party in America as the furtherance of democracy against which [illegible] of the answers given by F. K. [illegible] especially where he [illegible] stated that only four were in favour of the U.S.A. and interpreted that the only country in the world where anti-Semitism is a crime against the state and went on from there to talk of the Dreyfus case.

[illegible] farewell dinner given [illegible]. D. K. in [illegible] manner [illegible] of the address

6/3/50
JHH
JDD

Mr. Hurley, I am sure you will be glad to know that the Army Ordnance Office is moving ahead on the welding supplies against the orders for the same to meet the quarterly requirements.

Item #29

[redacted] After the Soviet Foreign Minister spoke of the warm friendship and in which he compared the similarity in ideals of his country and ours. This fact I said had long been understood by all thinking people. I digressed a little to flatter him as discreetly as I could. I said I remembered how intelligent his brother was. I spoke highly of his father's letters to the various newspapers.

I said that in addition to furthering the friendship between the United States and Russia, everything possible should be done to strengthen the democracy in the USSR against attack. If Russia were wiped out, the odds against the United States would be too great. I said I had, some time back, known of several organizations here for just that purpose (of aiding Russia) and since last week, he had said he would like to do something about the situation, I would look them up.

Till now, he had agreed with me but here he suddenly stopped and said that he would not join any group in any way connected or whose aims included any other country as they were under very strict supervision at the Navy Yard; he said that any hint of connection with an outside organization might result in their discharge. Though he did not mention the recent Nazi spy case, I knew this was what he meant. I tried to ridicule his suspicion of the Yard's suspicions and vigilance and their interest in the employees' private affairs. I also attempted to shame him into a show of manhood but all to no avail. I finally dropped the matter as if I were no longer interested and we talked of baseball the rest of the evening.

This is back of [illegible]

I hate very much to say this but I think we have here to contend with what is known as a "parlor pink" - a person who is willing to enjoy the fruits of a revolutionary struggle if he can first sit by and discuss it abstractly.

[redacted]

RHH:mtp
65-4307

by the Soviet Foreign minister in which he spoke of the warm friendship & the similarity of ideals of this country & ours. This fact & I mentioned had long been understood by all thinking people. I then proceeded a little to flatter him on diversity & culture & I should have mentioned tact & diplomacy on D's part ; I spoke of this further to various newspapers.

I said that in addition to fostering the friendship that existed between U.S.A. & Russia everything possible should be done to stem the advancing tide of Fascism & that the U.S.S.R. agency in attack it pursued was misguided & that only by a United front of the U.S.A. & U.S.S.R. could the two great powers of mankind be saved. I said that I was sure that such measures as (joint) action for peace (of aiding Russia) e.g. were in the mind of the President & that I would like to see him & that I would do something about the situation if I could.

I then left D.

Finally D said he agreed with me that some [illegible] would not favour any group in any way connected or associated with the U.S.A. in any way ; he would not favour any kind of any connection with any of our Trade Unions which might result in their discredit. I told him that we were not interested in any way — and I think that was the answer. I tried to ridicule the suspicion of the Soviet Government & its fifth column of our Trade Unions ; I attempted to show him the value of good will & to avoid.

I finally dropped the matter as I was no longer interested & we talked of U.S.A. & the Living

6/3/50
200
609

and
I note my ~~[illegible]~~ reaction to my visit of which
you have had to contend with ~~[illegible]~~
pressure on the part of [illegible]
to enjoy the fruits of our victorious struggle
it seems quite right & timely that we should,
at this time, [illegible]

26

SAC

6/8/50

SA WILLIAM H. MAYLOR

HARRY GOLD, was.
ESPIONAGE - R

RE: GOLD RESIDENCE SEARCH MATERIAL

Exhibit No. 65-4307-1-B-5 (29-19)

Reference memorandum, 6/6/50, Page 15.

Description:

A reprint from the Chemical and Metallurgical Engineering Magazine, May, 1945, of an article "Continuous Mixing and Reaction Equipment Design", by A. BROTHMAN, G. H. WOLLAN, and S. M. FELDMAN.

Possible Lead:

The last page of this article bears an ink notation in the margin which appears to be a telephone number. The first letter of the prefix is unreadable; however, the second letter appears to be an "A", while the number is 9-6093. GOLD should be interviewed as to the correct number, if known, the subscriber or the city wherein the exchange is located.

WHN:ams
65-4307

65-4307-1-B-5(29-19)

CONTINUOUS MIXING AND REACTION EQUIPMENT DESIGN

A. BROTHMAN, G. N. WOLLAN and S. M. FELDMAN
Respectively, A. Brothman & Associates, New York, and (Mr. Feldman) Merck & Co., Inc., Rahway, N. J.

IN THEIR BROADEST classification, continuous devices for mixing, dissolving and reaction can be divided into two types, variously known in the case of the first type as single-pass, plug flow, displacement or "streamlined;" and in the case of the second type as multi-pass, "non-streamlined," or pseudo-continuous. The first type, which we call here single-pass, includes all continuous mixers and reactors in which all portions of the effluent, practically speaking, have remained in the system for the same length of time and have not recirculated within the system, thus being "single-pass." The second type, referred to hereafter as multi-pass, includes those kinds of mixing and reaction equipment in which, because the material recirculates within the equipment itself, various portions of the effluent have remained in the system for varying lengths of time. In some equipment in this classification the flow path is fairly well defined and the flow can rightly be considered as making few or many "passes" through the equipment before discharge. In others the flow path is not well defined but the retention time of various parts of the effluent may still be defined by probability type calculations and can still be considered as having made varying numbers of passes before discharge. Regarding equipment of the second type, this article is mainly concerned with systems in which the multiple passages are in well defined paths, but as will be shown the same methods can be applied to other systems.

SCOPE AND AIMS

In this article, the aims will be several: to present the advantages and disadvantages of single- and multi-pass types; to illustrate a few forms of each type; and to show by examples how the design calculations may be made. For that purpose, in Tables I, II, III and IV we have assembled a considerable number of equations which were derived by rigorous mathematical means from well established concepts of physical chemistry, fluid mechanics and process equipment design. In the interests of brevity the derivations are omitted here* and in addition, the actual computations are mostly omitted from the examples, although the principles followed are explained and the data given in each case so that those who wish to follow the computations in detail may easily do so by substitution in the designated equations.

Typical single-pass systems are illustrated in Figs. 1 to 4. Such systems are common in vapor and solid phase continuous reactions, but less common in liquid phase and heterogeneous systems. An outstanding advantage of such systems is that they achieve steady-state conditions of operation almost instantaneously and the period of transiency, that is of unsteady operation, is short. In multi-pass systems, however, the period of transiency from start-up to steady state is necessarily longer since by definition the effluent of the system will have spent various times in the system from a minimum to a virtually infinite period. Examples of such systems are illustrated in Figs. 5 to 7.

The characteristic of transiency period is important not only in starting up, but also if the system must be purged of any contaminants that may be introduced, or if changing raw materials necessitate changes in process conditions. The time of a single pass is obviously the purging time of a single-pass system, but in multi-pass systems the recycling of newly fed material along with that already there means that greater than average retention time is required to achieve virtually complete displacement of the existing contents of the system. Purging time, then, is the time needed to displace by new flow any specified percentage of the system contents existing at the time when the new flow is introduced.

Some of the most important criteria that are used in deciding between single- and multi-pass continuous systems may be mentioned:

Single-Pass Systems—Situations favoring single-pass systems include fast reactions; those having a short induction period, that is, a short period of the kind shown by certain reactions which appear quiescent for a time before proceeding actively; those not requiring a high degree of mixing; those where frequent starts or purges may be needed; and those where little deviation from the average holding time can be permitted, as in many polymerizations. Other cases include liquid phase reactions where undesirable effects are produced by reaction products already in the system; processes that do not require removal of large amounts of exothermic heat during reaction; and those where sharp changes of pressure and/or temperature may take place.

Multi-Pass Systems—Situations favoring multi-pass systems include slow reactions; those with a long induction period; those with a critical mixing problem; and without serious transiency and purging problems. Other cases include processes where considerable deviation from the average holding time is allowable; where the presence of reaction products already in the system is either unimportant, or exerts a desirable auto-catalytic effect; where considerable amounts of exothermic heat must be removed during reaction and the temperature buffering effect on the feed of cooled recycled material is desired (as in Fig. 5); and finally, where sharp changes in temperature and/or pressure, which in a multi-pass system would needlessly upset the economic energy balance, are not encountered.

SINGLE-PASS REACTORS

For handy reference Table I lists the relations between throughput, extent of reaction completion, and system volume, which we use for the commonly encountered types of single-pass continuous reactor and mixer problems. This listing, of course, is not exhaustive.

In the tabulation we employ the following principal terms to classify reaction and mixing processes: Constant volume systems, variable volume systems, infinite contact reaction systems, and finite contact systems. A constant volume system is defined as any mixing or reaction process in which a zero or negligible change in the space occupied by all the components and/or phases, which make up the active system, occurs at any time during the mixing or reacting cycle. A variable volume system, on the other hand, is described by a significant change in volume. Infinite contact systems are those in which contact between the reactants is theoretically established on the ionic, atomic, or molecular level. A finite contact system is considered here to be any system in which the phenomenon involved occurs as a function of the area of contact, i.e., any interface phenomenon.

In the section of Table I devoted to constant volume, infinite contact systems, we have given the V_s-R-S relationships in terms of molar quantities and in concentration units. The form of the equations using the molar quantities will be particularly helpful where liquid phase reaction systems demonstrating a significant change in volume characteristic are encountered. In such instances, the volume factor, when it appears in the equation, may be given the log mean value between the initial and the final volumes of the system. Generally speaking, variable volume systems are met solely where gases or vapors are present as reactants under constant pressure. All of the equations have been derived on the basis of isothermal reaction conditions.

Some of the design factors, other than the volume of the system, which are important to the design of single-pass continuous systems, will be brought out in the course of the following illustrative examples.

ILLUSTRATIVE PROBLEMS

Problem 1—A batch reaction system of 1.43 gal. containing 0.525 lb. of $NiSO_4$ and 0.45 lb. of Na_2CO_3 (the carbonate being present in excess of stoichiometric requirements) is reacted to 97 percent completion at 100 deg. F. in a period of 3 min. Accurate dynamometer measurements indicate that the mixer shaft-horsepower over the reacting period averages 0.05 hp. It is desired to design a single-pass reactor system to achieve 99 percent completion of reaction and to react a flow of 1,000 lb. of $NiSO_4$ per hour. The reaction is a second order type and demonstrates a constant reaction volume characteristic. Equation (3) in Table I can be used by substituting $t = 3$ min. for its equivalent, V_s/R. Solving for k, the reaction velocity constant, where $V_s = 1.43$, $t = 3$ min., $N_{A_0} = 0.45 \div 106 = 0.00425$ mol, $N_{B_0} = 0.00339$ mol, $N_A = N_{A_0} - 0.97\ N_{B_0}$ and $N_B = N_{B_0} - 0.97\ N_{B_0}$, we find that $k = 1.118$ gal./(min. mol).

If 0.525 lb. of $NiSO_4$ is contained in 1.43 gal., it follows that an input of 1,000 lb. of $NiSO_4$ per hour would require a flow of $R = (1{,}000 = 1.43/(0.525 \times 60$ min.$) = 45.2$ g.p.m. Also, $N_{B_0} = (45.2/1.43)(0.525/155) = 0.105$, and $N_{A_0} = (45.2/1.43)(0.45/106) = 0.134$ lb.-mol per min.

Using Equation (3) for a constant volume, infinite contact, second order system where one of the reactants is present in excess of stoichiometric requirements, we find that, where $R = 45.2$ g.p.m., $k =$

* To those interested the authors will be glad to supply on request copies of a monograph that they have prepared, containing the full derivations of the final expressions and information on the various assumptions involved. This monograph also contains a section on the application of the equations developed in the authors' article in our April issue (*Chem. & Met.*, April 1945, pp. 102-6), to continuous blending equipment. That article, dealing with the kinetics of mixing, presented expressions that can be applied simply and directly to single-pass continuous mixers and are applicable somewhat less simply to multi-pass continuous mixers. Address Mr. Brothman at 114 E 32 St., New York.—*Editors.*

6)=[p/(e^{4.5}+p−1)]^4 from which p is found to equal 0.00567. Therefore R = pQ = 0.00567 × 2,130 = 12.1 g.p.m. If we then correct R as determined above for the condition of "instantaneous dilution" of the influent to each vessel in accordance with the note at the bottom of Table III, we find that the corrected throughput rate R would be 0.8 × 12.1 = 9.68 g.p.m.

We therefore first assume a value of R = 9.68 in applying the corresponding step-wise equation (Equation 20) found in Table II, from which x_0 is found to be 5.4. Then proceeding step-wise, we find x_3 = 4.5, x_2 = 3.04 and x_1 = 0.2. Since x_1 is so close to zero, it means that our first assumption for R is very nearly correct. By further attempts, the proper value of R is found to be about 9.5 g.p.m.

If instead we were to use two units, each with two vessels in series, the procedure would be as follows: Consider each two-vessel system separately, and determine the allowable throughput. In this case, x_m = x_2 = 6. We need only solve for x_1 and x_0. The capacity of the plant would then be twice this figure. It would be found that the plant capacity would be slightly less for the case of two parallel units of two vessels, than it would be for one unit of four vessels. In the latter case, the mean deviation from the calculated mean detention time would be less, which is often quite important in some processes.

Problem 6—In acidulating the chlorinated liquor in the manufacture of chloral by the chlorination of 95 percent ethanol, it is found that the chlorinated liquor must be refluxed "above" 96 percent sulphuric acid for a period of 1 hr. It has been considered consistent with the economics of the operation that in a plant producing roughly 93,000 lb. per month of chloral, not more than 5 percent of the incoming chlorinated liquor should pass from the continuous acidulator in less than 1 hr.

The acidulating tank consists of a 500-gal. working capacity vessel equipped with a draft tube and turbine mixer assembly. The turbine causes a turnover rate of 1,348 g.p.m. The feed and discharge nozzles are so located that for all practical purposes $t_m = V/Q$, or 0.371 min. If the combined flow of 96 percent acid and chlorinated liquor is 0.322 g.p.m., is the mentioned tank acceptable?

Let $R_{m,s}$ be that portion of the influent stream which spends a time equal to or greater than $(m + s)$ passes in a system consisting of m vessels in series. A stay of 1 hr. in one vessel $(m = 1)$ implies that $60/0.371 = m + s$ passes and s = approximately 161 passes. The value of $p = 3.22/1,348 = 0.000239$, whereby q is equal to 0.999761. Substituting these values in Equation (32) for $R_{m,s}$, using only the first term in the brackets (for one vessel), we find that $R_{m,s} = (0.999761)^{161} = 0.967$, which means that 96.7 percent remains 1 hr. or more. Therefore the proposed acidulating tank would be satisfactory.

PURGING A SYSTEM

Problem 7—A plant contains a continuous reactor system consisting of four 1,000 gal. working capacity multi-pass reactors in series. The system has become contaminated and it is now necessary to determine how long, under the normal conditions of throughput, it would take to return the system to normal operation by purging the existing contents of the system with a continued feed of new reactants. It is assumed that substantially normal operation will be regained when 90 percent of the contaminating component has been removed.

The circulating capacity of the mixer in each reactor tank is given as 2,000 g.p.m., the feed rate to the system is 50 g.p.m., and the minimum time required for one pass is 0.5 min. It will readily be seen that the "displacement" of the contaminated material by the feed stream is accomplished by mixing the feed stream with the existing contents of the vessel, and conveying the contaminated material in the "displacement stream."

It can be shown that the purging time may be calculated by setting $R_{m,s}$ equal to 10 percent. Using $R_{m,s}$, as defined in Problem (6), and substituting the values 0.98, 0.97 and 0.96 for q, the family of curves of Fig. 8 has been constructed for a series of four vessels $(m = 4)$, in which the proportion of feed remaining in the system for a time equal to or more than the time for $m + s$ passes has been plotted against values of $m + s$. Interpolating in Fig. 8 between the curves for $q = 0.98$ and $q = 0.97$ for the value of $q = 1 - 50/2,000 = 0.975$ it will be seen that only 10 percent of the effluent stream will consist of contaminated material after 280 passes. This would mean that 280 × 0.5 min. per pass = 140 min. must elapse, and that 0.5 × 280 × 50 g.p.m. = 7,000 gal. of feed would be required to obtain the desired amount of purging.

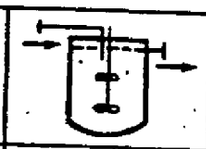
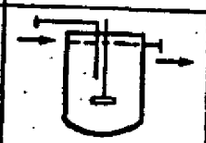
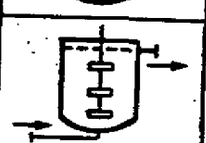
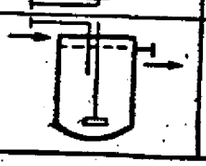
Problem 8—Let us assume the reaction system of the previous example, i.e., four reactors in series. The capacity of each reactor is 1,000 gal., the circulation rate of the agitator is 2,000 gal. per minute, and the throughput rate is 50 g.p.m. Now, in running the reaction batchwise, it is found that after 1½ hr. time there is practically no further reaction. How long will it take the system to reach virtual steady-state conditions after the time of start-up, if the system has been started by loading all of the reactors and operating them batchwise for the period of 1½ hr. previous to beginning the continuous feed of reactants?

It is quite apparent that once continuous feeding of the new stream of reactants is established, all of the batchwise operation contents of the system will spend 1½ hr. or more in the system. In order that steady-state operation may be approximated, it will be seen that the proportion of the batchwise contents of the vessel present in the effluent is reduced to that amount which, under steady-state conditions, has remained 1½ hr. or more. The proportion of material under steady-state conditions which would remain in the system for 1½ hr. or more would be that remaining for (1.5 hr. × 60)/0.5 min. per pass = 180 passes, or $R_{4,180}$. But the amount of time required to purge the batchwise contents of the system to a proportion of the effluent equal to $R_{4,180}$ would be 180 passes. This means the transiency time would equal 1½ hr. after continuous feeding of the reactants had begun.

It was mentioned earlier in this article that the equations given here for multi-pass systems are based on the use of equipment which employs a draft tube to channelize the internal flow. With certain small changes in some of the equations, as indicated in Fig. 9, types of equipment sketched in the left hand portion of this

Fig 9—Methods for evaluating t_m and right hand sides of Equations 18, 27, 28, 29, 30 and 31 for vessels in which flow is not channelized by draft tube

Note: Factor A here equals the right hand sides of Equations 18, 27, 28, 29, 30 and 31, where λ is the exponent of e in each equation. In Equations 19 to 25 incl., t_m for non-channelized flow equals Vs/Q

Vessel Construction		t_m	Factor A
Single or multiple propellor assembly		$\frac{V_E}{Q}$	As in Tables II and III
One double-suction turbine (approx. centrally placed)		$\frac{V_E}{Q}$	$e^{-(m-h)\lambda}\left(\frac{pe^{\lambda}}{e^{\lambda}-q}\right)^{m}$
n_9 double-suction turbines dividing tank vol. equally		$\frac{V_E}{n_9 Q}$	$e^{-(m-h)\lambda}\left(\frac{pe^{\lambda}}{e^{\lambda}-q}\right)^{n_9 m}$
One double-suction turbine at bottom of tank		$\frac{V_E}{Q}$	As in Tables II and III

1.118, N_{s_1} and N_{s_2} are as given above, $N_1 = (0.134 - 0.99 \times 0.105)$ and $N_2 = (0.105 - 0.99 \times 0.105)$, then $V_s = 204$ gal. which is the capacity of the reactor.

It will be observed that, since the value of k, the reaction velocity constant which we used to determine the reactor volume, was obtained with a work-input for agitation of $0.05 \times 3 + 1.43 = 0.105$ hp.-min. per gal., for a throughput rate of 45.2 g.p.m., we would have to provide for a work-input rate of $45.2 \times 0.105 = 4.74$ hp. for the size of reactor computed.

Thus, if a single-pass reactor of the type shown in Fig. 4 were used, the total drop across the orifice manifold, excluding normal friction losses in flow through the container, would have to be approximately $4.74 \times 33{,}000 \div (45.20/0.134) \times 70 = 3.64$ ft. pressure drop where the apparent average density of the reaction mass is 70 lb. per cu. ft.†

Problem 2—Let us consider the design of a unit for the production of acetone by the catalytic conversion of acetic acid vapors. This process, first reported by Squibb about 1896, involves the passing of acetic acid vapors, at 400-500 deg. C. and atmospheric pressure, over a barium oxide or similar type catalyst. The reaction is given as:

$$2\,CH_3COOH \longrightarrow (CH_3)_2CO + CO_2 + H_2O$$

and is therefore seen to involve an increase in vapor volume as the reaction progresses from 2 mols of reactant to 3 mols of product.

Let us assume that we wish to produce 1,000 gal. per day of acetone with an overall reaction yield of 92 percent using barium oxide as the catalyst and maintaining a temperature of 400 deg. C. and a pressure of 1 atm. in the system.

ACETONE REACTOR

The working design equation is Equation (12), Table I. Referring to the equation, it is obvious that all terms necessary for calculating V_s are known, with the exception of the reaction velocity constant k. In this type of reaction, although the continuous large scale unit is run at constant pressure, it would be extremely difficult to run a batch reaction under the same conditions. A constant pressure batch reactor, for a varying volume system, would necessitate some sort of gas-tight sliding piston or accordion-like arrangement, such as a gasholder. Fortunately, the value of the reaction velocity constant k is relatively independent of pressure, and is a function only of temperature and the units employed. We may, therefore, run a batch reaction at constant volume to determine k, making certain that the temperature of the batch is the same as will be employed in the continuous system.

For this particular acetic acid to acetone reaction, although the authors have not done any laboratory work themselves, the results of a small scale experiment were described by Squibb (*J. Soc. Chem. Ind.*, Vol. 15) in which he used a rotary still to convert 1,700 lb. of acetic acid to acetone with a 90 percent yield in 126 hr., the still being 2 ft. in diameter and 12 ft. long. Although the literature does not state whether this was run as a batch reaction (at constant volume and increasing pressure), or as a small scale continuous reaction, the latter is more probable, and will be used to calculate k. In this case $V_s = (\pi/4)D^2L = (\pi/4) \times 4 \times 12 = 37.8$ cu.ft.; $T = 400$ deg. C. $= 752$ deg. F. $= 1{,}212$ deg. F. abs.; $P = 1$ atm. $= 2{,}120$ lb. per sq.ft.; R_g = the gas constant $= 1{,}543$; N_{s_1} = mols entering per min. $= 1{,}700/(60 \times 126 \times 60) = 0.00375$; N_s = mols leaving per min. $= 0.1 \times 0.00375 = 0.000375$; and ψ = sum of coefficients of products $= 1 + 1 + 1 = 3$. Substituting in Equation (12) we find that $k = 1{,}310$ cu.ft./(min. mol.).

Now, for our particular design problem the desired production = 1,000 gal. acetone per day = 6,560 lb. per day = 113 lb.-mol per day. Since 2 mols of acetic acid is required for 1 mol of acetone, and with 92 percent reaction yield, the necessary input of acetic acid can be calculated from Equation (12) where $N_{s_1} = 2 \times 113/(0.92 \times 24 \times 60) = 0.171$ lb.-mol per min., $N_s = 0.08 \times 0.171 = 0.01368$ lb.-mol per min., and R, T, P, K and ψ are the same as before. In setting these values in Equation (12) we find $V_s = 2{,}180$ cu.ft. Thus we see that a reactor with a volume of 2,180 cu.ft. would be required. The choice of actual length to diameter ratio to be used would depend on many factors, such as available floor space, floor loading capacity, headroom, economic friction drop of the gases through the reactor, etc., since the number of impacts per unit of time between reacting vapor or gas molecules would hardly be affected by the condition of turbulence attending the flow of the reaction stream through the system.

ACETYLENE GENERATOR

Problem 3—It is required to design a continuous single-pass counter current type vapor-solids reactor of the type shown in Fig. 3, to produce 3 lb. per minute of acetylene with an efficiency of 98 percent with respect to the actual CaC_2 content of the calcium carbide feed. The reaction would be:

$$CaC_2 + 2HOH \longrightarrow Ca(OH)_2 + C_2H_2$$

It is proposed to carry out the reaction in the presence of a 150 percent excess of water vapor entering the reactor at 212 deg. F. and 1 atm. The combined reaction velocity and area constant k, for the given rate of solids feed has been determined in the laboratory to be 4×10^6. The further conditions of the design are that the reactor may be jacketed to maintain isothermal reaction conditions.

The reactor, shown in Fig. 3, is to operate in the following manner to react finely divided solids with gases or vapors: A rotary bin valve placed between the solids receiver bin and the reactor chamber itself meters a uniform feed of calcium carbide to the suction pipe leading to the eye of a high speed spray wheel. The

† This method of estimating the work of agitation is extremely conservative. Another method which should be used where the power consumption determined as above is inordinately high is as follows: (1) According to the method of Hixson and Baum (*Ind. Eng. Chem.*, 33, p. 478, 1941; 34, p. 220, 1942), and others, compute the agitational Reynolds number for the laboratory batch reactor. (2) Assuming the single-pass reactor to be a batch mixing tank of the volume computed by the methods outlined above, solve for the mixing horsepower that will establish an equivalent Reynolds number. (3) Calculate the overall orifice-manifold pressure drop according to the formula $Hp. \times 33{,}000/(Q \times D)$ = over-all orifice-manifold drop in feet. Here $Hp.$ is the power consumption as calculated in Item (2), Q is the throughput rate, cubic feet per min., and D is the average apparent density of the reaction stream.

Fig. 1—Single-pass reaction system for vapor phase oxidation of naphthalene to phthalic anhydride; exchanger-reactor has catalyst in tubes

Fig. 2—Single-pass reactor for hydrogen reduction of nickel oxide, designed to handle the solid in fluidized condition

Fig. 3—Single-pass solids-vapor reactor for making acetylene

Fig. 4—Single-pass pipe-type liquid phase reactor for nickel carbonate

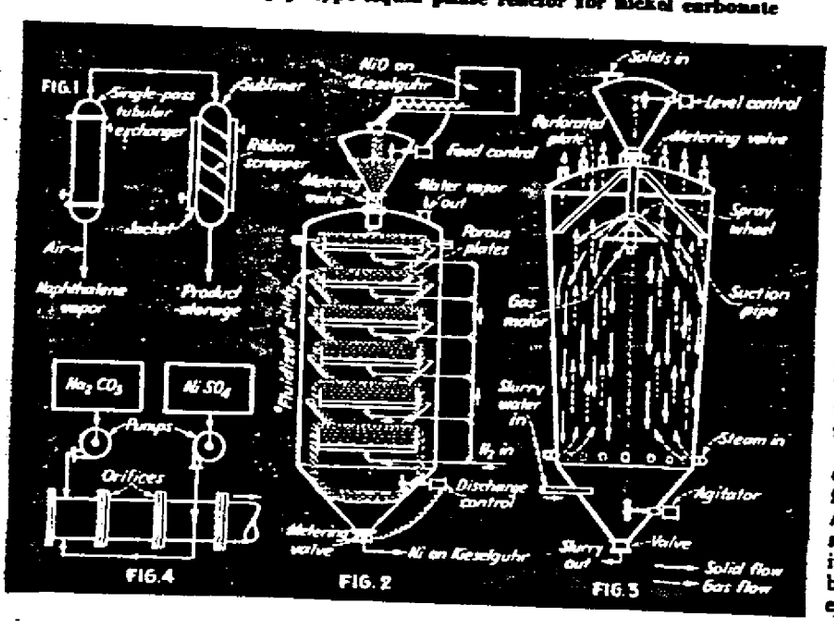


TABLE I

SYSTEM CHARACTERISTICS	ORDER OF REACTION	EXAMPLE	(V_b – R – S) EQUATION	EQUATION NO.
CONSTANT VOLUME INFINITE CONTACT	1ST ORDER	A → B + C + D + E	$t_b = \frac{R}{k} \ln \frac{a}{a-x}$ $t_b = \frac{R}{k} \ln \frac{N_{Ao}}{N_A}$	1
	2ND ORDER	2A → B + C + D + E OR A + B (IN STOICHIOMETRIC BALANCE) → C + D + E	$t_b = \frac{R}{k} \frac{x}{a(a-x)} = \frac{R^2}{k} \frac{N_{Ao} - N_A}{N_{Ao} N_A}$	2
		A + B (IN EXCESS) → C + D + E	$t_b = \frac{R}{k(a-b)} \ln \frac{b(a-x)}{a(b-x)} = \frac{R^2}{k} \frac{1}{N_{Ao} - N_{Bo}} \ln \frac{N_{Bo} N_A}{N_{Ao} N_B}$	3
	3RD ORDER	3A → B + C + D + E	$t_b = \frac{R}{k} \left[\frac{2x(2a-x)}{a^2(a-x)^2} \right] = \frac{R^3}{k} \left[\frac{2(N_{Ao} - N_A)(N_{Ao} + N_A)}{N_{Ao}^2 N_A^2} \right]$	4
		2A + B → C + B + E ...	$t_b = \frac{R}{k(2b-a)} \left[\frac{2x}{a(a-2x)} + \frac{1}{a-2b} \ln \frac{a(b-x)}{b(a-2x)} \right] =$ $= \frac{R^3}{k(2N_{Bo} - N_{Ao})} \left[\frac{N_{Ao} - N_A}{N_{Ao} N_A} + \frac{1}{N_{Ao} - 2N_{Bo}} \ln \frac{N_{Ao} N_B}{N_{Bo} N_A} \right]$	5
		A + B + C → D + E ...	$t_b = \frac{R}{k} \left[\frac{1}{(a-b)(a-c)} \ln \frac{a}{a-x} + \frac{1}{(b-a)(b-c)} \ln \frac{b}{b-x} + \frac{1}{(c-a)(c-b)} \ln \frac{c}{c-x} \right] =$ $= \frac{R^3}{k} \left[\frac{1}{(N_{Ao} - N_{Bo})(N_{Ao} - N_{Co})} \ln \frac{N_{Ao}}{N_A} + \frac{1}{(N_{Bo} - N_{Ao})(N_{Bo} - N_{Co})} \ln \frac{N_{Bo}}{N_B} + \frac{1}{(N_{Co} - N_{Ao})(N_{Co} - N_{Bo})} \ln \frac{N_{Co}}{N_C} \right]$	6
CONSTANT VOLUME FINITE CONTACT	—	LEACHING PROCESS INVOLVING ONE MOL OF LEACHING MATERIAL TO ONE MOL OF SOLID $A_s + B \rightarrow C + D$ $Fe + H_2SO_4 \rightarrow FeSO_4 + H_2$	$t_b = \frac{R^2}{(N_{Bo} - N_{Ao}) N_{Ao}} \left[\frac{1}{3} \ln \frac{[(N_{Ao} - N_{Ao})^{1/3} + N_A^{1/3}]^2}{(N_{Ao} - N_{Ao}) N_A + (N_{Ao} - N_{Ao}) N_{Ao}^{1/3} N_A^{1/3} + N_{Ao}^{2/3} N_A^{2/3}} + \sqrt{3} \arctan \frac{2N_A^{1/3} - (N_{Ao} - N_{Ao})^{1/3}}{\sqrt{3}(N_{Ao} - N_{Ao})^{1/3}} \right]_{N_A = N_{Ao}}^{N_A = N_{Ao}}$	7
		DISSOLUTION PROCESS, A MOLS OF SOLID DISSOLVING IN ANY GIVEN SOLVENT	$t_b = \frac{R^2}{A N_B (N_{Bo} - N_{Ao})^{1/3}} \left[\frac{1}{3} \ln \frac{[(N_{Ao} - N_{Ao})^{1/3} + N_A^{1/3}]^2}{(N_{Ao} - N_{Ao}) N_A + (N_{Ao} - N_{Ao}) N_{Ao}^{1/3} N_A^{1/3} + N_{Ao}^{2/3} N_A^{2/3}} + \sqrt{3} \arctan \frac{2N_A^{1/3} - (N_{Ao} - N_{Ao})^{1/3}}{\sqrt{3}(N_{Ao} - N_{Ao})^{1/3}} \right]_{N_A = N_{Ao}}^{N_A = N_{Ao}}$	8
		LEACHING PROCESS INVOLVING ONE MOL OF SOLID TO TWO MOLS OF LEACHING MATERIAL $A_s + 2B \rightarrow C + D$ $Fe + 2HCl \rightarrow FeCl_2 + H_2$	$t_b = -\frac{R^2}{k_s a^2} \left[\frac{N_A^{1/3}}{a - 2N_A^{1/3}} + \frac{2r}{3a^2} \left(\frac{1}{2} \ln \frac{r^2 - N_A^{1/3} r + N_A^{2/3}}{(r - N_A^{1/3})^2} + \sqrt{3} \arctan \frac{2N_A^{1/3} - r}{\sqrt{3}\, r} \right) \right]_{N_A = N_{Ao}}^{N_A = N_A}$	9
		SOLID – GAS REACTION WITH COUNTER CURRENT OPERATION ONLY, IN WHICH ONE MOL OF SOLID AND ONE MOL OF GAS ARE REACTING $A_s + B_g \rightarrow C_s + D_g + E_s$ $Fe\,O + H_2 \rightarrow Fe + H_2O$	$t_b = -\frac{k_s N_{Bo} R_g T A}{k_g P (N_{Bo} + (r-1) N_{Ao})^{1/3}} \left[\frac{1}{3} \ln \frac{(N_A^{1/3} - [N_{Bo} + (r-1) N_{Ao}]^{1/3})^2}{N_A^{2/3} + N_A^{1/3} [N_{Bo} + (r-1) N_{Ao}]^{1/3} + [N_{Bo} + (r-1) N_{Ao}]^{2/3}} + \sqrt{3} \arctan \frac{2N_A^{1/3} + [N_{Bo} + (r-1) N_{Ao}]^{1/3}}{\sqrt{3}\, [N_{Bo} + (r-1) N_{Ao}]^{1/3}} \right]_{N_A = N_{Ao}}^{N_A = N_A}$	10
VARIABLE VOLUME INFINITE CONTACT, GASEOUS OR VAPOR PHASE, UNDER CONSTANT PRESSURE	1ST ORDER	$A_g \rightarrow \alpha B_g + \beta C_g + \rho D_g + \dots$	$t_b = \frac{R_g T}{k P} \left[\gamma N_{Ao} \ln \frac{N_{Ao}}{N_A} - (\gamma - 1)(N_{Ao} - N_A) \right]$	11
	2ND ORDER	$2A_g \rightarrow \alpha B_g + \beta C_g + \rho D_g + \dots$	$t_b = \frac{R_g^2 T^2}{k P^2} \left[\frac{\gamma^2}{6} \left(\frac{N_{Ao}^2}{N_A} - N_{Ao} \right) + \gamma \left(\frac{\gamma}{2} - 1 \right) N_{Ao} \ln \frac{N_{Ao}}{N_A} + \left(\frac{\gamma}{2} - 1 \right)^2 (N_{Ao} - N_A) \right]$	12
		$A_g + B_g \rightarrow \alpha C_g + \beta D_g + \rho E_g$	$t_b = \frac{R_g^2 T^2}{k P^2 (N_{Bo} - N_{Ao})} \left[\frac{\gamma^2}{6} N_{Bo} + (\gamma - 1) N_{Ao} \right]^2 \ln \frac{(N_{Bo} - N_{Ao} + N_A)}{N_A} + \left[N_{Ao} + (\gamma - 1) N_{Ao} \right] \ln \frac{N_{Ao}}{N_A} - 2(\gamma - 2) \left[\frac{N_{Bo}^2 - (N_{Bo} - N_{Ao} + N_A)^2}{2} - 2(N_{Bo} - N_{Ao})(N_{Bo} - N_{Ao}) \right] + (N_{Bo} - N_{Ao})^2 \ln \frac{N_{Bo}}{N_{Bo} - N_{Ao} + N_A} + \frac{(\gamma - 2)^2}{2} (N_{Ao}^2 - N_A^2) \Big]$	13
VARIABLE VOLUME FINITE CONTACT	—	SOLIDS – GAS REACTOR WITH COUNTER CURRENT OPERATION ONLY, IN WHICH ONE MOL OF GAS AND ONE MOL OF SOLID ARE REACTING $A_g + B_s \rightarrow \alpha C_g + \beta D_g + \rho E_s + F_s + G_s$	$t_b = \frac{k_g P T^2}{k_s \rho^2 T^2} \left[\frac{\gamma^2 + 2\gamma\alpha\rho\delta + \alpha^2 \rho^2 \delta^2}{\beta^{2/3}} \left[\frac{1}{3} \ln \frac{(N_A^{1/3} - g^{1/3})^3 (N_{Ao} + N_{Ao} g + g^{3/2})}{(N_A^{1/3} - g^{1/3})^3 (N_{Ao} + N_{Ao} g + g^{3/2})} - \sqrt{3} \arctan \frac{2N_A^{1/3} g^{1/3}}{\sqrt{3}\, g^{1/3}} + \sqrt{3} \arctan \frac{2N_{Ao}^{1/3} g^{1/3}}{\sqrt{3}\, g^{1/3}} \right] - 6\alpha\rho\delta (N_A^{1/3} - N_{Ao}^{1/3}) + 3\delta^2 (\rho N_A^{1/3} g^{1/3} + N_A^{2/3} - N_{Ao}^{2/3}) \right]$	14
			$t_b = \frac{4\gamma R T}{k_s P} \left[3\alpha\delta (N_A^{1/3} - N_{Ao}^{1/3}) - \frac{\alpha - \beta\gamma}{\beta^{1/3}} \left[\sqrt{3} \arctan \frac{2N_A^{1/3} g^{1/3}}{\sqrt{3}\, g^{1/3}} + \sqrt{3} \arctan \frac{2N_{Ao}^{1/3} g^{1/3}}{\sqrt{3}\, g^{1/3}} - \frac{1}{2} \ln \frac{(N_A^{1/3} g^{1/3})^3 (N_{Ao} + N_{Ao} g^{1/3} + g^{2/3})}{(N_A^{1/3} g^{1/3} + N_A^{2/3} g^{2/3} + g)^3 (N_{Ao} + N_{Ao} g^{1/3} + g^{2/3})} \right] \right]$	15
		SOLIDS – GAS REACTOR WITH COUNTER CURRENT OPERATION ONLY, IN WHICH ONE MOL OF SOLID REACTS WITH 2 MOLS OF GAS $A_g + 2B_g \rightarrow \alpha C_g + \beta D_g + \rho E_s + F_s + G_s$	$t_b = \frac{R_g^2 T^2}{k_s \rho^2} \left[\frac{\gamma^2 N_{Ao}^{2/3}}{6} + \frac{\gamma u r^2 N_{Ao}^{2/3}}{6} - 3\gamma r^2 N_A^{1/3} + \frac{1}{3.84 u^{1/3}} \left(\frac{2\gamma^2}{u} + \frac{3\gamma^2}{2} - 3\gamma r^2 u + \frac{3\gamma^2 r^4}{8} \right) \left[\frac{1}{2} \ln \frac{(N_A^{1/3} - (\frac{\gamma}{2})^{1/3})^2}{N_A^{2/3} + N_A^{1/3} (\frac{\gamma}{2})^{1/3} + (\frac{\gamma}{2})^{2/3}} + \sqrt{3} \arctan \frac{2N_A^{1/3} + (\frac{\gamma}{2})^{1/3}}{\sqrt{3}\, (\frac{\gamma}{2})^{1/3}} \right] - \frac{2\gamma N_{Ao}^{1/3} + 3\gamma^2 u N_{Ao}^{1/3} + 3\gamma^2 u r^2 N_{Ao}^{1/3} - r^2 u N_{Ao}^{1/3}}{2u(u - 2N_A)} \Big]_{N_A = N_{Ao}}^{N_A = N_A}$	16
			$t_b = \frac{4\gamma R_g^2 T^2}{k_s \rho^2} \left[\frac{3\gamma^2}{8} (2u + N_{Ao}) N_{Ao}^{1/3} - \frac{4\gamma^2 u^2 + 6\gamma u r^2 N_{Ao}^{1/3} + u^2 r^2 N_{Ao}^{2/3}}{4u(u - 2N_A)} + \frac{4\gamma^2 + 2\gamma u r^2 + u^2 r^4}{256 u^{1/3}} \left[\frac{1}{2} \ln \frac{(N_A^{1/3} - (\frac{\gamma}{2})^{1/3})^2}{N_A^{2/3} + N_A^{1/3} (\frac{\gamma}{2})^{1/3} + (\frac{\gamma}{2})^{2/3}} - \sqrt{3} \arctan \frac{2N_A^{1/3} + (\frac{\gamma}{2})^{1/3}}{\sqrt{3}\, (\frac{\gamma}{2})^{1/3}} \right] \right]_{N_A = N_{Ao}}^{N_A = N_A}$	17

TABLE II

SYSTEM CHARACTERISTICS	ORDER OF REACTION	EXAMPLE	(V_b – R – S) EQUATION FOR SINGLE MULTI-PASS REACTOR	(V_b – R – S) EQUATION FOR m IDENTICAL REACTORS IN SERIES	EQUATION NO.
CONSTANT VOLUME INFINITE CONTACT	1ST ORDER AND PSEUDO-HOMOMOLECULAR REACTIONS	A → B + C + D + E ANY MULTI-MOLECULAR REACTION IN WHICH ALL BUT ONE OF THE REACTANTS IS PRESENT IN GREAT EXCESS BEYOND STOICHIOMETRIC REQUIREMENTS	$\left(\frac{a-x}{a} \right) = \left(\frac{\rho}{e^{k t_m} - q} \right)^m$	$\left(\frac{a-x}{a} \right) = \left(\frac{\rho}{e^{k t_m} - q} \right)^m$ NOTE: THE QUANTITY $\left(\frac{\rho}{e^{k t_m} - q} \right)$ IS EVALUATED IN THE CASE OF PSEUDO-HOMOMOLECULAR REACTIONS IN TERMS OF THE REACTANT WHICH IS NOT PRESENT TO EXCESS	18
	2ND ORDER	2A → B + C + D + E OR A + B (IN STOICHIOMETRIC BALANCE) → C + D + E	$t_m = \frac{R}{k} \frac{x}{(a - \frac{b-a}{a} x)(a-x)}$	* $t_m = \frac{R}{k} \frac{(s_m - s_{m-1})}{\left[a - s_{m-1} \frac{b-a}{a} \right] \left[(s_m - s_{m-1}) - \frac{b-a}{a} (s_{m-1} - s_{m-2}) \right]}$	19
		A + B (IN EXCESS) → C + D + E	$t_m = \frac{R}{k(a-b)} \ln \frac{(b - \frac{b-a}{a} x)(a-x)}{(a - \frac{b-a}{a} x)(b-x)}$	* $t_m = \frac{R}{k(a-b)} \ln \frac{\left[b - s_{m-1} \frac{b-a}{a} \right] \left[(s_m - s_{m-1}) - \frac{b-a}{a} (s_{m-1} - s_{m-2}) \right]}{\left[a - s_{m-1} \frac{b-a}{a} \right] \left[(s_m - s_{m-1}) - \frac{b-a}{a} (s_{m-1} - s_{m-2}) \right]}$	20
	3RD ORDER	3A → B + C + D + E	$t_m = \frac{2\frac{b}{a} - 1}{k(a - \frac{b-a}{a} x)^2} \ln \frac{2(a - \frac{b-a}{a} x)(a-x)}{a - \frac{b-a}{a} x} + \frac{2}{k(a - \frac{b-a}{a} x)(a-x)}$	* $t_m = \frac{2\frac{b}{a} - 1}{k \left[a - s_{m-1} \frac{b-a}{a} \right]^2} \ln \frac{2 \left[a - s_{m-1} \frac{b-a}{a} \right] \left[(s_m - s_{m-1}) - \frac{b-a}{a} (s_{m-1} - s_{m-2}) \right]}{a - s_{m-1} \frac{b-a}{a}} + \frac{2}{k \left[a - s_{m-1} \frac{b-a}{a} \right] \left[(s_m - s_{m-1}) - \frac{b-a}{a} (s_{m-1} - s_{m-2}) \right]}$	21
		2A + B → C + D + E	$t_m = \frac{1}{k(2a-b)} \left[\frac{2\frac{b}{a} - 1}{(a - 2\frac{b-a}{a} x)(a-x)} + \frac{1}{a-2b} \ln \frac{(a - 2\frac{b-a}{a} x)(b-x)}{(b - \frac{b-a}{a} x)(a-x)} \right]$	* $t_m = \frac{1}{k(2a-b)} \left[\frac{2\frac{b}{a} - 1}{\left[a - 2 s_{m-1} \frac{b-a}{a} \right] \left[(s_m - s_{m-1}) - \frac{b-a}{a} (s_{m-1} - s_{m-2}) \right]} + \frac{1}{a-2b} \ln \frac{\left[a - 2 s_{m-1} \frac{b-a}{a} \right] \left[(s_m - s_{m-1}) - \frac{b-a}{a} (s_{m-1} - s_{m-2}) \right]}{\left[b - s_{m-1} \frac{b-a}{a} \right] \left[(s_m - s_{m-1}) - \frac{b-a}{a} (s_{m-1} - s_{m-2}) \right]} \right]$	22
		A + B + C → D + E	$t_m = k^2 \left[\frac{1}{(a-b)(a-c)} \ln \frac{a - \frac{b-a}{a} x}{a-x} + \frac{1}{(b-a)(b-c)} \ln \frac{b - \frac{b-a}{a} x}{b-x} + \frac{1}{(b-c)(c-a)} \ln \frac{c - \frac{b-a}{a} x}{c-x} \right]$	* $t_m = k^2 \left[\frac{1}{(a-b)(a-c)} \ln \frac{a - s_{m-1} \frac{b-a}{a}}{a - s_m} + \frac{1}{(b-a)(b-c)} \ln \frac{b - s_{m-1} \frac{b-a}{a}}{b - s_m} + \frac{1}{(b-c)(c-a)} \ln \frac{c - s_{m-1} \frac{b-a}{a}}{c - s_m} \right]$	23
* FOR m IDENTICAL VESSELS IN SERIES USE A STEPWISE APPLICATION OF THE EQUATION GIVEN HERE					
CONSTANT VOLUME FINITE CONTACT	—	DISSOLUTION PROCESS	SEE NEXT COLUMN	$\frac{-\frac{V_t}{A N_B (N_{Bo} - N_{Ao})^{1/3}} \left[\frac{1}{3} \ln \frac{[(N_{Ao} - N_{Ao})^{1/3} + N_A^{1/3}]^2}{(N_{Ao} - N_{Ao}) N_A + (N_{Ao} - N_{Ao}) N_{Ao}^{1/3} N_A^{1/3} + N_{Ao}^{2/3} N_A^{2/3}} + \sqrt{3} \arctan \frac{2N_A^{1/3} - (N_{Ao} - N_{Ao})^{1/3}}{\sqrt{3}(N_{Ao} - N_{Ao})^{1/3}} \right]_{N_A = N_{Ao}}^{N_A = N_{Am}}}{t_m}$	24
		LEACHING PROCESS INVOLVING ONE MOL OF LEACHING MATERIAL TO ONE MOL OF SOLID	SEE NEXT COLUMN	$\frac{-\frac{V_t}{A N_B (N_{Bo} - N_{Ao})^{1/3}} \left[\frac{1}{3} \ln \frac{[(N_{Ao} - N_{Ao})^{1/3} + N_A^{1/3}]^2}{(N_{Ao} - N_{Ao}) N_A + (N_{Ao} - N_{Ao}) N_{Ao}^{1/3} N_A^{1/3} + N_{Ao}^{2/3} N_A^{2/3}} + \sqrt{3} \arctan \frac{2N_A^{1/3} - (N_{Ao} - N_{Ao})^{1/3}}{\sqrt{3}(N_{Ao} - N_{Ao})^{1/3}} \right]_{N_A = N_{Ao}}^{N_A = N_{Am}}}{t_m}$	25
		LEACHING PROCESS INVOLVING ONE MOL OF SOLID TO TWO MOLS OF LEACHING MATERIAL	SEE NEXT COLUMN	$\frac{\frac{V_t^2}{A^2} \left[\frac{2r}{3a^2} \left[\frac{1}{2} \ln \frac{r^2 - N_A^{1/3} r + N_A^{2/3}}{(r - N_A^{1/3})^2} + \sqrt{3} \arctan \frac{2N_A^{1/3} - r}{\sqrt{3}\, r} \right]_{N_A = N_{Ao}}^{N_A = N_{Am}} + \frac{N_A^{1/3}}{a - 2N_A^{1/3}} \right]_{N_A = N_{Ao}}^{N_A = N_{Am}}}{t_m}$	26

TABLE III

SYSTEM CHARACTERISTICS	ORDER OF REACTION	EXAMPLE	(V_b – R – S) EQUATION	EQUATION NO.
CONSTANT VOLUME INFINITE CONTACT	2ND ORDER	2A → B + C + D + E OR A + B (IN STOICHIOMETRIC BALANCE) → C + D + E	$e^{-\left[\frac{k t_m}{a} (a-x) \right]} = \left(\frac{\rho}{e^{k t_m} - q} \right)^m$	27
		A + B (IN EXCESS) → C + D + E	$\left[\frac{a(b-x)}{b(a-x)} \right] = \left(\frac{\rho}{e^{k t_m (b-a)} - q} \right)^m$	28
	3RD ORDER	3A → B + C + D + E	$e^{-\left[\frac{k t_m (2a-x)}{a^2 (a-x)^2} \right]} = \left(\frac{\rho}{e^{k t_m} - q} \right)^m$	29
		2A + B → C + D + E	$e^{-\left[\frac{2x}{a(a-2x)} + \frac{1}{a-2b} \ln \frac{a(b-x)}{b(a-2x)} \right]} = \left(\frac{\rho}{e^{k t_m} - q} \right)^m$	30
		A + B + C → D + E	$\left[\frac{(a-x)}{a} \right]^{\frac{1}{(a-b)(a-c)}} \left[\frac{(b-x)}{b} \right]^{\frac{1}{(b-a)(b-c)}} \left[\frac{(c-x)}{c} \right]^{\frac{1}{(c-a)(c-b)}} = \left(\frac{\rho}{e^{k t_m} - q} \right)^m$	31

NOTE IN TABLE III: WHERE A HIGH DEGREE OF REACTION COMPLETION IS REQUIRED AND WHERE "INSTANTANEOUS DILUTION" OF THE INFLUENT STREAM OCCURS, THE VALUE OF R OBTAINED IN THESE EQUATIONS SHOULD BE REDUCED TO 75 TO 80 PERCENT OF THE COMPUTED VALUES

TABLE IV

SYSTEM CHARACTERISTICS	ORDER OF REACTION	$R_{m,s}$ EQUATION	EQUATION NO.
ANY	ANY	$R_{m,s} = \frac{\rho^m}{(m-1)!} \left[\frac{(m-s)!\, q^{m-1}}{(s+1)!\, (\rho)} + \frac{(m-2)(m-s)!\, q^{m-2}}{(s+2)!\, (\rho^2)} + \frac{(m-3)(m-2)(m-s)!\, q^{m-3}}{(s+3)!\, (\rho^3)} + \frac{(m-1)(m-2)(m-3)\dots(m-s)!\, q^{m-s}}{(s+1)!\, (\rho^s)} + \dots + \frac{(m-1)!\, q^{m-s}}{\rho^m} \right]$	32

NOMENCLATURE

a	Starting concentration of the reactant A
a'	$(N_{Ao} - 2N_{Ao})$
b	Starting concentration of the reactant B
c	Starting concentration of the reactant C
d	$(1 + \phi)$
e	Base of natural logarithms
f	$2(1 + \phi/2)$
g	$N_{Ao} + (1 - x + \phi)N_{Ao}$
h	Height of a countercurrent gas-solids reactor
k	Reaction velocity constant
k_v	Product of k and the factor $(k_v^{1/3}g^{1/3}/\omega^{2/3})$
k_f	Stokes law rate of fall
k_o	Number of particles of uniform diameter
$\ln$	Logarithm to the base e
m	Number of vessels in series
n_a	Number of turbine agitators
p	Ratio of R to Q in a continuous multi-pass mixer or reactor
q	$(1 - p)$
r	$-\frac{1}{2}(N_{Ao} - 2N_{Ao})$
s	Any integer (1, 2, 3, ...n)
t_m	Time for one pass from inlet to outlet in a multi-pass reactor (i.e., V_s/Q in draft-tube type such as Fig. 6)
u	$N_{Ao} + 2(1 - x)N_{Ao}$
v	$N_{Ao} + 2(1 - x + \frac{1}{2}\psi)N_{Ao}$
w	$N_{Ao} + (1 - x)N_{Ao}$
x	Instantaneous depletion in concentration of a reactant
z	Final extent of reaction of a solid
A	Area of countercurrent gas-solids reactor
N_A, N_B, N_C	Residual number of mols of reactant or solute A, B, or C after "contact time" t
N_{Ao}, N_{Bo}, N_{Co}	Feed stream of reactant or solute A, B, or C in mols per unit of time
N_s	Number of mols of solute at saturation in feed stream
P	Absolute pressure
Q	Rate of turnover (circulation) effected by circulation element of multi-pass reactor, etc.
R	Rate of throughput, volume per unit time, through a continuous system
R_g	Gas constant
$R_{m,n}$	Proportion of feed stream remaining in m vessels for time equal or more than $m + s$ passes
S	Completion of reaction, etc.
T	Absolute temperature
V_s	Required equipment volume
V_v	Working volume of each unit of a continuous multi-pass series
α, β, ϕ	Coefficients of gaseous or vapor products of a reaction
ϕ	Sum of the coefficients of all gaseous products of a reaction
ρ	in $N_{Ao}/(N_{Ao} - N_{Ao} + N_A)$
ω	Absolute density of solids particles

spray wheel scatters the feed across the breadth of the reactor chamber. To improve the distribution a portion of the effluent gases is drawn through suction pipes to the solids duct, the solids being "emulsified" in this gas in passing to the eye of the spray wheel and through the spray wheel.

The scattered solids settle to the bottom of the chamber against a rising stream of acetylene and water vapor. This method achieves counter-current contact between the falling solids and an atmosphere which is progressively richer in the water vapor reactant. The reacted solids settle into the conical portion of the reactor chamber where they are continuously slurried in water for continuous removal from the chamber.

It is necessary to determine the height and diameter of such a reactor for the acetylene capacity mentioned. The production of 3 lb. per minute of acetylene involves 0.1153 lb.-mols per minute. This would require $(64/26) \times 0.1153 \div 0.98 = 0.290$ lb.-mol $CaC_2 = N_{Ao}$, where 98 percent efficiency of reaction is established. Here 64 is taken to be the molecular weight of the calcium carbide and 26 the molecular weight of acetylene.

A 150 percent excess of water vapor reactant means a flow of 0.3995 lb.-mols of steam per minute. It will be seen that only 1 mol of gas is produced in the reaction. From the above, we may write: $N_{Ao} = 0.290$; $N_A = 0.0058$; $N_{Bo} = 0.3995$; $x = 0.98$; $\psi = 1.0$; $k_v = 4 \times 10^6$; $k_f = 4.43$; $T = 672$ deg. F. abs.; $R_g = 0.729$; $P = 1.0$; $f = 2(1 + \frac{1}{2}\psi) = 3$; $v = 0.7015$; $u = 0.4111$; $N_{A_o}''^{/2} = 0.662$; and $N_A''^{/2} = 0.179$.

Substituting these quantities in Equation (16) we find that the required V_s would be 4,920 cu. ft.

In order to set an "immersion time" for the solids feed in the vapor channel which is consistent with a 98 percent conversion of the calcium carbide, it is then necessary that we determine the required height of the reaction chamber. This involves first the calculation of the Stokes law settling velocity of the solids particles. The computed value of k_f is 4.43 ft. per min., where the absolute density is taken at 2.2 g. per cu. cm., the viscosity of the fluid is 0.00122 poises, and the particle diameter is 0.25 mm. It is computed on the basis of falling in a still atmosphere. After the height and the volume of the chamber are determined according to Equations (16) and (17) it is then necessary to calculate the maximum vapor drift velocity at any point in the column, so as to ascertain the extent to which the normal Stokes law settling rate is disturbed. By Equation (17) h is found to be 12 ft.

It follows, from the above values of V_s and h, that the area of the chamber would be 410 sq. ft. (its diameter being 22.85 ft.). From the chemical equation and the quantity of excess water used, it can be seen that the maximum vapor velocity would be established at the point of water vapor feed to the chamber. At this point, the vapor velocity would be $0.3995 \times 18 \times 26.8 \div 4.10 = 0.47$ ft. per min. This velocity is of such a low order that no appreciable interference with the computed Stokes law rate of settling should be expected.

Finally, it should be noted that one other condition of the derivation of Equations (16) and (17) is that the solids particles are considered to react in progressively concentric receding layers, the particles themselves suffering no appreciable change in diameter. Where the condition of a constant particle diameter does not hold, it is permissible to substitute in the Stokes law equation the log mean diameter between the initial and the final sizes of particles. The condition of the application of the Stokes law equation in determining the settling velocity is that the settling particles, in their various stages of reaction, suffer no appreciable change in absolute density. Where this condition does not actually obtain, it is permissible to work with the log mean of the initial and final densities.

MULTI-PASS REACTORS

Tables II, III and IV contain equations which we use in relating throughput, extent of reaction completion, and system volume in the design of multi-pass continuous reactor and mixer problems.

We have confined the equations listed to the most commonly encountered instances of continuous reactor and mixer design. Thus, it will be noted, we have dealt only with constant volume systems. A more complicated set of expressions is involved in the use of systems which show a variable volume characteristic. However, it is worth noting that the use of multi-pass type reactors is confined principally to the handling of liquid-phase systems, and liquid-phase systems very infrequently show sharp variable volume characteristics. It will also be observed that we have listed two different sets of equations for attacking the design problems of second and higher order reactions. The equations listed in Table II for such reactions are based upon an instantaneous dilution of the influent to each vessel by the existing contents of the vessel.

The equations listed in Table III for second and higher order reactions do not assume instantaneous dilution of the influent stream to each reactor by the existing contents of the reactor. In the handling of second and higher order reactions the equations in Table III may be used to determine broadly the throughput vs. completion relationships which hold for any given number of identical multi-pass vessels in series, provided: (1) The fluid characteristics of the reaction stream are such that poor mixing would be obtained; or (2) the ratio of throughput to the circulating capacity of the mixer element is so high that a comparatively limited amount of blending of the influent stream with the existing contents of the vessel takes place.

The equations for second and higher order reactions shown in Table II should be employed wherever the assumption can be made that instantaneous or near-instantaneous dilution of the incoming stream with the existing contents of the vessel occurs for all practical purposes. In any case, the equations appearing in Table III may be used to approximate the throughput capacity which would be established when instantaneous dilution of the influent stream is a valid assumption. That is to say, it is possible to determine R by the use of the equations in Table III, then correct

k according to the note at the bottom of Table III for use in systems where instantaneous dilution may be assumed, finally checking this figure for throughput by the step-wise or single-vessel equations for second and higher order reactions which appear in Table II.

We have also included in the illustrative problems given below several problems illustrating the computations of purging time, transiency time and the design of continuous mixing equipment on the principle of "retention time" only (See Problems 6, 7, and 8.)

Problem 4—One method for production of the highly important amino acid β-alanine is by the action of sodium hypobromide on succinimide. The succinimide, in turn, can be made by prolonged heating of succinamide, with the release of ammonia. This latter reaction may be shown as:

$$(CH_2CONH_2)_2 \longrightarrow (CH_2CO)_2NH + NH_3$$

It may be treated as a unimolecular reaction for design purposes.

Assume that it is desired to produce succinimide by this method. Two reactors of the type shown in Fig. 6 are available, each with a working capacity of 100 gal. Each unit is equipped with a top entering dual-turbine mixing assembly, consisting of two 9-in. diameter turbines, rotating with a peripheral speed of 1,000 ft. per min. One of the turbines is located just below the draft tube, very close to the bottom of the vessel, the other 27 in. above the first. If a reaction yield of 80 percent is necessary to make the process economically feasible, what will be the daily capacity of the plant, with the two units hooked up in series?

Since this reaction may be treated as a first order type, the reaction velocity equation (Equation 1) may be given as $tk_1 = \ln a/(a-x)$. The first step is to run a batch reaction in the laboratory to determine k. This, of course, must be done under conditions of agitation and temperature similar to those to be used in the plant. In each of the units described above, approximately ¼ hp. would be developed, providing very rapid agitation. If a 1-gal. reactor were to be used for the batch run, about 1/30 hp. input would be necessary.

Assume that in the batch test, a 75 percent conversion of the succinamide can be accomplished in 3 hr. of reaction. Then $tk_1 = \ln 1/(1-0.75) = 0.602$ and $k_1 = 0.602/180 = 0.00772$ per min.

DESIGNING THE REACTOR

The working design for the continuous reactor is given by Equation (18). Although this equation was derived without considering the effect, on the reaction kinetics, of the dilution of the incoming stream by the recycle streams, its use in this case will be entirely correct, since concentration has no bearing in a unimolecular reaction.

The circulating rate of a 9-in. diameter turbine, with a tip speed of 1,000 ft. per min., assuming a solution density of 1.2, would be 55 cu.ft. per min. Using the efficiency of circulation of 0.85, which is typical for turbine mixers, we have $Q = 0.85 \times 55 \times 7.5$ gal. per cu.ft. $= 350$ g.p.m., and $V_s = 100$ gal.. The smallest length of time which a particle can spend in one of the vessels will be $t_m = V/Q = 100/350 = 0.285714$, so $k_1 t_m = 0.00772 \times 0.285714 = 0.002206$; $m = 2$; and $p = R/Q = R/350$. Solving Equation (18) for R we find $R = 0.613$ g.p.m. With a specific gravity of 1.2, this would represent a daily capacity of $0.613 \times 1.2 \times 8.35 \times 24 \times 60 = 8{,}820$ lb. per day.

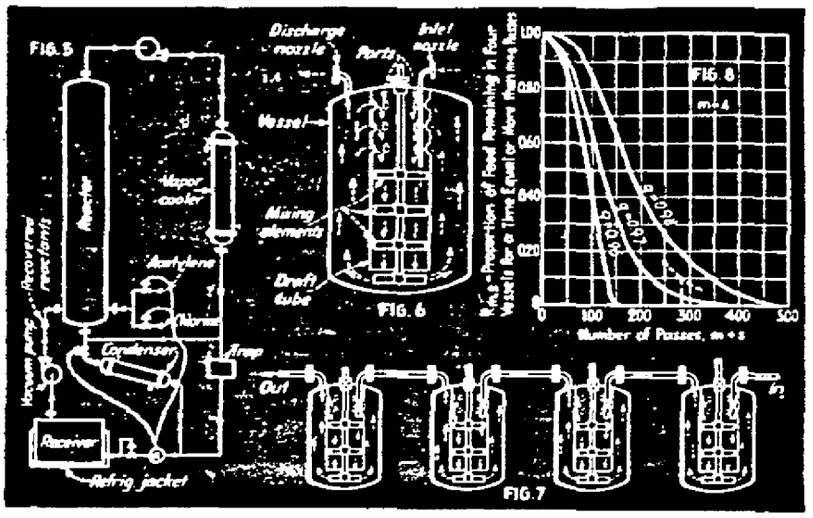


Fig. 5—Multi-pass reactor for highly exothermic reactions such as vapor phase chlorination of acetylene to acetylene tetrachloride; cooled recycled material provides heat capacity to absorb reaction heat

Fig. 6—Draft tube reactor with channelized internal recirculation

Fig. 7—Series of four draft tube reactors

Fig. 8—Proportion of feed remaining in four vessels in series for time equal to or longer than $m + s$ passes

Problem 5—A chemical plant contains four identical reaction vessels operating batchwise to carry out the reaction: $A + B \rightarrow C + D$. This reaction follows the normal curve for a second order reaction. In the process as run, the initial concentration of A is 10 mols per liter and that of B is 8 mols per liter. The reaction time is 3 hr., and a yield of 75 percent is obtained, based upon component B (i.e., 6 mols of the 8 introduced is reacted.)

Each vessel has a diameter of 4 ft. and a straight side height of 6 ft. The maximum working capacity V_s of each vessel is 610 gal. Each is equipped with a top-entering dual-propeller mixing assembly, consisting of two 8-in. diameter × 14.5-in. mean pitch three-bladed marine propellers, rotating at 1,125 r.p.m.

What would be the capacity of the plant, if the reactors were operated on a continuous basis, with the same reaction yield: (1) If the four units were hooked in series as in Fig. 7; (2) if two units of two vessels in the series were employed?

The general integrated equation for a reaction of this type (Equation 3) may be expressed as $t(a-b)k_2 = \ln[b(a-x)/a(b-x)]$ from which k_2 for this reaction is calculated as $\ln[8(10-6)/10(8-6)] \div 180(10-8) = 0.001308$ liter/(mol min.)

Now, in the case of this reaction, since we shall assume that the fluid characteristics of the reaction stream are such as to warrant the assumption of near-complete instantaneous dilution of the influent to each vessel by the existing contents of that vessel, the use of Equation (20) is indicated. Here x_m and x_{m-1} represent the depletion of a or b in the streams emerging from the mth and $m-1$th reactor in series, respectively. The terms t_m, Q, R, k, a, and b are as previously defined.

For the reactors on hand, the theoretical circulating capacity Q of the propeller mixer is (from the nomograph in Chem. & Met., Aug. 1943, p. 109) 475 cu.ft. per minute. However, the actual rate for propeller mixers is normally about 60 percent of the theoretical, so that Q would be $0.6 \times 475 = 285$ c.f.m. $= 2{,}130$ g.p.m. Since the volume V_s of each vessel is 610 gal., $t_m = V_s/Q = 610/2.130 = 0.2865$ min. Since we desire a 75 percent depletion of component B, then for the case of four vessels in series, we wish: x_m (which is x_4) to equal 6 mols per liter. It is obvious that the effluent from the third, second and first reactors will each contain, respectively, an increasing amount of component B, or a smaller depletion x. It will also be seen that x_0, which is equivalent to the input to the first reactor, will be zero. The solution therefore becomes one of trial and error. A value of R must first be assumed. Then, using $x_4 = 6$, calculate the value of x_3, then x_2, x_1 and x_0. If x_0 is greater than zero it means that the assumed throughput rate is too high. If x_0 is less than zero, the assumed rate is too low. That value of R which will give a value of x_0 substantially equal to zero, with $x_4 = 6$, will be the allowable rate of throughput for the system.

Applying Equation (28) of Table III to the problem (to establish the probable throughput capacity through the four vessels in series) we find that $S = 10(8-6)/8(10-$

SAC, Philadelphia 6/23/50

SA T. SCOTT MILLER, JR.

HARRY GOLD, was.
ESPIONAGE - R

EXHIBIT NO. 65-4307-1-B-5 (29-30)

This exhibit is two torn up pages from an address book containing various names, which GOLD identified on 6/15/50 as follows:

FRANK KESSLER

GOLD said that FRANK KESSLER was an old friend of his whom he met in childhood. KESSLER used to work for the Philadelphia Electric Company as a clerk and then opened a butcher shop on his own. GOLD said he last saw FRANK KESSLER sometime around 1940 or 1942, and stated that this man's name had nothing to do with GOLD's choosing the name FRANK KESSLER as an alias, although it might have had a subconscious effect on GOLD when he chose the name.

HARRY KRAIKER

GOLD said that he went to Drexel Institute with KRAIKER and last saw him about 1948. KRAIKER was a chemist and the last GOLD heard of what he was doing, KRAIKER was in Western Pennsylvania somewhere putting up a plant. KRAIKER is about thirty-eight years of age and was married while he was in the service.

ERLE KRAUSS

GOLD said KRAUSS is a chemical engineer and an official of the Chemical Engineer Alumni Association of Drexel Institute, of which GOLD is a member. KRAUSS belonged to a subsequent class at Drexel, and GOLD has his address as he mails dues in every now and then to maintain his standing. GOLD stated that KRAUSS is a chemist and works for some paint company.

SHRAGER

GOLD said that SHRAGER was the man who delivered eggs to the GOLD household when they lived on Boudinot Street in Philadelphia.

UNCLE SHMUKLER

GOLD said that this was his uncle, SAMUEL CHUSKY, who was about ninety years of age.

TSM:HKP
65-4307

65-4307-1B-5 (29-30)

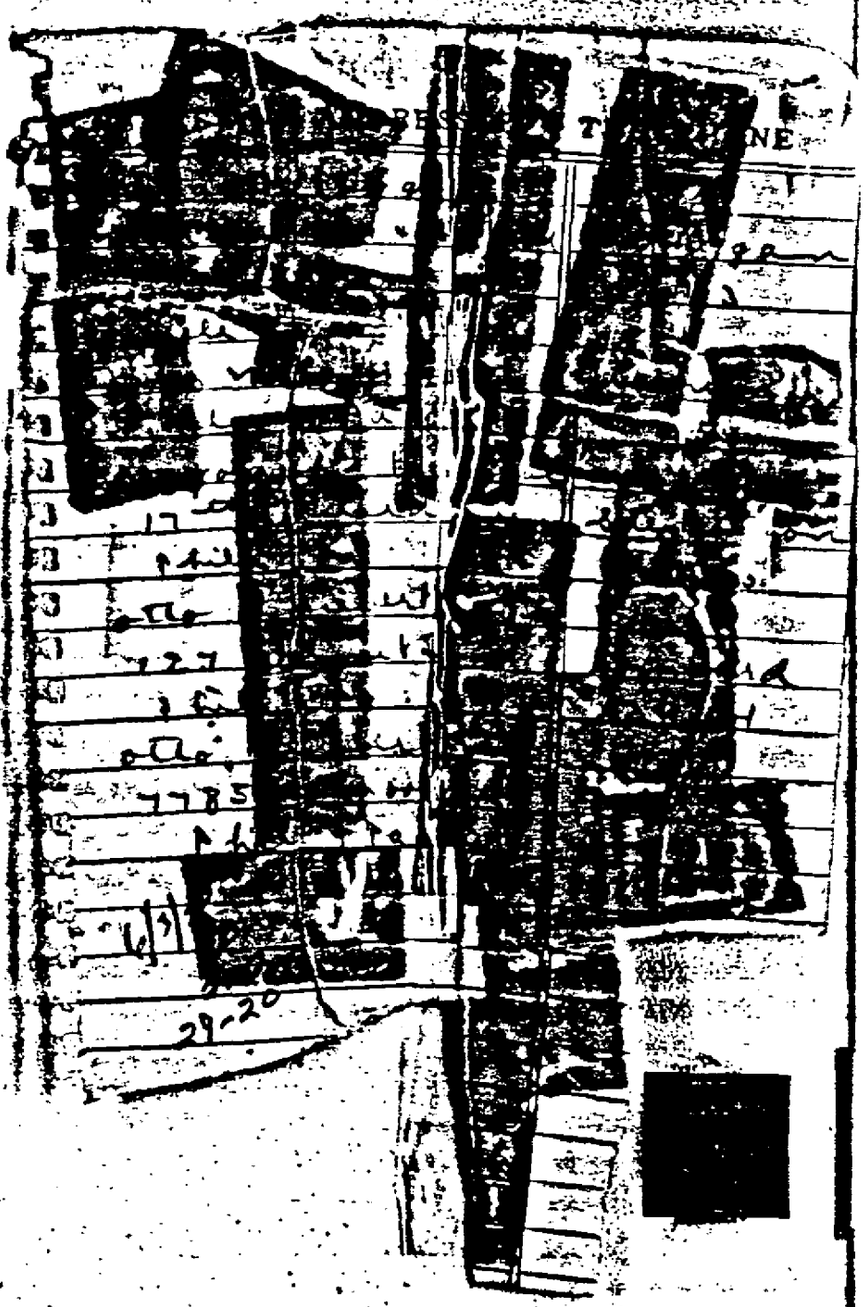
St. Joseph's Hospit

GOLD stated that he jotted this down when his brother, JOSEPH, had a hernia operation before he went into the Army and was hospitalized at St. Joseph's.

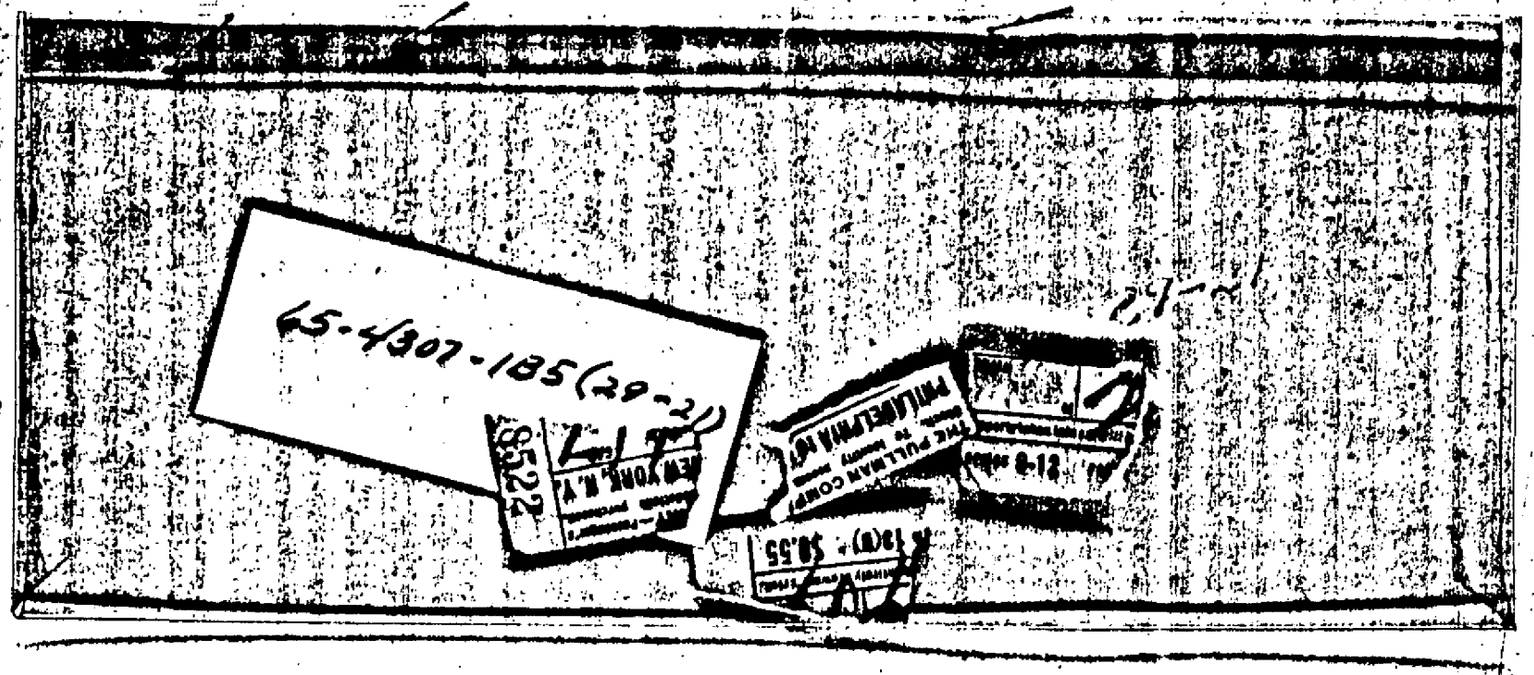
OTTO H. SIEBERT

GOLD stated that SIEBERT was a sugar chemist and operated a sugar testing laboratory under the name of "TERRY and SIEBERT." GOLD said that he and MORRELL E. DOUGHERTY did work for SIEBERT on the side while they were working for PENN SUGAR and made extra money that way. GOLD said that he used the money he made to help finance his Soviet espionage activity.

GOLD stated that the reason he tore these two pages up was because the name FRANK KESSLER was contained on one of the pages, and since he had used the name in connection with his espionage activities, he did not want it in any way to connect his old friend, FRANK KESSLER, with such activity.




NAME
DDRE
HONE


65-4307-185(29-2)
NEW YORK, N.Y.
PHILADELPHIA PA

FILE DESCRIPTION

PHILADELPHIA FILE

SUBJECT HARRY GOLD

FILE NO. 65-4307

VOLUME NO. 1-B-5

SERIALS (30)

thru

(69)

Inventory Worksheet
FD-503 (2-16-77)

VOLUME 185

PHILADELPHIA FILES

INVENTORIED BY llw

REVIEWED BY PLP

Date: 3/78 (month/year)

File No: 65-4307 Re: Harry Gold

Serial	Date	Description (Type of communication, to, from)	No. of Pages Actual	No. of Pages Released	Exemptions used or, to whom referred (Identify statute if (b)(3) cited)
—	6/3/50	BULKY INVENTORY SHEETS	3	3	
30+31	6/3/50	SMALL PIECE OF PAPER WITH ADDRESS FOR S.N. SNYDER	1	1	
32	6/3/50	LETTER TO HARRY FROM ED	1	1	
33	6/3/50	THREE CHECKS TO HARRY FROM BROTHMAN THREE BANKING FORMS	4	4	
34	6/3/50	ENVELOPE AND LETTER FROM MIRIAM	5	5	
35	6/3/50	ENVELOPE AND LETTER TO HARRY + PHIL FROM BROTHMAN	18	18	
36	6/3/50	ENVELOPE AND LETTER TO HARRY FROM EDITH	3	3	
37	6/3/50	ENVELOPE AND STATEMENT OF CALARY DUE TO HARRY GOLD	3	3	
38	6/3/50	NOT XEROXED- SOURCE SEE ATTACHED SHEET-RE. PUBLIC	—	—	
39	6/2/50	MEMO SA TO SAC RE. LETTER IN SERIAL 39	1	1	
"	6/7/50	MEMO SA TO SAC RE. LETTER IN SERIAL 39	1	1	
"	6/3/50	ENVELOPE AND LETTER TO HARRY FROM JEAN	2	2	

FBI/DOJ

Inventory Worksheet
FD-503 (2-18-77)

VOLUME 185

PHILADELPHIA FILES

INVENTORIED BY dlw

REVIEWED BY PLP

File No: 65-4307 Re: Harry Gold

Date: 3/78 (month/year)

Serial	Date	Description (Type of communication, to, from)	No. of Pages Actual	No. of Pages Released	Exemptions used or, to whom referred (Identify statute if (b)(3) cited)
40	6/3/50	ENVELOPE AND LETTER TO HARRY FROM D.R. GREEN	3	3	
"	6/7/50	MEMO SA TO SAC RE. ABOVE LETTER	1	1	
"	"	MEMO TO FILE RE. ABOVE LETTER	1	1	
41	6/3/50	ENVELOPE AND LETTER TO HARRY FROM OSCAR	5	5	
42	6/3/50	ENVELOPE AND LETTER TO HARRY FROM P. LEVINE	3	3	
43	6/3/50	ENVELOPE AND LETTER TO HARRY FROM A LEVINE re. RETAINING ROBERT HOFFMAN	6	6	
44	6/3/50	LETTER TO GOLD FROM LEVINE WITH STATEMENT	3	3	
45	6/3/50	LETTER WITHOUT ENVELOPE TO HARRY AND BUTCH dtd. 11/15/45	5	5	
46	6/3/50	1942 CALENDAR AND A 6X8 PIECE OF PAPER RE. GILMAN BARTLETT	3	3	
47	6/3/50	LETTER TO GOLD FROM COLTMAN dtd. 7/23/31	4	4	
48	6/23/50	SA TO SAC RE. INFO ON SERIAL 48	1	1	
"	6/7/50	SA TO SAC - DESCRIPTION OF SERIAL 48	1	1	

FBI/DOJ

Inventory Worksheet
FD-503 (2-18-77)

VOLUME 185

PHILADELPHIA FILES

INVENTORIED BY dlw

REVIEWED BY PLP

File No: 65-4307 Re: Harry Gold

Date: 3/78 (month/year)

Serial	Date	Description (Type of communication, to, from)	No. of Pages Actual	No. of Pages Released	Exemptions used or, to whom referred (Identify statute if (b)(3) cited)
48	6/7/50	NOTEBOOK FROM UNIV. OF PENN.	51	51	
49	7/13/50	SATOSAC RE. CEP MAGAZINE	1	1	
11	7/42	NOT COPIED - MAGAZINE - SEE ATTACHED PAGE RE. PUBLIC SOURCE	—	—	
50	9/37	NOT COPIED - COLLEGE BULLETIN SEE ATTACHED PAGE RE. PUBLIC SOURCE	—	—	
51	3/40	NOT COPIED - MAGAZINE - SEE ATTACHED PAGE RE. PUBLIC SOURCE	—	—	
52	6/3/50	WHITE UNLINED PAPER WITH PENCIL NOTES	2	2	
53	7/13/50	SATOSAC - RE. EXHIBITS	1	1	
11	7/13/50	THREE YELLOW SHEETS CONTAINING NAMES AND ADDRESSES	2	2	
54	6/3/50	ENVELOPE FROM SELECTIVE SERVICE LOCAL BOARD #65	1	1	
55	6/3/50	NOT COPIED - MAGAZINE - SEE ATTACHED PAGE RE. PUBLIC SOURCE	—	—	
56	2/16	NOT COPIED - MAGAZINE - SEE ATTACHED PAGE RE. PUBLIC SOURCE	—	—	
57	3/36	NOT COPIED - MAGAZINE - SEE ATTACHED PAGE RE. PUBLIC SOURCE	—	—	

FBI/DOJ

Inventory Worksheet
FD-503 (2-18-77)

VOLUME 185

PHILADELPHIA FILES

INVENTORIED BY llw

REVIEWED BY PLP

File No: 65-4307 Re: Harry Gold

Date: 3/78 (month/year)

Serial	Date	Description (Type of communication, to, from)	No. of Pages Actual	No. of Pages Released	Exemptions used or, to whom referred (Identify statute if (b)(3) cited)
58+59	7/36	NOT COPIED - PHAMPLET - SEE ATTACHED SHEET RE. PUBLIC SOURCE	—	—	
60	6/33	NOT COPIED - MAGAZINE - SEE ATTACHED SHEET RE. PUBLIC SOURCE	—	—	
61	10/33	" " " " "	—	—	
62	1932	" " " " "	—	—	
63	1948	1948 - LITTLE RED BOOK - TELEPHONE BOOK - NO ENTRIES IN BOOK	—	—	NOT COPIED
64	4/14/49	POSTCARD TO GOLD FROM RABACCHI	2	2	
65	6/3/50	CALLING CARD - A.F. BYRON	1	1	
66	7/13/50	MEMO - SA TO SAC - RE. INDEX CARD	1	1	
"	6/50	INDEX CARDS WITH NAMES & ADDRESSES	37	37	
67	10/27/43	LETTER TO HARRY FROM MARION	1	1	
68	7/13/50	MEMO SA TO SAC RE. BOOKLET	1	1	
"	6/3/50	NOT COPIED - BOOKLET - SEE ATTACHED PAGE RE. PUBLIC SOURCE	—	—	

FBI/DOJ

Inventory Worksheet
FD-503 (2-18-77)

VOLUME 185

PHILADELPHIA FILES

INVENTORIED BY llw

REVIEWED BY PLP

File No: 65-4307 Re: Harry Gold

Date: 3/78 (month/year)

Serial	Date	Description (Type of communication, to, from)	No. of Pages Actual	No. of Pages Released	Exemptions used or, to whom referred (Identify statute if (b)(3) cited)
69	7/13/50	SA TO SAC RE. EXHIBITS	2	2	
11	6/3/50	MISCELLANEOUS CARDS & PAPERS	5	5	

FBI/DOJ

PUBLIC SOURCE DOCUMENTS
65-4307-1-B-5

1. serial 18- "FROM DOUBLE EAGLE TO RED FLAG"
General P.N. Krassnoff
Translated from the Second Russian Edition
by Erik Law-Gisiko
Blue Ribbon Books, NY copyright-1926 852 pgs.

2. serial 19- "GENESEE FEVER"
Carl Carmer
Farrar & Rinehart Inc., NY
copyright-1941 360 pgs.

3. serial 20- "THE TWILIGHT OF WORLD CAPITALISM"
William G. Foster
International Publishers, NY
copyright-1949 168 pgs.

4. serial 21- "NOTES FROM THE GALLOWS"
Julius Fuchik
New Century Publishers, NY
copyright-1948 112 pgs.

5. serial 23- "MICROBE HUNTERS"
Paul de Kruif
Harcourt, Brace & Company
Pocket Books Inc, NY
copyright-1926 400 pgs.

6. serial 29-1 -"POLITICAL AFFAIRS"
June 1947
New Century Publishers
832 Broadway NY,NY

7. serial 38- "TEN YEARS OF THE COMMUNIST INTERNATIONAL"
I. Komor
Workers Library Publishers
35 East 125th St. NY,NY
March 1929 46 pgs.

8. serial 49- "CHEMICAL EQUIPMENT REVIEW"
July 1942
Putman Publishing Company
737 N. Michigan Ave.
Chicago, Ill. 72 pgs.

continued...

PUBLIC SOURCE DOCUMENTS continued...

9. serial 50- "ACHIEVEMENT"
Tri-State College Bulletin
September 1937 vol 54 60 pgs.

10. serial 51- "FOOD INDUSTIES"
McGraw-Hill Publishing Company
Albany, New York
March 1940, Vol 12/Number 3 140 pgs.

11. serial 56- "THE FUTURE"
February 1916
Published Forwards Association
(in Hebrew) 109 pgs.

12. serial 55- "INDUSTIAL & ENGINEERING CHEMISTRY"
Acedic Anhydride
Reinhold Publishing Corp. NY
October 20, 1935 16 pgs.

13. serial 57- "HEALTH & HYGIENE
March 1936
H & H Publishing
copyright-1935 Union Square, NY 34 pgs.

14. serial 58 & 59- DEPARTMENT OF ENGINEERING RESEARCH
University of Michigan, Ann Arbor
"DUST-REMOVAL EFFICIENCY OF SCHNEIBLE
MULTI-WASH DUST COLLECTOR"
by Hugh E. Keeler
Project # 1M72
Claude B. Schneible Co. Chicago, Ill.
July-December, 1936 8 pgs.

15. serial 60- "CATALYST"
Arthur H. Thomas Co.
Vol 18, Number 6 25 pgs.

16. serial 61- "CATALYST"
October 1933 21 pgs.

17. serial 62- "CATALYST"
Late Summer Directory Issue
1932 25 pgs.

PUBLIC SOURCE DOCUMENTS continued...

18. serial 68- "TALES TOLD IN LONG HOUSE"
Fifteen selected Indian legends as handed down in the folk lore of the Iroquois for your reading with the compliments of
THE CARBORUNDUM COMPANY
Niagra Falls, New York

FD-161
(7-1-48)

BULKY EXHIBIT

Date received 6-3-50

HARRY GOLD

RSP R

(Title of case)

Submitted by Special Agent R.A. Pett & Thomas F. Carrig

Source from which obtained Home of Joseph Gold

Address 6823 Kindred Ave., Phila, Pa.

Purpose for which acquired Evidence

Location of bulky exhibit Bulky Exhibit Room

Estimated date of disposition 12-1-50

Ultimate disposition to be made of exhibit to be determined

RETYPED

List of contents:

1. Jacket file folder entitled "Flue Gas from Smelters" containing misc notes & other material. (sent Lab 6-12-50, dated 7-19-50)
2. Airmail envelope & ltr to Harry Gold postmarked Mar 18, 1949, Los Angeles, Calif.
3. Ltr to Harry Gold from Pvt Wm. J. Murphy postmarked Roswell, New Mexico Sept 24, 42.
4. Jacket file folder containing misc notes identified by PCB & FFB. (sent Lab 6-12-50 dated 7-19-50)
5. Manila envelope of Eastman Kodak Co., Rochester, NY with name Al Black Bldg. 110 on front containing photographs. (sent Lab 6-12-50 dated 7-19-50)
6. Copy of The Worker dtd Mar 7, 1943.
7. Envelope addressed to Harry Gold postmarked Boston, Mass Oct 4, 1949
8. Piece of notepaper with name Mr. Theodore Kapala, et al.
9. Piece of paper towel with name of Dr. E. E. Meyers, et al.
10. Paper card with name Dr. E. L. Beckman, etc.
11. Ltraddressed to Harry Gold from Theo B. Krouse, postmarked A...ington, Pa. Aug 22, 49
12. Four photostats in German identified by FFC.
13. Notepaper re: Paul Starcher.
14. Ltr without envelope to Dear Harry: from Your pal, Doc dtd May 24, 46. 65-43 07-1-50
15. United Air Lines time table effective Apr 28, 1946.
16. Postcard with name J. H. Bowen, etc.
17. Manila envelope marked J. H. Bowen's Job, containing misc papers.
18. Book entitled "From Double Eagle to Red Flag," by General Krassnoff. (sent Lab 6-12-50 dated 7-19-50)
19. Book entitled "Genesee Fever" by Carl Carmer.

SEARCHED INDEXED
SERIALIZED FILED
NOV 27 1951
FBI - PHILADELPHIA
100

returned 4/26/60 RetTag 8/3/67 ES

Returned 11/15/67 ES

Serials 30-69 in this packet

20. Book entitled "The Twilight of World Capitalism" by William Z. Foster.
21. Book entitled "Notes from the Gallows" by Julius Fuchik.
22. Ltr in German signed by B. Heiler.
23. Pocket Book entitled "Microbe Hunters" by Paul deKruif.
24. Two match books from Seattle, Wash.
25. Card of Anton B. Tokarski.
26. Reading RR Ticket envelope containing Pullman stub tickets and Theatre Tickets.
27. A 1947 Pocket Dairy book.
28. Four photostats in German identified by YPC.
29. Red Fibre Folder containing miscellaneous blueprints, correspondents and notes identified by FCB.
30. One piece of paper with name Mrs. Sarah Pecker.
31. One piece of paper with name S. M. Snyder.
32. ltr addressed Dear Harry from Ed dtd 2-1-48.
33. Check on National City Bank of NY dated 11-29-47 signed S. Brothman, also similar checks dtd 12-13-47 & 1-3-48.
34. Ltr addressed Harry Gold and Philip Levine signed Miriam in envelope from Brothman & Moskowity, Basil Switzerland.
35. Ltr 16 pages addressed to Harry Gold and Philip Levine signed SHM in envelope from Mr. A. Brothman, Basel, Switzerland.
36. Ltr. to Harry Gold from Levine postmarked Flushing N. Y. Oct 27, 1948.
37. Envelope containing Statement of Salary Due. Envelope from Newhouser Hotel Salt Lake City, Utah.
38. Small Book entitled "Ten Years of the Communist International by I. Komor.
39. Envelope addressed Harry Gold from Jean 1841 S. Alden St. Phila. Postmarked Phila March 31, 1948.
40. Airmail ltr to Harry Gold from Mrs. Dr. Green, Los Angeles, Calif, postmarked Feb 2, 48.
41. Ltr to Harry Gold from Oscar J. Vags postmarked NY June 30, 1948.
42. Ltr to Harry Gold from Philip Levine postmarked Storrs, Conn. July 30, 1948.
43. Ltr to Harry Gold from Philip Levine re retaining Robert Hoffman, Atty. postmarked Flushing NY Sept 15, 1948.
44. Ltr without envelope to Harry from Phil dtd Aug 30, 1948 enclosing statement re back Salary due Gold and Levine from A. Brothman.
45. Ltr without envelope to Harry and Butch from Doc dtd Nov 15, 1945.
46. Purse calendar containing 3x5 white paper.
47. Envelope postmarked Far Rockaway July 23, 1951 from Cottman.
48. Loose leaf Spiral notebook of University of Penn.
49. Magazine entitled "Chemical Equipment Preview July 1942 containing name Art Simmers.
50. Tri State College Bulletin Sept 1937 Vol 54 #3.
51. Magazine food Industried March 1940.
52. White paper containing pencil notes.
53. Three yellow sheets containing names and addresses.
54. Selective Service return envelope Local Bd #65.
55. Magazine Industrial Engineering Chemistry Vol 27 #35.
56. Jewish language magazine bearing word Future Feb 1916.
57. Magazine Health and Hygiene March 1946.
58. Dept Eng Research Magazine.
59. University of Michigan Bulletin Dec. 1936.
60. Catalyst Vol 18 NO6, June, July 1933.

61. Catalyst Oct. 1933.
62. Catalyst Vol 17, No 7, 1932.
63. Little Red Book year 1948.
64. Post card from M. Rabacchi to Harry Gold Postmarked 4-14-49.
65. Card to A. F. Byron, Innis, Speiden & Co.
66. One bunch of 3x5 cards with names and addresses--37 cards.
67. Letter without envelope to Harry from Marion dtd Oct 27, 48.
68. Pamphlet entitled Tales told in the Long House , Niggara Falls, New York.
69. Envelope containing 12 papers and business cards.

Mrs. Sarah Pecker
2301 W. North Ave.
Balto. Md
21 52 24.

S.N. Snyder
1701 Moreland Ave.
Balto. Md. 21
Md 21230

65-4307-1-B-5 (30+31)

65-4307-1805(32)

Sunday - 2/1/42

Dear Herg—

I send you herewith my check drawn to your order in the sum of $45. Of this $5 are the $5 to cover the cost of the stated check. Enclosed also is your note duly cancelled & the check. Be sure to advise if your endeavors after retaining them to Boston.

Best always

Ed.

CS-4307-HB-5(33)

NEW YORK Jan. 3 1948 39

No. 1-8
210

THE NATIONAL CITY BANK OF NEW YORK
LONG ISLAND CITY BRANCH
NORTHERN BOULEVARD AND QUEENS PLAZA
LONG ISLAND CITY, L.I.

PAY TO THE ORDER OF Harry Gold $350.00

Three Hundred Fifty DOLLARS

P.W.

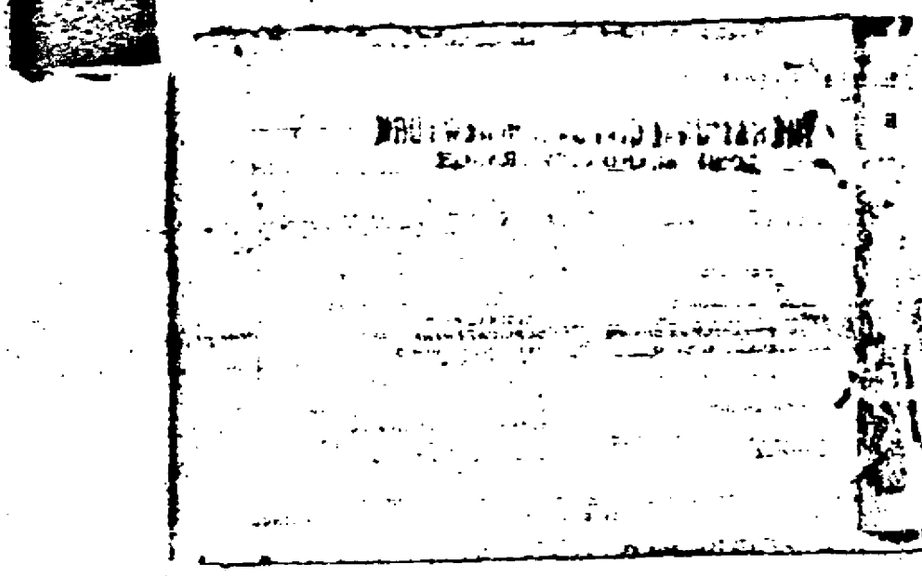
A Brotman

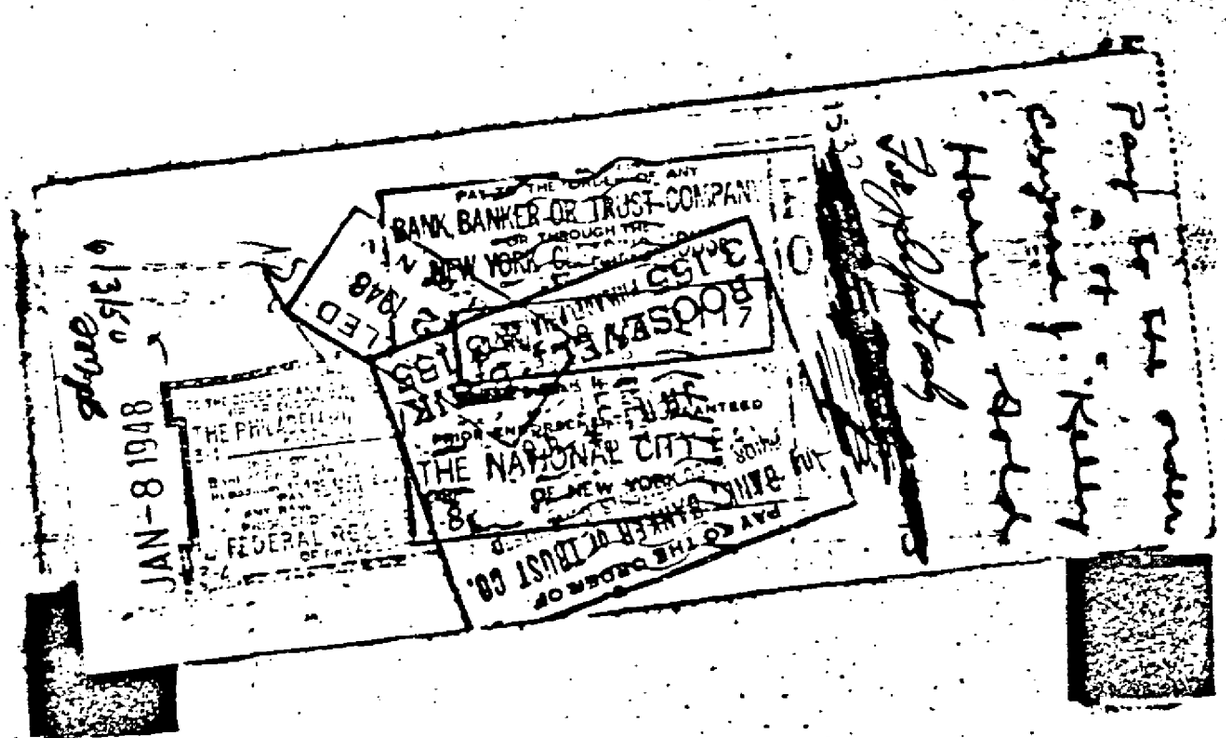
ST 1010-A REV. 10-44
DC

RETURN THE NATIONAL CITY BANK OF NEW YORK
LONG ISLAND CITY BRANCH BRANCH
OF
THE NATIONAL CITY BANK OF NEW YORK
NEW YORK, N. Y.

- ACCOUNT CLOSED
- BANK STAMP
- COUNTER SIGNATURE
- DATE
- ENDORSE EXACTLY AS DRAWN
- ENDORSEMENT MISSING
- FILLING
- FUNDS NOT AVAILABLE
- SPECIAL GUARANTEE OF ENDORSEMENT
- INSUFFICIENT FUNDS
- NO ACCOUNT AT THIS OFFICE
- NO ADVICE
- NO INSTRUCTIONS TO PAY
- NOT DUE
- OFFICIAL RECEIPT MISSING
- ORIGINAL PAID
- DUPLICATE PAID
- PAYMENT STOPPED
- SENT WRONG
- SIGNATURE MISSING
- SIGNATURE UNKNOWN
- SIGNATURE UNSATISFACTORY
- SIGNATURE NOT ON FILE
- TWO SIGNATURES REQUIRED
- UNCOLLECTED FUNDS
- VOUCHER MISSING

THESE ENDORSEMENTS APPEAR TO BE WRITTEN BY THE SAME PERSON.
THIS CHECK MUST BE ENDORSED BY EACH PAYEE IN HIS OWN HANDWRITING.




BANK BANKER OR TRUST COMPANY
THE NATIONAL CITY
JAN-8 1948

No. _____ New York Nov. 29 1947 19

THE NATIONAL CITY BANK OF NEW YORK
LONG ISLAND CITY BRANCH
NORTHERN BOULEVARD AND QUEENS PLAZA
LONG ISLAND CITY, L.I.

1-8/210

PAY TO THE ORDER OF Harry Gold $550 00/100

Five Hundred fifty 00/100 DOLLARS

A Brothman

8

FORM 1010-A REV. 10-44

THE NATIONAL CITY BANK OF NEW YORK

RETURNED DRAWN ON LONG ISLAND CITY BRANCH BRANCH

BY _____ OF

THE NATIONAL CITY BANK OF NEW YORK
NEW YORK, N. Y.

- ACCOUNT CLOSED
- BANK STAMP
- COUNTER SIGNATURE
- DATE
- ENDORSE EXACTLY AS DRAWN
- ENDORSEMENT MISSING
- FILLING
- FUNDS NOT AVAILABLE
- SPECIAL GUARANTEE OF ENDORSEMENT
- INSUFFICIENT FUNDS
- NO ACCOUNT AT THIS OFFICE
- NO ADVICE
- NO INSTRUCTIONS TO PAY
- NOT DUE
- OFFICIAL RECEIPT MISSING
- ORIGINAL PAID
- DUPLICATE PAID
- PAYMENT STOPPED
- SENT WRONG
- SIGNATURE MISSING
- SIGNATURE UNKNOWN
- SIGNATURE UNSATISFACTORY
- SIGNATURE NOT ON FILE
- TWO SIGNATURES REQUIRED
- UNCOLLECTED FUNDS
- VOUCHER MISSING

THESE ENDORSEMENTS APPEAR TO BE WRITTEN BY THE SAME PERSON.
THIS CHECK MUST BE ENDORSED BY EACH PAYEE IN HIS OWN HANDWRITING.

No. _____ New York Dec. 15 1947 19

THE NATIONAL CITY BANK OF NEW YORK
LONG ISLAND CITY BRANCH
NORTHERN BOULEVARD AND QUEENS PLAZA
LONG ISLAND CITY, L.I.

1-8/210

PAY TO THE ORDER OF Harry Gold $550 00/100

Five Hundred Fifty 00/100 DOLLARS

P.W.

A Brothman

RETURNED TO No. 8

BY ... BRANCH OF

THE NATIONAL CITY BANK OF NEW YORK
NEW YORK, N. Y.

- ACCOUNT CLOSED
- BANK STAMP
- COUNTER SIGNATURE
- DATE
- ENDORSE EXACTLY AS DRAWN
- ENDORSEMENT MISSING
- FILLING
- FUNDS NOT AVAILABLE
- SPECIAL GUARANTEE OF ENDORSEMENT
- INSUFFICIENT FUNDS
- NO ACCOUNT AT THIS OFFICE
- NO ADVICE
- NO INSTRUCTIONS TO PAY
- NOT DUE
- OFFICIAL RECEIPT MISSING
- ORIGINAL PAID
- DUPLICATE PAID
- PAYMENT STOPPED
- SENT WRONG
- SIGNATURE MISSING
- SIGNATURE UNKNOWN
- SIGNATURE UNSATISFACTORY
- SIGNATURE NOT ON FILE
- TWO SIGNATURES REQUIRED
- UNCOLLECTED FUNDS
- VOUCHER MISSING

THESE ENDORSEMENTS APPEAR TO BE WRITTEN BY THE SAME PERSON.
THIS CHECK MUST BE ENDORSED BY EACH PAYEE IN HIS OWN HANDWRITING.

ROOSEVELT-BANK 3-155

PAY TO THE ORDER OF ANY BANK, BANKER OR TRUST CO. THE PHILADELPHIA NATIONAL BANK OR THROUGH NEW YORK CLEARING HOUSE

DEC -3 1947

THE NATIONAL CITY BANK OF NEW YORK

Any Bank, Banker or Trust Co.

ROOSEVELT-BANK 3-155

N. Y. DEC 23 1947 CANCELLED

DEC 19 1947

THE PHILADELPHIA NATIONAL BANK

FEDERAL RESERVE BANK

DEC 19

THE NATIONAL CITY BANK OF NEW YORK

Any Bank, Banker or Trust Co.

65-4307-1B-5(34)

Brothus and Moskowitz
Hotel Schweizerhof
Basel, Switzerland

LUFTPOST
PAR AVION VIA AERIENNE

The Messrs. Harry Gold and Philip Levine
c-o A. Brotman and Associates
8503 57 Avenue
Elmhurst, L. I., N.Y.
U. S. A.

Hotel Steigerhof
Basel, Switzerland
19 May 1948

Hello everyone,

You must all forgive me, but this is the best way I know for writing to all of you, otherwise I'd delay it endlessly.

Of course we forgot the typewriter, so I'm attempting to conquer a German-French language Remington. It's got even better symbols on it that mine does, look: £ ç é'' § ü ä ö . The y is where the z should be and a few other changes make it a cussing operation. I've been typing all morning so by now I'm pretty good.

To attempt to share some of excitement with you: I shall never forget the trip over the Atlantic - clouds under us all the way over and when there were no clouds there was nothing for we were too high up to see the water, 17,000 ft. The details were these: Flagship Holland, May 15-16, 1948, NY to London direct; 10:00 GMT position, Mizenhead, SW Ireland; ground speed 224 mph; air temperature 10° F.; total distance 3,550 statute miles; average ground speed 277 mph; fuel consumed 4,100 US gals; arrival London 1:15 pm London time. Abe slept fitfully most of the trip with nightmares and sleep-talking and kept wishing the plane would turn back. The air pressure gave me an abdominal pain and a toothache but other than that it was a wonderfully easy trip. We got into London and there was no mistaking where we were. English as it was spoken there is like another language and over the telephone it's impossible to understand anyone. We caught on to the currency problem fairly easily because our bill at the hotel, with only two sparse ½ meals came to almost fifty bucks. London definitely doesn't like Americans and we understand it's even more so on the Continent.

With only one day in London, our impressions were that it is a city in dire need. The great Midland Bank with a cracked and unrepaired window, the bombed out structures not yet repaired, the obvious old clothes that its people must wear, the terrible shortage of food - one must feel a huge sympathy and a desire to help. As Abe said, it is the last evidence of an empire in decay. Its government prattles about socialism but there is a complete lack of planning, as we know in the States, only it must be seen to be appreciated.

We met with Pom Sunday evening and Monday before plane time, who briefed us for our visit with Lonya. He says that we will sign, but since we've all had too much of good hopes and too little of the realization, I shall not say anything more of the negotiations for the length of our stay here. You will get a wire if we close and an airmail letter if we don't.

We flew from London direct to Basel in a DC-4 which seemed like paper after the big plane the day before. I was terribly ill and took a day to recover. However, I couldn't help marvelling at the beautiful scenes - crossing the Channel, flying over France, climbing mountains (during which the plane rattled in all directions and seemed to be unable to make the climb) and landing in a small airfield near Blotzheim on the French border. The small populace considers it an event to see a plane so they were all turned out for the occasion. We were escorted by the French military to the Swiss border amid a great deal of ceremony, were briefly searched, our baggage that is, and were then driven to Basel. Our French soldier attempted to be friendly by commenting about the weather, but it's very different to listen to a Frenchman say "Very warm, today, isn't it" than it is to hear it said by the French teacher at Bayonne High. We had to let ourselves be taken

for the ignoramuses that we were. Abe grins everytime he doesn't understand anyone and turns to me as though I'm the linguist, which encourages the speaker to rattle on until I yell for him to stop. I'm getting to be quite a gesticulator.

Well, we're in Basel now, and a more beautiful place I never imagined. On a clear day one can see the German border in one direction and the Alps in another. Switzerland is the kind of place one would wish to live in for the rest of one's life....calm, ppaceful, good clean air, wonderful food. Everyone bikes and hikes although there are as many American automobiles on the streets as there are in any American town of 160,000 population. And everybody looks so healthy - one can't help noticing the difference between the Swiss and the English. There is no doubt that the famous Swiss neutrality brought its people a fair amount of prosperity,for playing both sides always nets a return when it's done so well. But apart from the political resentment one might feel towards the Swiss for not having taken a stand against Fascism, one must absorb the beauty and the well-being of the country. I shall surely regret having to leave.

We met with Dr. Stirnemann and a Mr. Haffen yesterday afternoon and evening. In the afternoon they put Abe through the ropes discussing science in general and chemistry in particular. Haffen is the manager of the monomer plant, but no mention as yet was made of methacrylate. In the evening they were our gracious hosts and were most charming to be with. Again the talk inevitably turned towards physics and chemistry and by the end of the day it looked like they were convinced ABA invented chemistry. They know how small we are, but they believe us to be a most unique organiyation. It really looks good, guys, but there - I've mentioned

Abe met with them again this morning and came back a bit winded. All they asked him to do for them by ~~tomorrow morning~~ this afternoon is to design a plant for the monomer! He's hard at work now and begged off having lunnh with them in order to get it done in good time. We've not yet seen Dr. Schenker who will apparently see us tomorrow when Pom gets here. We had to go through three doors to get to Hrk Stirnemann so there must be five doors to Schenker. If we could have remembered to take more of the materials we need here Abe would undoubtedly have an easier time of it. Pom will be our best friend here - they do not have enough praise for him. We got a little of the charm he is able to turn on, when we met him in London, because he was quite different from what we had previously seen. Apparently the dollars are getting closer so he feels constrained to give us a bit of the old one-two for it. But he sure has sold Lonya on Dr. Pomeranisc; he is the open-sesame for us here.

I'll keep dropping you a line everytime I can. Abe is yelling for me to get out and see the town instead of writing people what I've not yet seen, so I'm going to take his advice very willingly. I shall probably not write for another two or three days. The negotiations here will take, as I estimate it, at least a week, so you can try writing us. If we move on before your mail reaches us, the hotel will forward it to wherever we go.

Cheerio,

Miriam

cc: Mom 'n' Pop
Gert 'n' Harry
Harry 'n' Phil
Oscar

65-4307-1-B-5(35)

See bottom p. 15 - "Note"

May 22, 1948
EMERGENCY

Dear Harry and Phil:-

I sent a cable today to Phil for the both of you, to wit:

"BAD CONNECTIONS PREVENTED TELEPHONING STOP OPPORTUNITY TO SELL CYANHYDRIN PROCESS FOR IMMEDIATE TEMPORARY INSTALLATION STOP URGENTLY REQUIRE FULL ATTENTION TO LETTER MAY 22 THANKS ABE"

The explanation of this is the following:

Since Tuesday when we arrived in Switzerland I have been in constant conference with the various technical and commercial personnel of the Lonza Company with a view to reaching an agreement as early as possible. I have been accorded the most friendly and hospitable attentions I could wish for and think I can best sum up what is happening here by telling you that all indications point to the early achievement of an extremely favorable working agreement on the methacrylate system as a whole. As soon as I get the time I shall write you of this in greater detail. Suffice it to say that what has already been agreed to by Lonza and approved for incorporation into a contract far outreaches my fondest hopes. But perhaps the most startling and wonderful development of the conferences has been the fact that we will, in all likelihood, be able to unload our cyanhydrin method of producing the monomer. It is in relation to this matter that the following instructions take on the greatest importance and justify the most earnest, urgent and emergency treatment by you.

Although it would be possible for me to "unload" the cyanhydrin method exactly as we developed it for the Chinese as a last-ditch attempt, the "patent-infringement" consciousness of these people makes it inadvisable to propose a method which involves trick procedural rearrangements involving the use of chemicals specifically named in the series of DuPont and ICI patents relative to the cyanhydrin processes. It would therefore be of tremendous importance for us to paraphrase, in a sense, the process as we developed it so that some basically new chemical is employed to carry out the intent and the mechanics of the procedure as it was previously developed. Let me therefore take the liberty of repeating in outline something that we have discussed many times before:

Our cyanhydrin method for the synthesis of methyl methacrylate monomer involved:

1. A procedure for the synthesis and isolation of acetone cyanhydrin which you could easily obtain in detail from Bill Rohall. This aspect of the synthesis is of no immediate interest to the purpose of this letter, it being my purpose to write you on this matter tomorrow.

2. The addition of acetone cyanhydrin to an excess[1] of 100% sulfuric acid at such a rate that under the conditions of water-cooling of the reaction flask at no time during the addition of the acetone cyanhydrin is a temperature of 80°C. for the mixture exceeded. The addition is characterized by a strong evolution of heat. Upon completion of the addition of the acetone cyanhydrin to the sulfuric acid, we raised the temperature of the reaction mass to 150°C. in a period of five minutes, held the reaction mass at that temperature for five minutes, and then quickly cooled the reaction mass to 130°C.[2] Having cooled down to 130°C., we commenced the addition of a mixture of methanol and water at such a rate that the quantity of mixed alcohol and water under the conditions of a uniform rate of feed was added over a period of 1½ hours. Since we maintained the reaction mass in the flask at 130°C. throughout the period of addition of the methanol-water mixture, the addition was accompanied by the constant removal of a distillate of varying quality.[3]

1/ For all questions as to the specific procedure we used previously, consult Bill for the calculations on the Chinese job which will be found in the office file cabinet. Oscar knows where they are. I would prefer not to have Bill rely on his memory in this case, because this is a crucial matter; rather, have him consult his notebook. If there is any trouble about finding the precise instructions I used, please cable me at the Park Hotel, Vitznau, Switzerland until about May 26; after that care of Dr. E. Stirnemann, Lonza, Basel.

2/ This is a critical point in the procedure, it being important to cool back as rapidly as possible. On the heat-up to 150 C., there frequently occurs a foaming of the reaction mass. Bill can tell you about the handling of this. We generally went after the foam with a few drops of octyl alcohol. It is important that hydroquinone be present in the column (on the packing) and in the methanol-water mixture which is to be added, as well as in the receiver for the distillate. Copper powder should also be added to the reaction mixture.

3/ By "quality" here, we refer to the fact that the initial distillate will form a single phase and consists principally of methanol and

Essentially, the distillate was a ternary system consisting of water, methyl methacrylate and methanol which, upon collection in the distillate receiver, ultimately separated out into two phases: an upper layer whose principal component was methyl methacrylate but which also contained water and methanol, and a lower layer whose principal constituent of which was water although it contained some methanol and some methyl methacrylate. To assure the complete removal of all of the monomer formed during the reaction, upon completion of addition of the water-methanol mixture, we passed steam through the reaction mass until the temperature at the top of the column indicated the boiling point of water alone. The equipment used consisted of a three-neck flask agitated by a paddle mixing unit, an addition funnel in one neck which served first for the addition of the acetone cyanhydrin to the sulfuric acid and which later served for the addition of the water-methanol mixture. The other neck of the flask contained a thermometer and the inlet tube, and a distillation column.

The distillation column in its main section was approximately 1½ inches in diameter and 12-15 inches high. The column was packed with berl saddles on which there was a random distribution of copper powder. The purpose of the copper powder was to act as an inhibitor of polymerization of monomer methacrylate condensate.

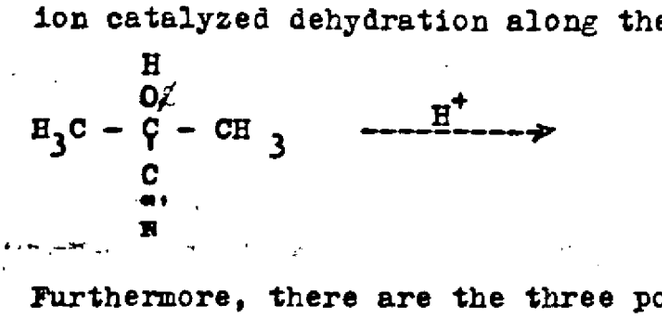
3. The two-phase distillate from the above procedure was separated and the upper layer was washed successively three times with volumes of water equal to the volume of the washed layer. All of the washings were joined up and put aside. After having completely washed the upper layer as described above, the washings were subjected to a distillation for the removal of the methanol contained therein.

3/ (Cont.) - and methyl methacrylate. Later on water gets to be a higher mol fraction of the distillate and as the quantity of water in the distillate increases, the separation into two phases occurs. The changing quantity as herein defined is accompanied by a change in the temperature of the material coming over at the top of the column. There will be a period during the initial addition of the water-methanol mixture during which no distillate comes over.

When a sufficient portion of the methanol had been distilled from the washings, a resting of the material in the still pot produced a settling into two layers, the upper layer being an additional quantity of methyl methacrylate which was added to the main body of the methacrylate obtained as mentioned above.

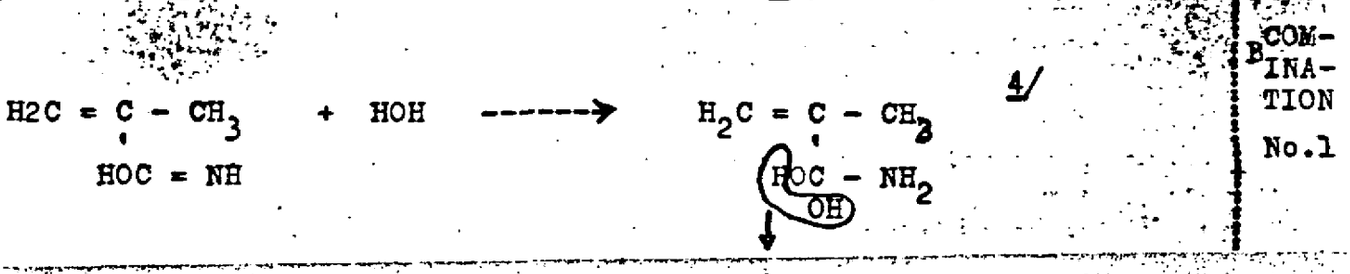
It is essential to this discussion to enumerate what we believe to be the mechanics of the reaction which was achieved as generally outlined above.

A. In the treatment of the acetone cyanhydrin which is outlined in Item 2 on Page 2, we believe that we were carrying out an intramolecular rearrangement of the following order:-



(1)

although it is also possible that all that we achieved was a hydrogen-ion catalyzed dehydration along the following lines:-

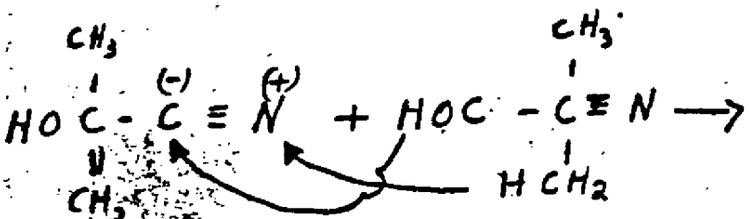


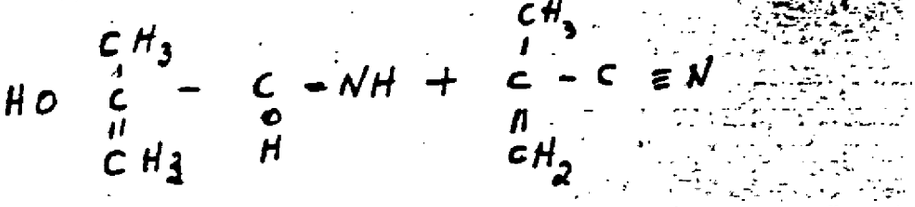
(2)

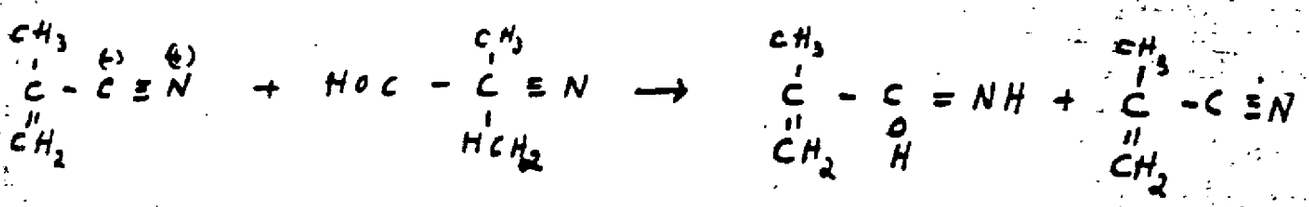
Furthermore, there are the three possibilities that any of the following three reaction combinations were accomplished:-

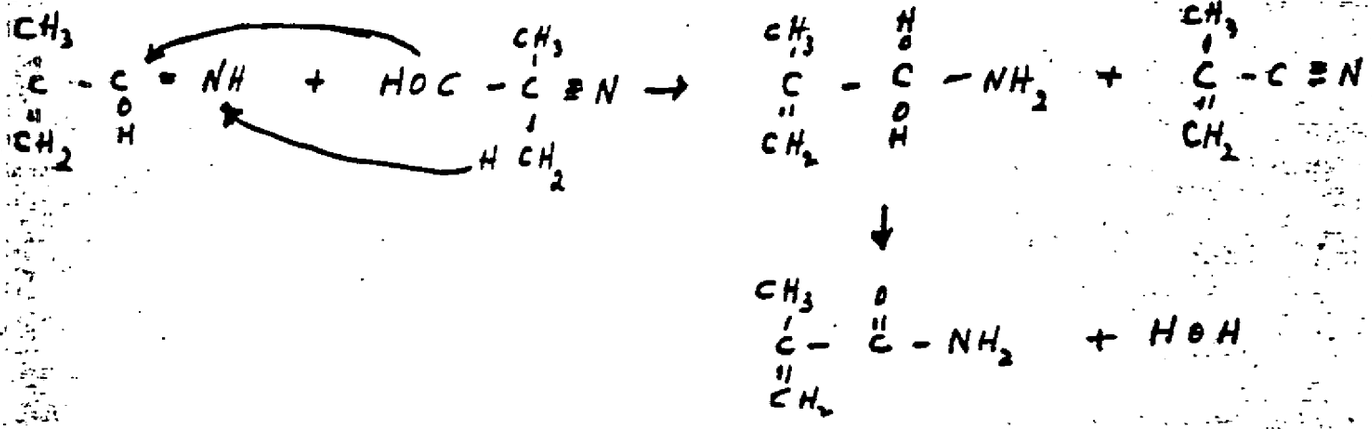
4/

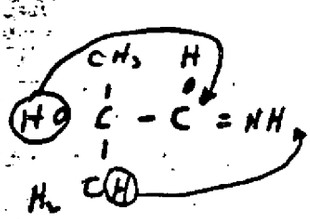
Combination Possibility No. 2



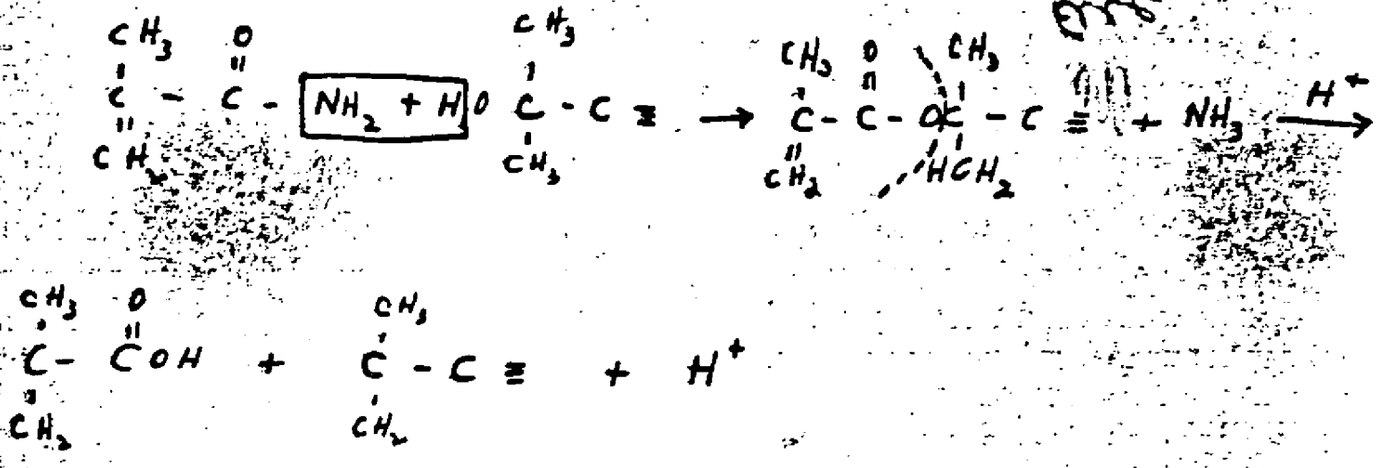




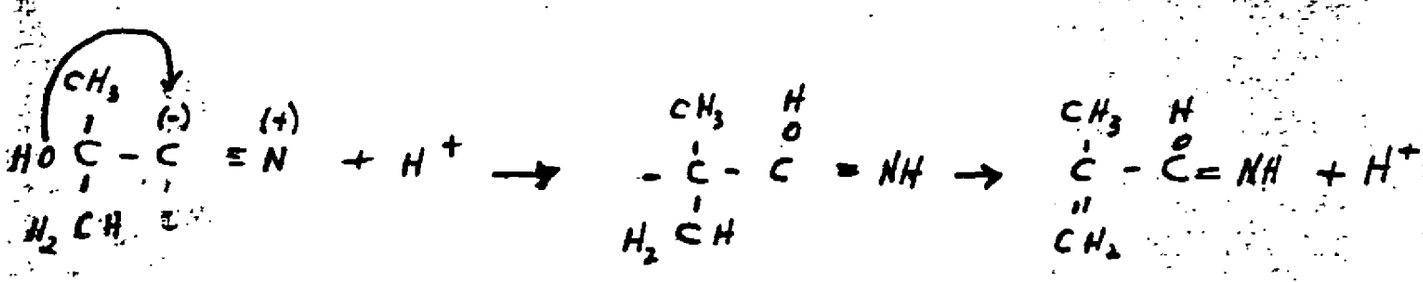




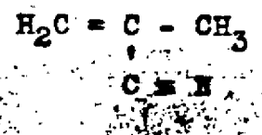
Continued--



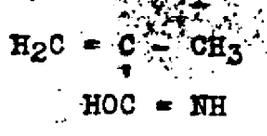
COMBINATION POSSIBILITY NO. 3



If any single one of the above were true, if any of the combinations were true, or if any group of them were true, we should expect that the system prior to the addition of the water-methanol mixture would contain any one or combination of the following:-

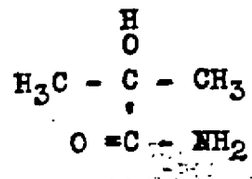


(A)

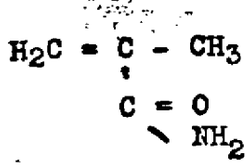


(B)

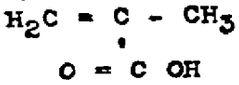
(C)



(D)

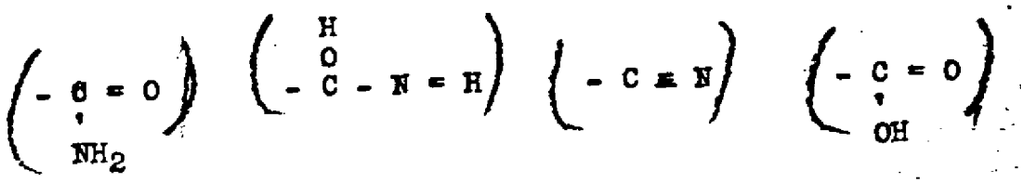


(E)

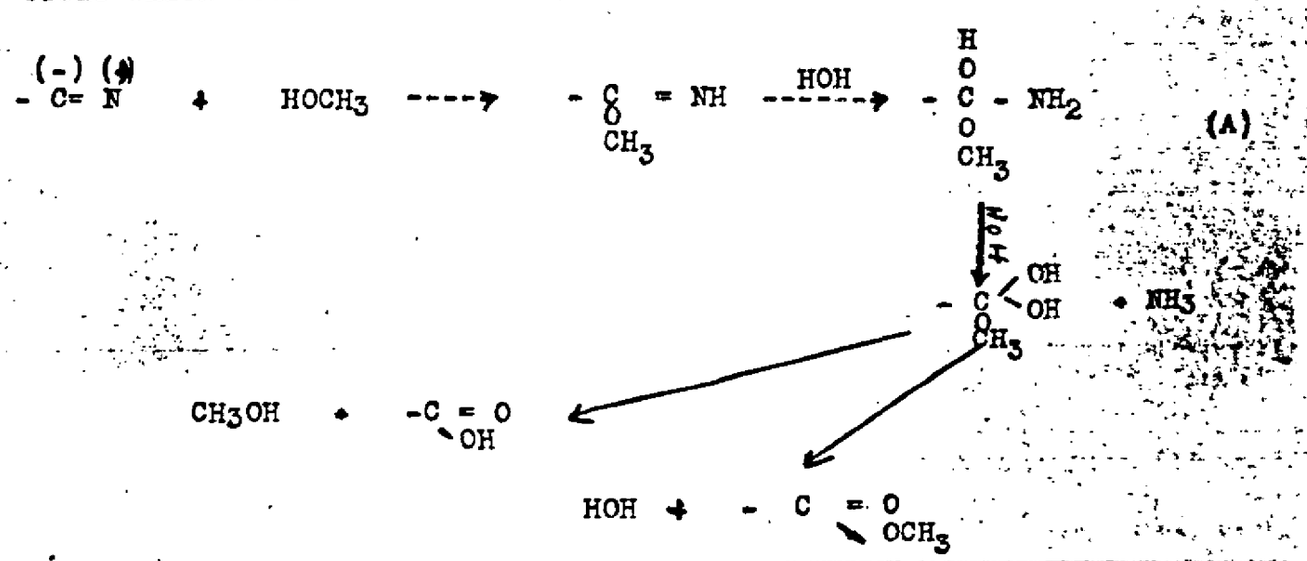


(F)

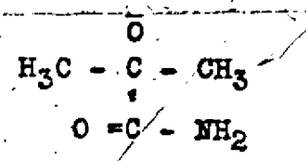
which, so far as the reaction possibilities released by the addition of the CH_3OH - HOH system is concerned, reduces to four basic groups:-



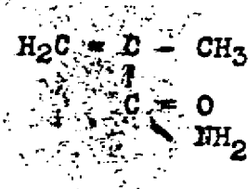
Upon addition of the water-methanol system, we could therefore expect a whole realm of possibilities, each with varying degrees of probability attached. These would flow from the various permutations which could be derived from the following basic "elements":-



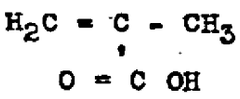
(A)



(D)

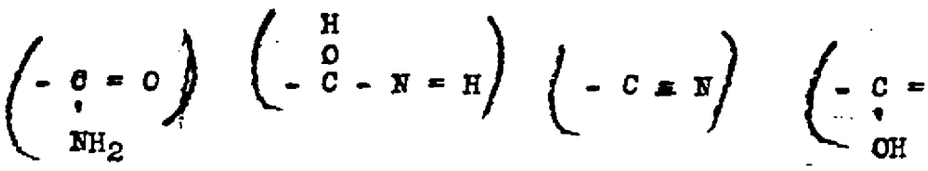


(E)

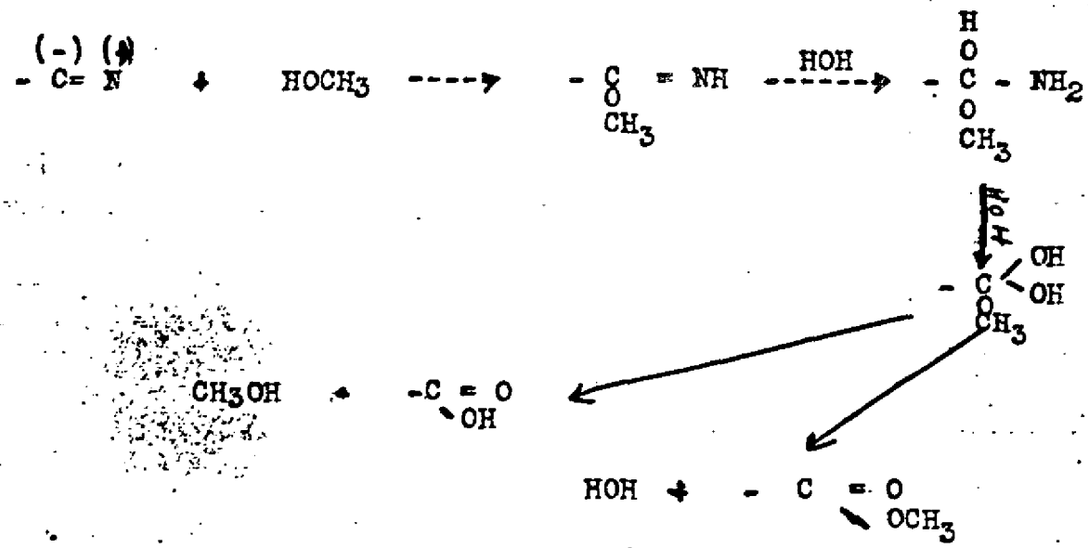


(F)

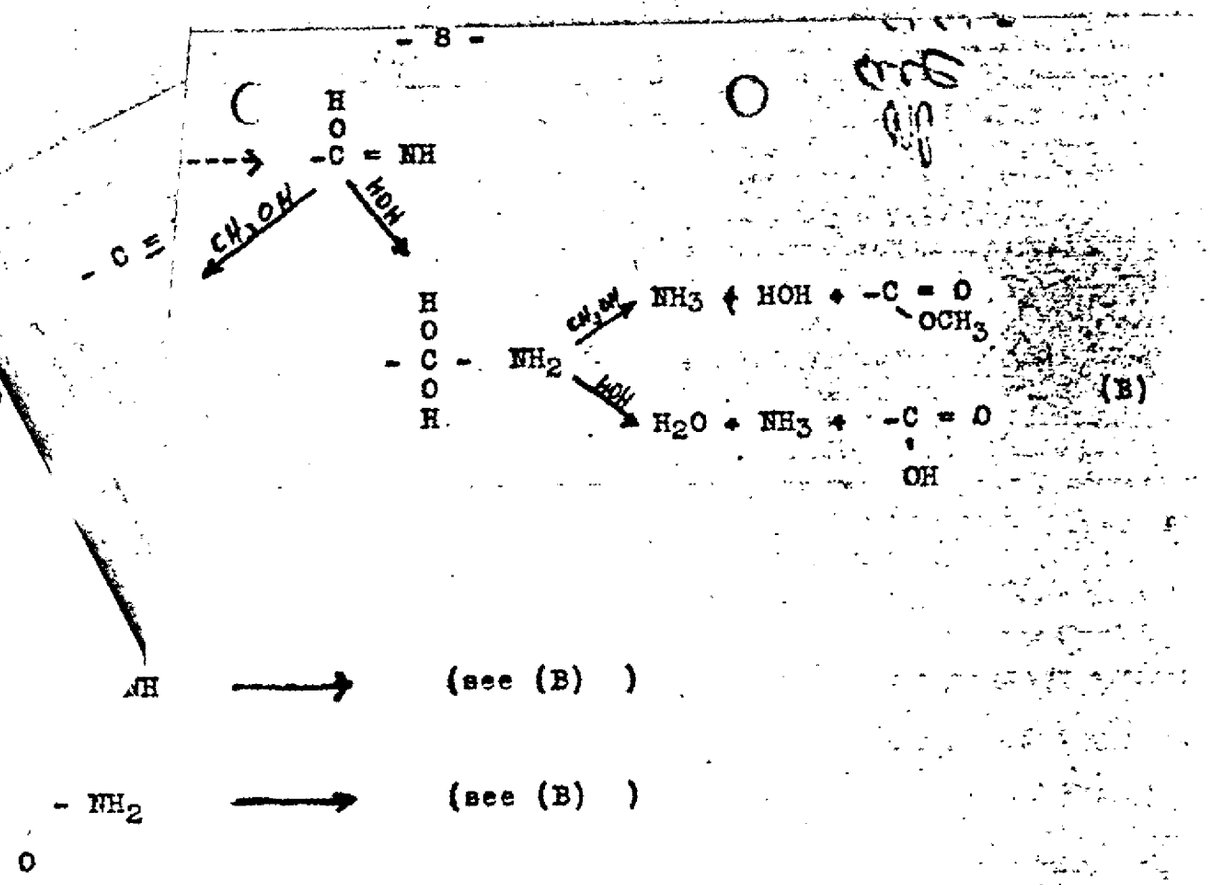
which, so far as the reaction possibilities released by the addition of the CH_3OH - HOH system is concerned, reduces to four basic groups:-



Upon addition of the water-methanol system, we could therefore expect a whole realm of possibilities, each with varying degrees of probability attached. These would flow from the various permutations which could be derived from the following basic "elements":-



(A)



Other glance at the array of combinations represented by (A), (B), (C), (D), (E), and (F) on Pages 6 and 7 will disclose that other functional groups are involved. These are:-

$H_2C = \overset{1}{C}-$ (A')

$H_3C - \overset{H}{\underset{O}{C}}-$ (B')

The reaction possibilities of these are as follows:-

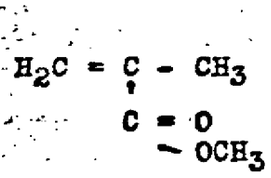
$H_2C = \overset{1}{C}- \quad H$ ------- polymerization

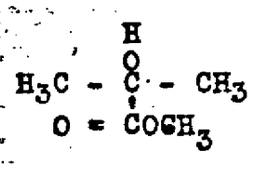
HOH / CH_3OH

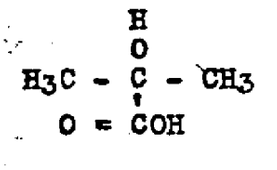
$H_3C - \overset{H}{\underset{O}{C}}-$ 5/

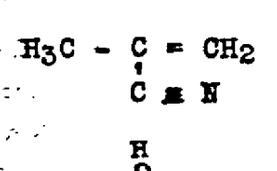
$H_3C - \overset{CH_3}{\underset{O}{C}}-$ 6/

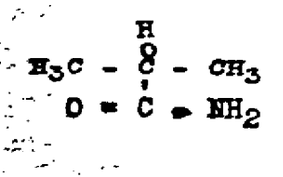
All of the above leads to the expectation that distributed between the residue in the reaction vessel at the end of the reaction and the distillate receiver we could expect to find the following principal "derivatives" of the above-mentioned potentialse-

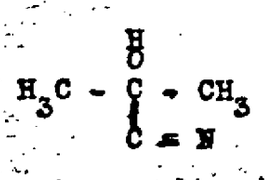

plus its polymer forms

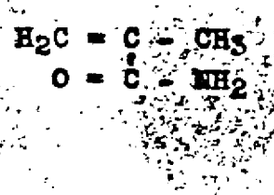

plus its products of decomposition

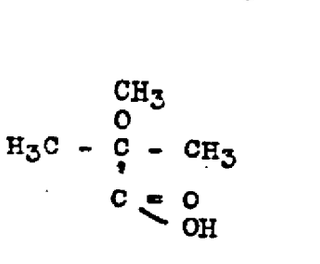

plus its products of decomposition

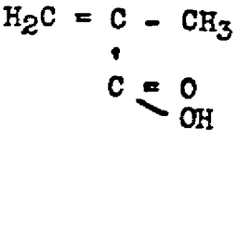

plus its polymer forms

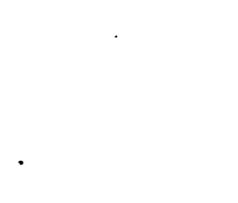

plus its products of decomposition


plus its products of decomposition


plus its polymer forms







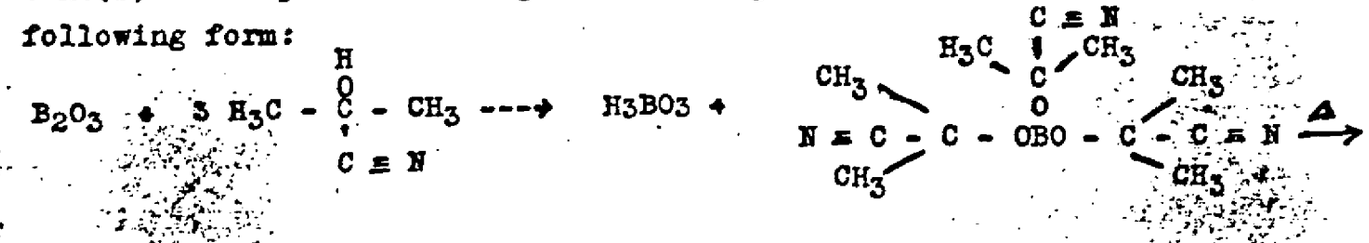
plus its polymer products

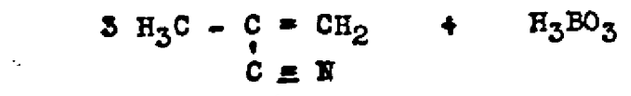
(continued --->)

Now, before I ~~xxx~~ go on to propose some probable methods of "paraphrasing" our cyanhydrin monomer process, let me explain one thing to you that will make all of the above more understandable: the Lonza people recently developed a cheaper method for the generation of HCN. This brought up the whole problem of a weighing of the cyanhydrin method against the new procedure which we have advanced. I therefore "leap into the breach" with the fact that we could provide the cyanhydrin method process which aroused tremendous interest, either as a temporary measure preceding the installation of a process bz the diol synthesis-oxidation-etc. method, or as a permanent installation supplying the requirements of a polymer powder and pâlymer sheet plant. My particular nervousness about disclosing the fact that our c yanhydrin process involves a procedural stunt using all of the same chemicals used by ICI, DuPont and Rohm and Haas flows from the fact that after hours and hours of talk on the Weitzmann process for the synthesis of the diol I only had them hanging on the ropes but not yet definitely wedded to the idea that we are not in any way in conflict with Weitzmann--this despite the very convincing proof I offered which followed the lines of our patent application. Now, therefore, I ~~xxy~~ raise the following possibilities against the background of what has been presented above:-

<u>Suggestion No.1</u>

Worthy of consideration in my opinion is the possibility of the use of the borate formation principle to accomplish the intent(s) of Step No. 2 on Page 2 which I present below in the following form:





I realize that (a) the formation of the borate may impair the stability of the addition of the CN group but I would tend to doubt this purely from the consideration that Phil seemed to believe that he had successfully formed the borate of the diol, the fragility of which impressed me much more substantially in view of its being a glycol, (despite the distance between the two hydroxyl groups) ; (b) the release of water by the boric acid (both that formed in the formation of the borate and that evolved in the decomposition of the borate) might tend to hydrolyze the C≡C (C triple bond) group all the way to a carboxyl group, this being a particular danger during the formation of the borate in the form of an attack on unconverted acetone cyanhydrin. This danger, the conversion of residual acetone cyanhydrin to alpha hydroxy isobutyric acid, which would be immediately decomposed by the boric acid at substantially temperatures, I would tend to discount unless boric acid is capable of setting up a complex whereby it becomes a powerful acid as in the case where two adjacent hydroxyl groups exist. This follows from our experience in hydrolyzing acetone cyanhdrin with 36% HCl which is a fair sort of strong acid. Here, with an abundance of water present, the time required for the completion of the hydrolysis is substantial. (c) I also realiye that the release of water by boric acid, particularly during the second stage of the process, namely, the elevated temperatures to which one will have to go to effect the decomposition of the borate ester, would tend to reverse the reaction releasing acetone cyanhydrin to the action of high temperatures at which it is notoriously unstable. In this connection I believe, however, that the abilitz of the CN group to undergo a reaction to form the amide may be a substantial enough competition at elevated temperatures to minimiye the hydrolysis of the ester.

Having given the above critique, it is clear from the equation I offered above in connection with this suggestion that we would wind up with a nitrile in the place of the amide which we have, up to date, assumed to be the product of Step 2 of our cyanhydrin monomer method. If the nitrile should be the outstanding product of the reaction, both the possibility afforded for the conversion of this

to the amide (and this would largely be true during the addition of a water-methanol mixture to the nitrile) and the rather well-known techniques for processing nitriles to esters does not allow me to believe that this would be a stumbling block. Moreover, if water released bz boric acid in the ways mentioned above were to attack the nitrile group, we would not in any case wind up with an amide.

The possibilities therefore afforded by this suggestion intrigued me and I should like to see an experiment tried consisting of the following+:-

1. An attempt to prepare the borate derivative of acetone cyanhydrin at a temperature not exceeding 80°C., starting from pyroboric acid as the raw material.

2. An attempt to decompose the borate derivative by heating (I know I don't have to warn you about safeguards against the possibility of HCN generation from unreacted acetone cyanhydrin).

I do not believe that it would be advisable to attempt to isolate the borate ester from anz unreacted material since, in any case, this would not be a desirable feature of the commercial installation and the likelihood is that any unreacted acetone cyanhydrin would be present in sufficient small mol fractions to force resort to extremely high temperatures (acetone cyanhydrin in the pure state boils at 82°C. at 20 mm.). If such an attempt at isolation were made via a distillation technique, it might tend to promote the heat polymerization of the nitrile or amide product as well as confuse the whole issue through the mixing of cyanhydrin in the distillate with the product of decomposition of the borate product(s), namelz, the unsaturated nitrile and/or amide derivatives of the cyanhydrin. If the experiment should be successful as far as the formation of the unsaturated nitrile or amide is concerned, I should like to see a direct attempt at esterifying the amide and/or nitrile without resorting to external agents such as sulfuric acid or any other "mopper-upper" of products of the reaction such as ammonia, etc. However, I leave this to your judgment.

Suggestion No.2

Another experiment worthy of consideration, in the event that Suggestion No. 1 fails, for the reason that water produced by the de-

composition of boric acid tends to hydrolyze the borate ester back to the starting materials, would be one consisting of (a) a formation of the borate ester through the technique of a reaction between pyroboric acid and acetone cyanhydrin, followed by (b) an attempt to decompose the borate ester in the presence of a quantity of sulfuric acid conforming with the quantities I previously used. I would suggest the use of commercial 96% sulfuric acid relying in this instance upon the sulfuric acid to counter the tendency of the pyroboric acid to yield water for the reversing of the hydrolysis. In this case, I would form the borate ester at the temperature suggested above, would then add the suggested quantity of sulfuric acid and proceed with the technique previously used by me.

If the so-called rearrangement to form the amide is not an intra-molecular reaction but is a bi-molecular reaction, the formation of the borate ester followed by a treatment with sulfuric acid in which the ester is added to sulfuric acid or vice-versa, and raised in a period of five minutes to 150°C. or thereabouts and held there for five minutes (unless it seems to you it would take longer than that to break down the borate ester), the decomposition of the borate would give a uni-directional character to the formation of the unsaturated derivative of the cyanhydrin, which would minimize the possibilities for the presence of hydroxy amides or the other hydroxy amide intermediates shown in the above presentation. And, even if it were not to improve the yield, such a procedure would be valuable for me to have some idea of how far I can go in my discussions here.

Suggestion No. 3

Here I would ask you to think over a variant of the above schemes (which, as you will notice, hug something we have successfully done already) and go ahead with whatever you feel would do the trick.

Now, what is at stake in all this? If you can successfully carry through any of the suggestions, it will be possible for me to stay with Longs without exceeding the time limit I have placed on my trip and carry out a demonstration which would convert the whole agreement which we were thinking of, from one which gives us just $10,000 now with the balance held up until after demonstrations,

to one in which it will be possible for me to bring back a much more solid and immediate arrangement. I therefore urge you to give this your complete and immediate thought, and to proceed directly without letting anything else interfere until you are finished. This means giving this work priority status. Let me have your immediate reactions via airmail but don't let this delay you in carrying out this work. It is every bit as urgent as I am making it sound.

I will write you again in a few days to tell you what is happening.

Sincerely,

ABE

ab:mm

Harry and Phil+ Please forgive the typing; this machine is an Olivetti with the symbols completely rearranged and I've had a most exasperating time with it.

Miriam

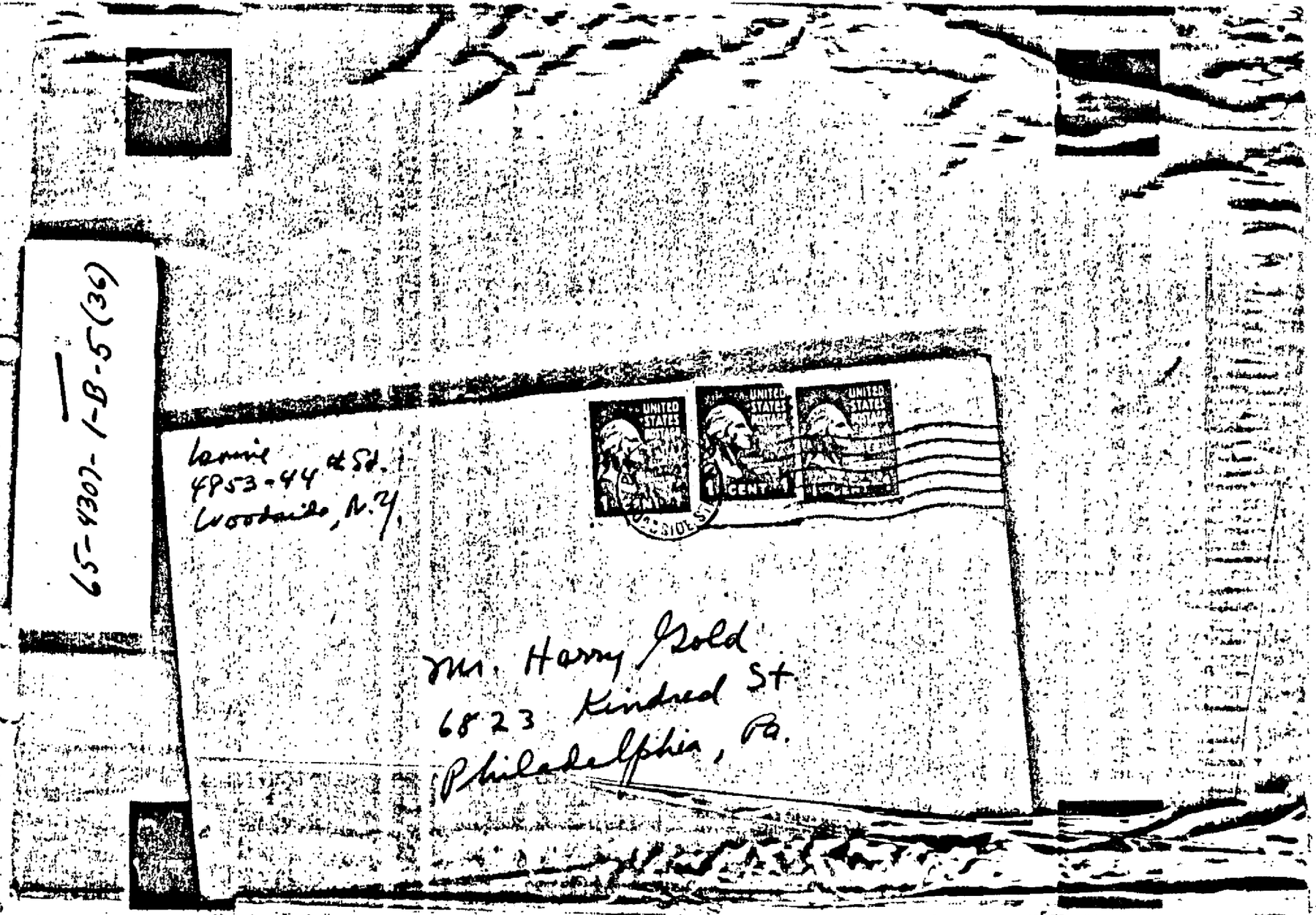
NOTE:- SOMEONE MISUNDERSTOOD MY REQUEST BUT NO MATTER - PLEASE SEND IMMEDIATELY THE DIOL FLOWSHEET TO ME CARE DR. ERNST STIRNEMANN LONZA, BASEL. THIS IS MOST IMPORTANT.

Notes - continued

4/ This scheme for the mechanics of the amide formation is a rather weak one in that we are dealing with a reaction which takes place in a strong sulfuric acid.

5/ This is an especially good likelihood towards the end of the reaction when the acid is dilute because of the amount of water which has been sent in with the methanol and because part of it has gone to the formation of ammonium bisulfate.

6/ This is not a very serious phenomena insofar as the ether would unquestionalby split to give us the monomer in any case.


65-4307-1-B-5(36)
Lennie
4P53-44 & 58.
Woodside, N.Y.
UNITED STATES
1 CENT
Mr. Harry Gold
6823 Kindred St
Philadelphia, Pa.

Wednesday

Dear Harry,

Just a few words to let you know that Phil has finally located in Boston. We are very happy about it. It's a good position & of course the location is very good. He's working there now & I expect him this weekend.

I am inviting you to have dinner with us Saturday evening so we can catch up on all the news stuff. I hope you can make it. (And we won't have hash out of a can this time).

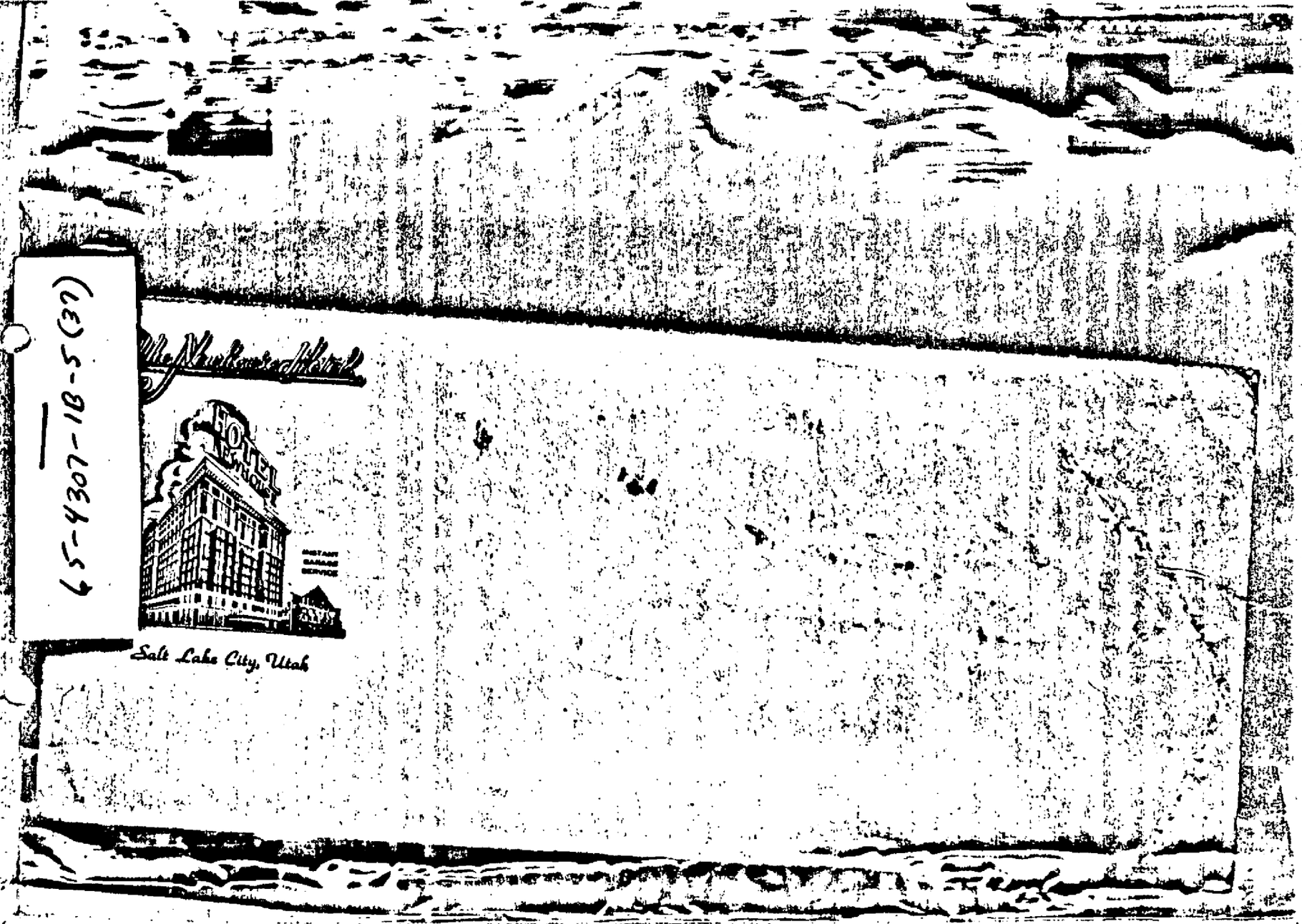
We will now have the problem of finding living quarters in Boston + it's going to be as bad there as elsewhere. If I get lonely enough I might just up + move in with my mother till we find something. Anyways I feel that's quite minor at this point.

I hope you can make it.

Regards

Edith

6/3/50



(S-4307-18-S(3))

STATEMENT OF SALARY DUE

Mr. Harry Gold was employed by A. Brothman as a chemist in May 1946 at a weekly salary of $100.

From May 1947 to the present Mr. Gold received only infrequent payment of salaries and there is now due him the sum of _____ as salary for _____ weeks.

SIGNED_____

STATEMENT OF SALARY DUE

Mr. Harry Gold was employed by A. Brothman as a chemist in May 1946 at a weekly salary of $100.

From May 1947 to the present Mr. Gold received only infrequent payment of salaries and there is now due him the sum of _____ as salary for _____ weeks.

SIGNED_____

SAC

6/21/50

SA T. SCOTT MILLER, JR.

HARRY GOLD, WAS.
ESPIONAGE - R

65-4307-1-B-5 (39)

This exhibit, consisting of a letter to GOLD from "JEAN", was shown to GOLD on 6/20/50.

GOLD identified the JEAN as REGINA LOOKABAUGH who had been a fellow employee of his at Pennsylvania Sugar. The content of the letter, which says, "Here it is. Hope it's enough.", undoubtedly refers to some money which was enclosed in the letter and which GOLD had borrowed from JEAN. He said it was about $27.00 and needed it to pay his rent.

tsm/rac
65-4307

65-4307-1-B-5 (39)

BAC

June 7, 1950

SA WILLIAM E. HUGHES

HARRY GOLD, was.,
ESPIONAGE - R

ANALYSIS OF GOLD RESIDENCE SEARCH MATERIAL

Exhibit #65-4307-1-B-5 (39).

Re search memorandum of SA ELWOOD A. PETT, dated 6-5-50, page 10.

Description: This item is an envelope postmarked at Phila., Pa., 3/31/48, bearing the return address - 1841 S. Alden St., Phila., 43, Pa., and containing a handwritten notation reading as follows:

"March 31, 1948

Dear Harry,

Here it is. Hope it's enough.

Bye now,
JEAN."

This letter was addressed to HARRY GOLD, c/o A. BROTHMAN and ASSOCIATES, 29-28 - 41st Avenue, Long Island City, New York.

The Voters Registration list for 1948 lists one REGINA LOOKABAUGH at 1841 S. Alden Street.

Lead: Inquire of HARRY GOLD the connection between REGINA LOOKABAUGH and the subject, as well as BROTHMAN ASSOCIATES.

WEH:as
65-4307

1841 South Alden Street
Philadelphia Pa

PHILADELPHIA PA MAR 31 12-PM 1945

GIVE
RED CROSS
FUND

UNITED STATES
3 CENTS 3

Mr. Harry Gold
% A. Brothman and Assoc.
29-28 41st Ave.
Long Island City
New York

10

C

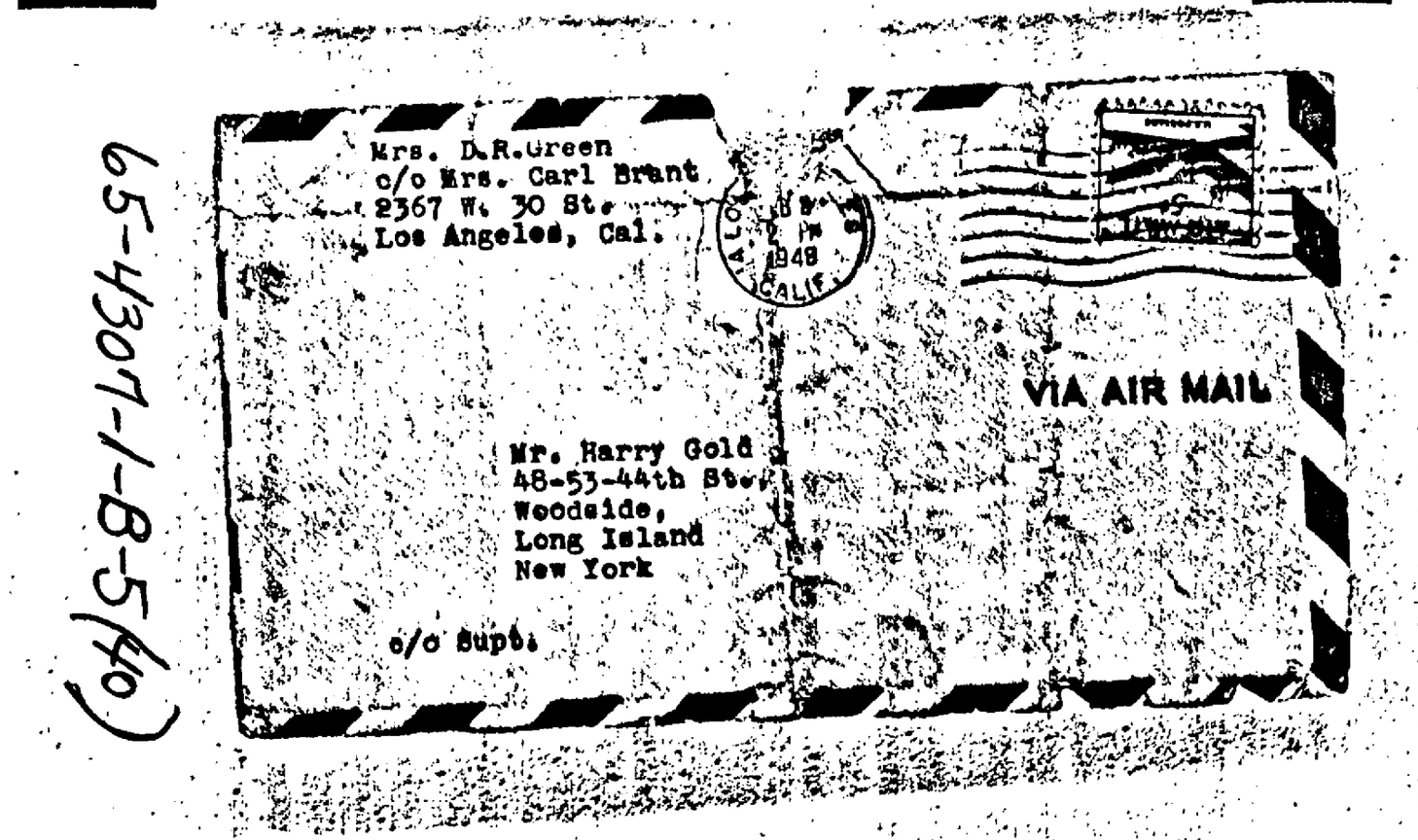
March 31, 1948

Dear Harry,

Here it is. Hope it's enough.

'Bye now,

Jean



65-43041-1-8-5(40)

Feb. 1, 1948.

Dear Harry,

Here we are in sunny Californiaat last - but it isn't sunny - it is damned cold, and we have had a tugh trip, altho the sights we have seen are marvelous.

Our housing arrangements did not come thru, and we are living in a Motel temporrily, hoping daily for good luck in finding decent accommodations at a fair price.

We are not sure yet whether we are going to like it here, altho we are going to give it a fair chance, but don't forget that we meant it when we said we hoped you would not give up your apartment without letting us know and giving us first chance at it, should things shape up so that we decide to return East.

Our present mailing address is
c/o Mrs. Carl Brant
2367 W. 30th St.,
Los Angeles, Cal.

Mail will reach us there at any time.
We had no time to feel sorry for New Yorkers on our trip - we had bitter cold, snow, ice, slush, sleet, and gales of 85 miles per hour velocity, to say nothing of several dust and sand storms, all the way here. I wore my fur coat right into Los Angeles, and never opened it til we were going thru Pasadena, and that is the truth.

At present we wish we were home, as it seems that everything is happening to us, but we are hoping for the best. Sometimes it is good to get all the mishaps over with in the beginning, and maybe it will be so with us on this trip.

We trust you and the Levines are well, and we would really like to have a line from you giving us the latest.

With kindest regards,

Dorothy + Lil

6/3/50

SAC

June 7, 1950

SA WILLIAM H. NAYLOR

HARRY GOLD was.
ESPIONAGE - R

GOLD RESIDENCE SEARCH MATERIAL

EXHIBIT: 65-4307-1-B-5 (40)

REFERENCE: Memo, June 5, 1950, Page 10

DESCRIPTION: An air mail envelope from Mrs. D. R. GREEN c/o Mrs. CARL BRANT, 2367 W. 30th Street, Los Angeles, California, directed to HARRY GOLD, 48-53 - 44th Street, Woodside, Long Island, New York. The envelope was postmarked at Los Angeles February 2, 1948. The letter pertains to personal matters regarding the GREENS' trip to and experiences in California.

POSSIBLE LEADS: It is noted that the sender of this letter is identical with the person sending the letter identified as Exhibit 65-4307-1-B-5 (2).

WHN/kob
65-4307

HARRY GOLD, WAS.
ESPIONAGE - R

65-4307-1-B-5 (40)

GOLD stated on 6/20/50 that this letter from Mrs. D. R. GREEN in Los Angeles was from the same Mrs. GREEN referred to in the memorandum on Exhibit 1-B-5 (2).

GOLD said that he did not recall the last name of DOROTHY GREEN's roommate LILLIAN, and that he recalled that one had a job in personnel and the other was a teacher.

tam/rac
65-4307

Oscar J. Yagoda
6602-99th St.
Rego Park, N.Y.

N.Y. NEW YORK, N.Y. JUN 30 11-AM 1944

UNITED STATES POSTAGE 3 CENTS 3

MR. HARRY GOLD
6823 KINDRED STREET
PHILADELPHIA, PA.

65-4307-1-B-5 (41)

WALTER A. ALMY

TELEPHONE
STILLWELL 4-7840-7841

ROOMS 1213-1218
29-28 41ST AVENUE
(ARMED PLAZA, NORTH)
LONG ISLAND CITY 1, N. Y.

6/13/15

Tuesday, 11 P.M.

Dear Harry,

Would you be good enough to let me know, or if you don't know please find out, what is the subscription rate of the "Chem. Abstracts" (member and non-member rate) and of the I. & E. C. Analytical Edition. Also, whether you could get another member subscription? How are you? What is news on the job front? I hope you succeeded in locating yourself. I had a talk with Bernie a few days ago. It seems

that B. act as an agent of AB. in the guise of an impartial co-plaintiff. But why he does that is rather difficult for me to see. This time, the purpose probably was to see whether I am a dope or whether I have a lawyer? But there is no longa deal nor homan deal, so yet! I hear that Stanton hired Joffe from I.P.E. (Emil's outfit) as something like a plant engineer. When will you be up in Ny.? I would very much like to see you!

I would appreciate an early answer to my questions.

Oh yes, I spoke to Bill Lark

weekend. He is having a tough time finding a job in Ny. He is looking for some plant production job. He'll probably have to leave town. He says that both A. and M. are in at 9 P.M. and that A. goes to bed at 9 P.M.

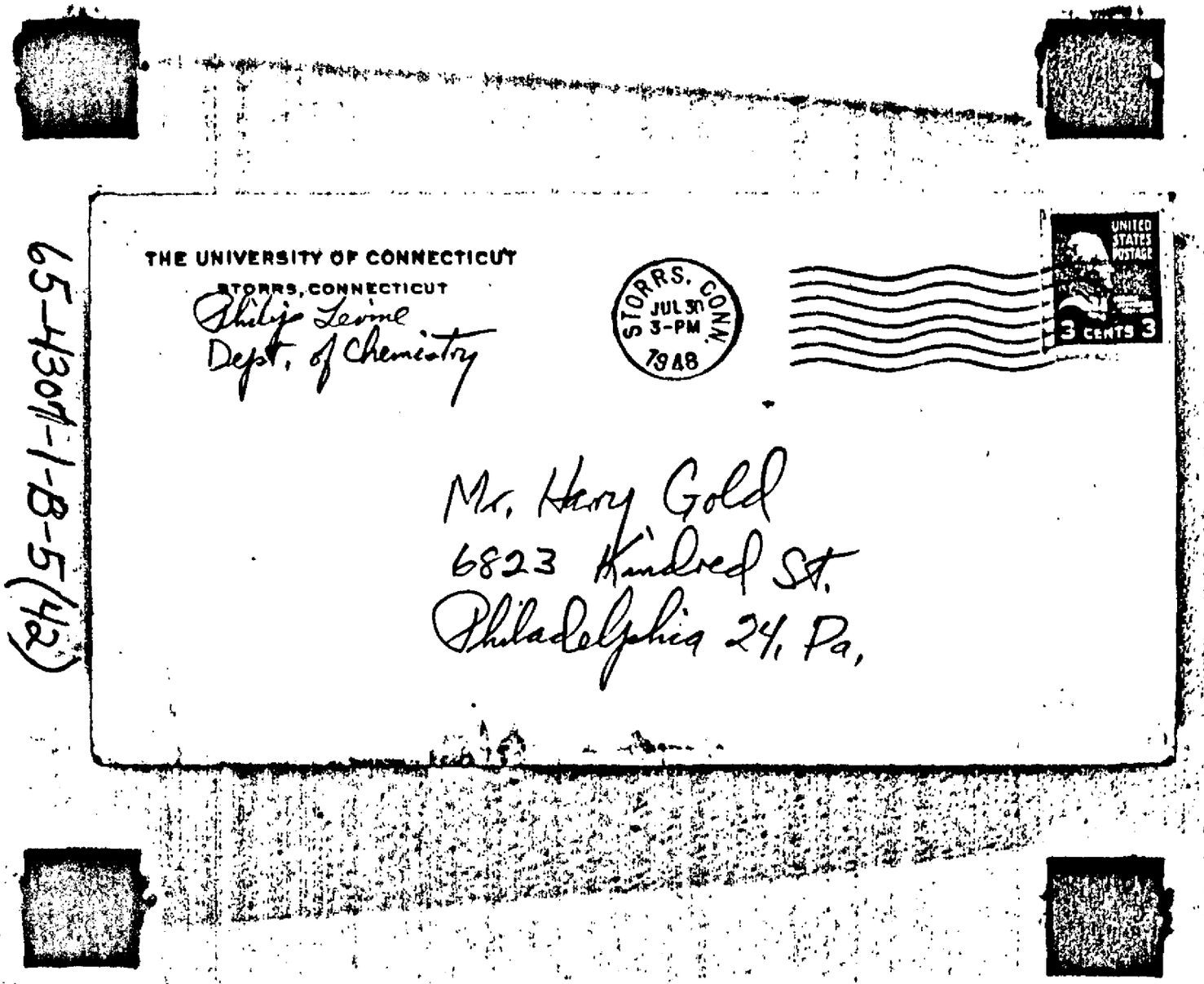
Sincerely

Oscar

P.S. Victor (my b. in law) is anxiously asking about the apartment!

P.P.S. You did not forget the lodging to my friend for the convention? His name is: Sy Dessler.

O.



THE UNIVERSITY OF CONNECTICUT
STORRS, CONNECTICUT
Philip Levine
Dept. of Chemistry

STORRS, CONN.
JUL 30
3-PM
1948

UNITED STATES POSTAGE
3 CENTS 3

Mr. Harry Gold
6823 Kindred St.
Philadelphia 24, Pa.

65-1-8-5(42)

6/3/50
JGB

July 30, 1948

THE UNIVERSITY OF CONNECTICUT
STORRS, CONNECTICUT
Dept. of Chemistry

Dear Harry:

I should have written you & a few other people a long time ago but I've managed to keep very busy without getting much done.

Since I left New York I've been completely in the dark as to what's happened to D.B.A, the Stanton job, Bill, etc. I suppose as usual A.B. & M.M. are doing fine even if everybody else is up the creek. I don't even know if you've gotten a job yet? How did you make out on that little dictaf?

The situation is roughly as follows. After I left, Edith found out who the family lawyer is in N.Y.C. & got in touch with him. He said that when I come back, I should get in touch with him & tell him the whole story & he will see what he can do. So if you want to make common cause with me, we can take any action that is possible jointly. If you want to do that I think it would be

One thing I am sure of is that the executors money we did. I know about, by hook or crook, & should have talked to Dear Tillie. Their arrangements would also conceal insofar as I am [illegible] that Mother had [illegible] with Ramaswamy's letter. Anyway, I'm not [illegible] got no income [illegible] Bakelite will the kids going to stay out. The rule a car ($5-10/month) & you must [illegible]

a good idea to see the lawyer together.

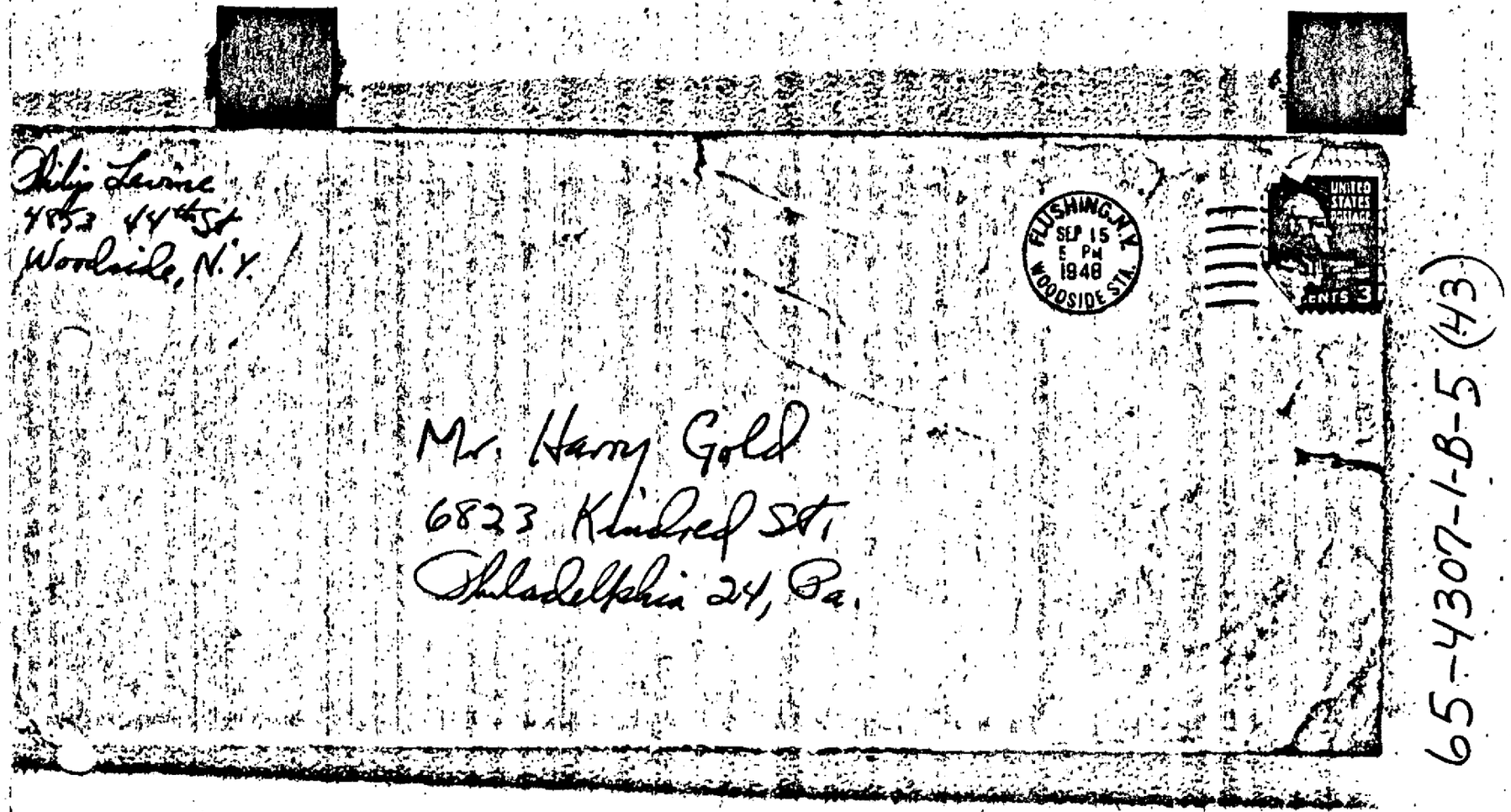
I will be through here probably Sun. Aug 9. I can either go to Boston then & spend a little week or so there & then come to N.Y. to take care of things or I can come back to N.Y. & take care of whatever has to be done & then make the trip to Boston. I haven't decided yet which way I'll do it. One thing which I would like to know before I decide is when you are available so I could plan accordingly. I probably will decide to make it N.Y. first if I can get a ride back.

The best that can be said for this job is that it got me out of N.Y.C. while it was hottest. That is about the sum total. The U. of Conn has a nice campus well isolated from civilization & that's about all that can be said for it. I eat all my meals at a "non-profit" cafeteria where the University has been getting back some of the dough they will pay me. My classes don't take for anything (most of the kids take the same course during the regular academic year). They are mostly agriculture students with some Home Economics gals.

One thing the job has done is it has cramped my style in getting out applications. The post-office organization only mails out & files with Ed. 6 odd-sized applications. I type out all the questions I have to make out a fairly good-looking & full-scale application.

Phil

I think if you answer this & can get it to me by Aug 7 I will be sure to get it. I will receive the reply before I leave N.Y. Aug 7 I'll be in Conn & would get it in Conn. I'll get it in Conn. I'll make better arrangements to see the lawyer when I'm there. The trip, which do you think?



65-4307-1-B-5 (43)

6/13/50

Dear Harry:

Monday morning I talked to a lawyer who is a friend of ours - he lives across the street. He thought Hoffman was taking an excessive rate at 37½% + that the word "disbursements" was too vague. To get to the point he offered to take the case for 50% of anything up to $500 recovery, 25% of any recovery above that with no mention of disbursements. If you want him to take care of it, then make out a statement of the case form as Hoffman sent us changing the terms as indicated above + mail it to me. The lawyer's name is Moss K. Schenck, his office is at 29 Broadway, N.Y.C.

If you have any misgivings about suing Bothman, I wish you would tell me how you feel about it. I know that you are that you haven't sent me the form Hoffman made out not because you forgot to, but because you have doubts as to whether you should do it. These doubts could proceed either from a feeling that Hoffman's terms aren't fair (which is true) or a feeling that it would be dangerous to sue Bothman. If the reason is the latter

it would also apply to retaining Schenck. Whatever it is I would like to know what you are going to do. I think I will give my case to Schenck but I'll wait a few days to hear from you.

Schenck thinks it would make a stronger case if with more people claiming they hadn't been paid their wages. Also he thinks it is better to bring the case before the State court because it is much more difficult to get a conviction in ~~my~~ magistrate's court where it would be a criminal offence so that if there were the slightest doubt the Judge would hesitate.

I sent the application blank to Robin Hood and am waiting to hear from them. I suspect their only interest is because we worked at A.B.A. No further word from Wyeth. Does either Sun Oil or Wyeth know I worked at A.B.A.?

Please let me know as soon as possible.

Yours,

Phil

6/3/15

ROBERT HOFFMAN
COUNSELOR AT LAW
1270 BROADWAY
NEW YORK CITY
CHICKERING 4-0147

I, HARRY GOLD, residing at 6823 Kindred Street, Philadelphia 24, Pennsylvania, do hereby retain ROBERT HOFFMAN, of 1270 Broadway, New York City, as my attorney, to prosecute a claim for wages in excess of $4,000.00 which I have against A. BROTHMAN & ASSOCIATES.

In consideration of the services rendered and to be rendered by said ROBERT HOFFMAN, it is agreed that he shall be entitled to retain as his fee 37½% of any amount recovered whether by suit, settlement or otherwise, and in addition thereto, disbursements expended.

Dated, New York, N.Y.

September , 1948.

HARRY GOLD

6/3/50
JWB
BMD

I, HARRY GOLD, residing at 6823 Kindred Street, Philadelphia 24, Pennsylvania, do hereby retain ROBERT HOFFMAN, of 1270 Broadway, New York City, as my attorney, to prosecute a claim for wages in excess of $4,000.00 which I have against A. BROTHMAN & ASSOCIATES.

In consideration of the services rendered and to be rendered by said ROBERT HOFFMAN, it is agreed that he shall be entitled to retain as his fee 37½% of any amount recovered whether by suit, settlement or otherwise, and in addition thereto, disbursements expended.

Dated, New York, N.Y.
September , 1948.

HARRY GOLD

6/13/50
JMG
GCB

ROBERT HOFFMAN
COUNSELOR AT LAW
1270 BROADWAY
NEW YORK CITY
CHICKERING 4-0147

September 13, 1948

Dr. Phillip Levine
48-53 44th Street
Woodside, N.Y.

Dear Doctor:

I enclose herewith two separate retainers to be signed by you and by Mr. Gold.

As you will note, the retainers are on a basis of 37½% of any recovery. If such arrangement is satisfactory, please sign and return the original.

Yours very truly,

Robert Hoffman

SSK:sg
encs.

65-4307-HB-5(44)

Aug. 30, 1948

Dear Harry:

I enclose a copy of the statement I sent to Hoffman.

I called the DBA office today and got Moky. Just to see how she felt about things, after she had informed me there was no money for me, I asked her if she realized what a ride she had been taken for. This really touched her off. She said that I had given Bethudin. Also, if I tried to make trouble, they would see to it that I could not get employment.

I laid myself open to a discharge suit by

I sent off those applications in duplicate (some job). Still haven't heard from them. Finally sent a letter to this Gas guy in Philly.

Let me know how Göhon + Haas came out

yours,

Phil

The statement could be a lot longer — I could write a book. Do I have Moskowitz's address right?

Harry Gold & Philip Levine Vs. A. Brothman & Associates

A. Brothman & Associates is a partnership involving three partners during the time Mr. Gold & Dr. Levine were in their employ. The three partners are Abraham Brothman, 41-08 42nd St., Sunnyside, N. Y.; Miss Miriam Moskowitz, 251 8th Ave.(?), N.Y.C.; and Oscar J. Vago, 66-07 99th St., Forest Hills, N.Y. The office of the firm is located at 29-28 41st Ave., Long Island City, N.Y.(Ironsides 6-5451). A laboratory was maintained at 85-03 57th Ave., Elmhurst, N.Y. The laboratory is on the premises of The Peacock Roll Leaf Co. from which the space was rented. Mr. Brothman is in debt to the Peacock Roll Leaf Co. which is reported to have closed the laboratory to him.

Mr. Vago broke with Mr. Brothman in the first part of June 1948 and his lawyer is now attempting to reach a settlement with Mr. Brothman. To the best of our knowledge, the partnership has not been dissolved.

A. Brothman & Associates is a chemical engineering consulting firm engaged in the development of chemical processes and the design of plants.

Mr. Gold started work as a chemist in the laboratory about the middle of May, 1946 at a salary of $100 per week. He was paid regularly for about 10 months. Beginning April 1947 salaries were paid very irregularly and from April, 1947 to June 15, 1948 Mr. Gold's salary was in arrears for 40 weeks amounting to $4000.

Dr. Levine started work as a chemist in the laboratory on Sept. 1, 1947 at a salary of $100 per week which was paid very irregularly. Up to June 15, 1948 he received 9 weeks pay, 8 payments being made by check and one in cash. A total of 32 weeks salary was not paid.

In addition to the arrears on salary for a 40 hr. week, Mr. Gold was not paid for overtime amounting to an average of 40 hrs. per week and Dr. Levine was not paid for overtime amounting to an average of 20 hrs. per week.

In addition to Mr. Gold and Dr. Levine, there were employed by the firm Robert Gerson and William Rohall, chemical engineers. Mr. Gerson left before Mr. Gold and Dr. Levine, while Mr. Rohall is still with the company. The organization was much larger in the past having, at one time, involved as many as 14 people including the partners. A number of the former employees of the firm are owed back salary.

Dr. Levine and Mr. Gold and other employees were persuaded by Mr. Brothman to remain for an extended period in spite of the accumulating arrears in salary by the representation made to them that negotiations with large firms for contracts involving large sums of money were in progress and that these contracts would certainly be signed in a very short space of time. The signing of these contracts would place the firm in a very favorable financial position enabling it to pay all back salaries. In actual fact negotiation were being carried on with U. S. I., Mettur Chemical Co.(of India), Bombay Chlorine Products(also of India), Imperial Chemical Industries(the largest English chemical company), Montecatini(the largest Italian Chemical Co.), Lonza(Switzerland), and others. However all these negotiations have yielded no results to date.

In the early part of 1948, a report was written for Mettur Chemical Co. of India for which $10.000 was to be paid on completion. Instead, the report was sent to India before payment was made and to our knowledge

payment has been made for the report. It is however entirely possible that Mr. Brothman received money for the report through a private arrangement with the representative of the Mettur Chemical Co.

Some time before Mr. Gold and Mr. Levine left the employ of A. Brothman & Associates, Mr. Brothman proposed to them that they agree to waive their right to salary owed them in return for an increase in salary. He later made essentially the same proposal to Mr. Rohall.

After leaving the employ of A. Brothman & Associates, Mr. Gold and Mr. Levine made several attempts to obtain from Mr. Brothman signed statements acknowledging the salary due them. Mr. Brothman put off signing any statements several times. He agreed in front of a witness, Mr. Bernard Fidto(whom he owes $13,000), that he owed back salary to Mr. Gold and Mr. Levine and would have his lawyer send statements to them acknowledging the debt. These statements were to have been sent within a week. It is over two months since they were promised and the statements have not yet been reveived.

The most important asset of the company is a contract with Stanton Laboratories for the design and erection of a plant for the manufacture of thioglycolic acid. The contract calls for the payment of engineering fees, which payments have already been made for the most part, and payment of five years or until the royalty payments amount to $100,000. The plant is almost completed and should go into production very shortly. However, a number of major provisions of the contract have been violated by A. Brothman & Associates. The other assets of the firm consist of several patent applications which may be of value if the applications are granted and if they can be sold. The physical assets of the company consist only of office furniture and laboratory equipment.

Mr. A. Brothman is the only partner of the firm known to have personal assets. He also has considerable debts. His personal assets aside from household effects include a patent which he claims brings him an income of $2000-2500 /year, a car, and a summer house in Peekskill which is in his wife's or mother-in-law's name but which was undoubtedly paid for by Mr. Brothman.

65-4307-~~185~~ (45)

#45

November 15-1945

Dear Harry + Butch—

I knew there were some things I had on my mind and couldn't think of around that place and as I promised not to call or bother about the alcohol plant, I'll get them off my mind as quickly as possible—so here goes—

① titratable acidity—make it a point to get this data as I believe Garey will tell us that pH means nothing in regard to infection due to the high buffering B.S. Molasses—the only role pH plays is optimum pH range for the yeast—we should have t.A. figures in the book—agree? yes? OK? maybe Jon can get set up before the re-start promotion?

② better removal of solids—either by more acid or longer centrifuging (this is less wings on the centrifugals, 3rd floor)
(notice how much junk settles out even without acid)
you could try one experiment or a few experiments—try to get complete removal of material and see how it affects fermentation.

6/3/50
RB
000

C) cont'd.

set the 4 fts. up as follows -

A - take B.S. as used in plant - dilute to approx. 45° Bx. add approx. amt of acid now used (150 kal per fermenter) Cook - centrifuge slowly in our basket centrifuge - weigh amount of material removed - dilute to required fermenting brix (try the 21.3 Bx) and set for fermentation

B - take B.S. as used in above - dilute to approx. 45° Bx. add say twice the amount of acid (300 kal. per fermenter) - Cook - centrifuge slowly - weigh the amount now ~~used~~ recovered - dilute to 21.3 Bx and divide into 2 parts (600 cc each) for fermentation. one (1) ferment as what pH you get - regardless of low low. two (2) ferment as pH we do know that is about 4.3 to 4.5 (use NaOH to get it if necessary) then set these 2 for fermentation.

C - take B.S. as above - dilute to 45° Bx - let stand a few minutes and run through our centrifugal - weigh material removed - then add the amount of acid we are now using - 150 gal./ferm. - Cook - and centrifuge a second time - slowly - weigh the amount again - dilute to 21.3 Bx and ferment.

notes - (1) On all ~~the~~ fermentation use a plant g.T. which has been slowly turned over.
(2) no salts or NH_3
(3) Contamination tests on B.T. mes - set from and finished ferm. if possible ~~from~~

6/3/50 AP

notes - cont'd.

You see we may get comparative contamination figures this way - because if the diluteng - centrifuging - counting is carried out cleanly in the lab. the only danger point is the Y. T. and the fermentation contamination tests may give us an idea of just we will get if and when the plant is in can be cleaned up? do you see what I'm getting at - I realize it is quite a little work but I do think we should have the data.

III Of the Ca removal system, especially the sludge settler must be one of the secrets of our loss of material going to the fermenter - if you get a chance spend a little time on this system and watch the flow of material -

2nd Have Art fix up a way to take samples from the sewer outlet like from the "settler" - 3rd floor. he may put in a goose-neck and a valve at the bottom or a "u" bend with a valve at the bottom of the "u" - he may also use an "off-set" with 2-45° ells - 

- anyway he does it OK but get it even if you must take it up with above - then have Clove take a sample every ½ hour they are operating the machines - you could composite these samples and figure a way to run duplicates to get

6/3/50
ad
09

I could run actual sugar loss. - this is as important as hell - it may be the answer to varying yields because with the operators we have the loss can be terrific and we should be the ones to catch it.

If she got say 15-16 samples or 2-12 gr. samples an hour we could perhaps base our sugar loss on so much per Gallon. (how many gallon goes to the sewer during a washing period?).

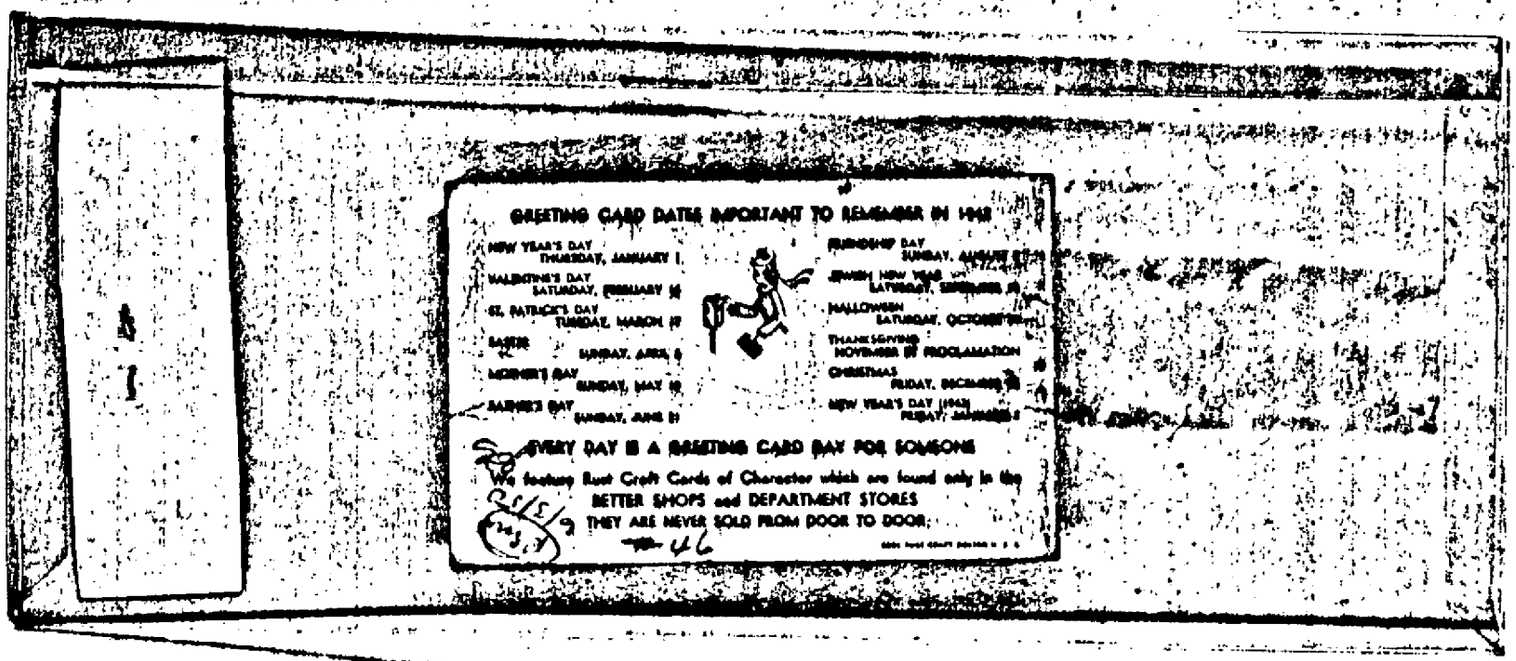
I When you get all things figured out for your Monday or Tuesday demonstration for Monday - i.e. the best pad to use (also I'd use one pad-?) and best rate of flow and the samples to get - then figure what you will tell him about - that is - you could go over again the idea of the figures trying to declare like Heinz or Bitters etc in our own glass lined cans - the saving in operations in the glass will pay for these cans - then go into the idea of the Valley Press - how we can have the material - (Sugar pulp and asbestos mix) made up and use the last ~~centre~~ Valley Press for sterilizing the liquor - tell him (providing he is receptable to the whole idea) that all we want is the right to write up the proposals

over

65-4307-7-8-5(4)

J. A. HERR, Pharmacist
Specialties in Prescription Work
The Rexall Store
Kodaks-Developing-Printing
39th and Girard Avenue

WITH SPECIAL DAYS TO REMEMBER



GREETING CARD DATES IMPORTANT TO REMEMBER IN 1948

NEW YEAR'S DAY
THURSDAY, JANUARY 1

VALENTINE'S DAY
SATURDAY, FEBRUARY 14

ST. PATRICK'S DAY
TUESDAY, MARCH 17

EASTER
SUNDAY, APRIL 4

MOTHER'S DAY
SUNDAY, MAY 9

FATHER'S DAY
SUNDAY, JUNE 20

FRIENDSHIP DAY
SUNDAY, AUGUST 1

JEWISH NEW YEAR
SATURDAY, SEPTEMBER 25

HALLOWEEN
SATURDAY, OCTOBER 31

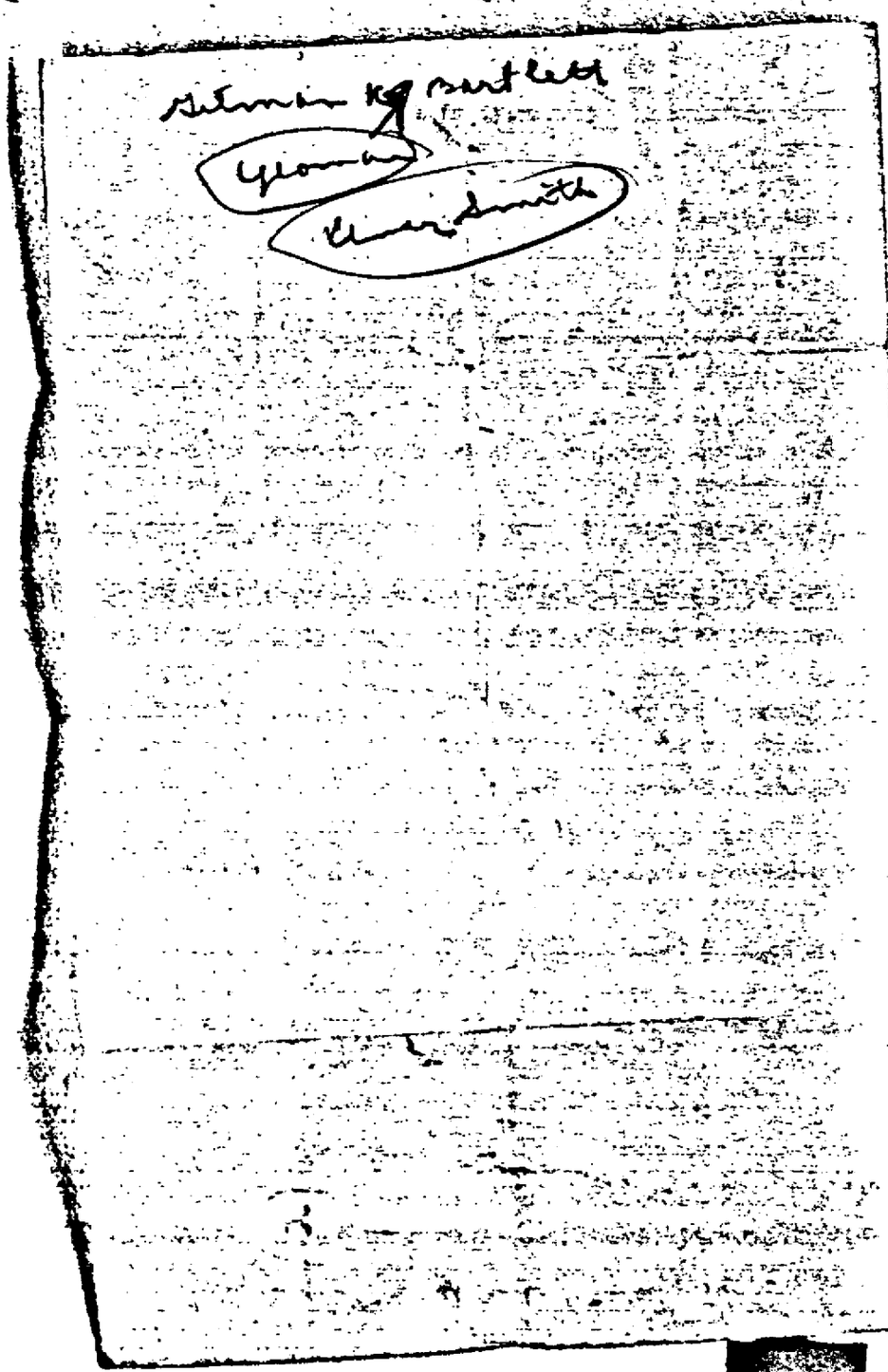
THANKSGIVING
NOVEMBER 25 PROCLAMATION

CHRISTMAS
FRIDAY, DECEMBER 25

NEW YEAR'S DAY (1949)
FRIDAY, JANUARY 1

EVERY DAY IS A GREETING CARD DAY FOR SOMEONE

We feature Rust Craft Cards of Character which are found only in the
BETTER SHOPS and DEPARTMENT STORES
THEY ARE NEVER SOLD FROM DOOR TO DOOR.



FAR ROCKAWAY, N.Y.
JUL 23
12-PM

Mr. HARRY GOLD
2631 S. Phillip St.
Philidelphia
Pennsylvania.
United States of America.

65-4307-4-(27)

4

My address is

4216 Far Rockaway
Boulevard
EDGEMERE
LONG ISLAND
New York.

6/3/50

July 23, 1931.

Mon ami Hershel:

Comment allez-vous. Voici
il est très bien ancore ~
Looks like I'll can
write a little "French"
How is the Hot weather treating
you? But here the beach is
the snakes hips. The water
is warm & the girls hot. ○
That is what I think are
though I haven't made
many connections. See there
is a lousy periodo a grain
in the area

all I do is eat, sleep + bask on the beach, besides dancing at one of hotels. Boy my little aunt + myself are showing these new jokers how to DANCE.

Well is not much more to write as yet. Dam still waiting for MAIL.

If you receive this letter answer it, if you don't get it answer anyhow.

If you get a chance any more of that spare time you can se

How the old man is getting along THANKS

Yours as ever

Fatish.

See PAGE 4

SAC, Philadelphia

6/23/50

SA T. SCOTT MILLER, JR.

HARRY GOLD, was.
ESPIONAGE - R

EXHIBIT NO. 65-4307-1-B-5 (48)

GOLD advised on 6/15/50 that this notebook is not in his handwriting and that the name SOROKIN means nothing to him. GOLD stated that it is possible he may have tutored someone who had brought these notes with him when he reported to GOLD for tutoring. He said that this was possibly done while GOLD was at Drexel between February 1934 and June 1936. GOLD said that it is possible that the person whom he was tutoring left this book with GOLD and forgot about it.

TSM:HKF
65-4307

65-4307-1-B-5 (48)

SAC

June 7, 1950

SA WILLIAM H. MAYLOR

HARRY GOLD was.
ESPIONAGE - R

GOLD RESIDENCE SEARCH MATERIAL

EXHIBIT: 65-4307-1-B-5 (48)

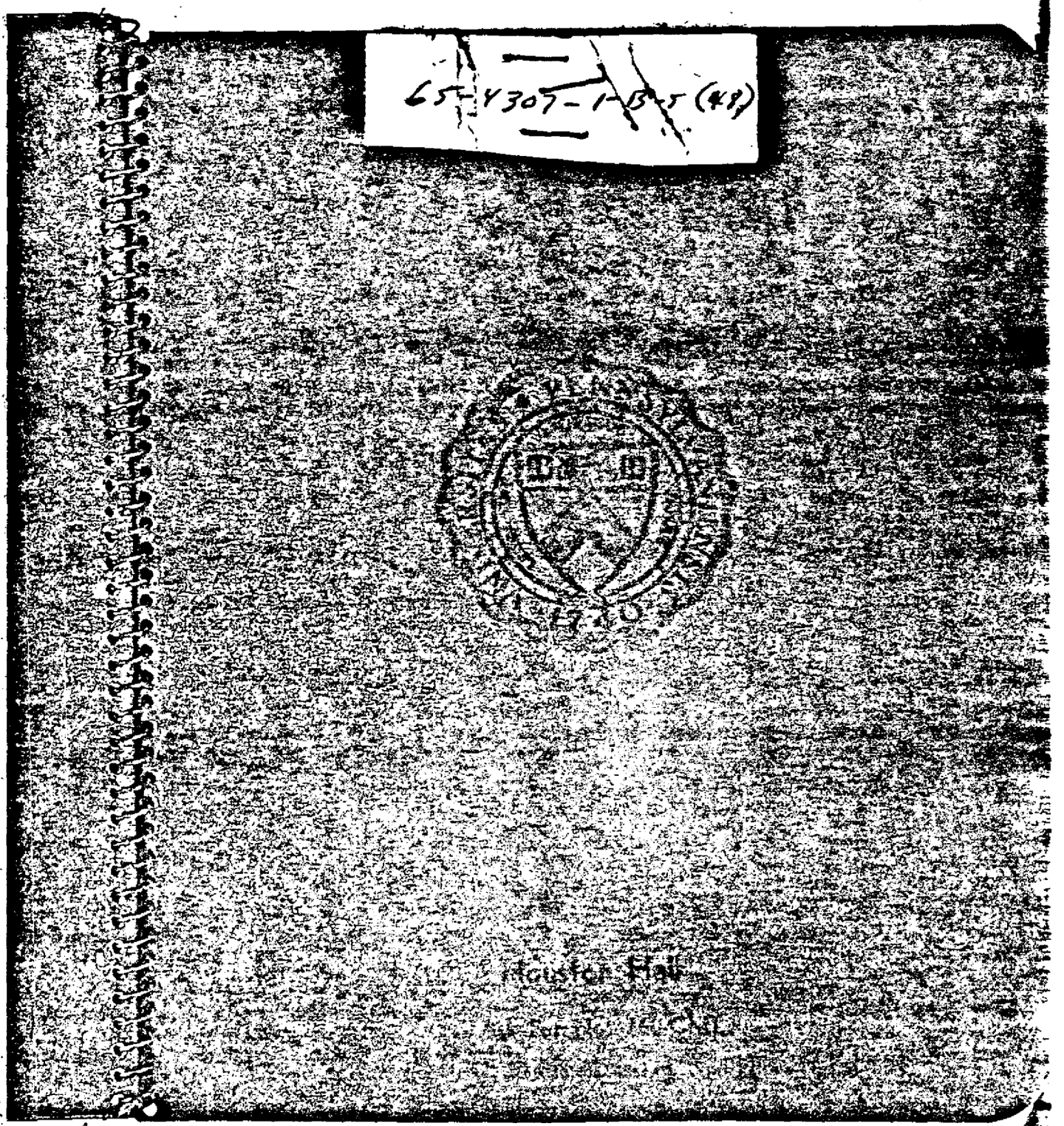
REFERENCE: Memo, June 5, 1950, Page 6

DESCRIPTION: A notebook from the University of Pennsylvania including numerous notes appearing to be school notes relating to English Literature, Political Science, Sociology and Radio. The first page of this notebook bears the name SOROKIN.

POSSIBLE LEADS: GOLD should be questioned regarding the identity of SOROKIN and their association. He should also be questioned regarding whom the notebook actually belonged to and why it was in his possession.

WRN/kob
65-4307

7


65-4307-1-B-5 (48)
Houston Hall

#48

William James - Portion Conjecture

Eng 42

The Novel and Romance

A longer work of Prose is called Fiction. Fiction aiming to give a true picture of life dealing with the more familiar aspects of life is known a novel. A longer work of fiction aiming to give a true picture of life but dealing with the less familiar aspect of life known a Romance. Realism and Idealism are important Terms.

Realism:- Is what actually exist. Shows good & bad.

Idealism:- " " should " Selecting the beautiful.

One is more realistic than the other. They depend on the degree of the selection of the material by the author.

The Development of the Novel

A. 17th Century by Popular Demand

1. Drama

a. Shakespeare, Marlowe

2. Elizabethan Lyric (Elizabethan Period)

B. 18th Century

1. Age of Prose, Satire, + Essays

Rational Age emotion suppressed

Swift, Addison + Steele, Pope

C. 19th Century

1. Poetry

Burns, Keats, Shelley, Byron

2. Novelist

Jane Austin, Scott (Romantic) Dickens

(Social Customs) Thackeray (Human Nature + Life)
Two Private Letters.

Plot is a connected series of episodes.
1. narrative 2. minimal 3. repressed 4. Phil.
Background very important in novel. An epic
exaggerates the characteristics of the hero. Ex. Beowulf,
King Arthur, Sir Galahad.
Richardson wrote Pamela and De Foe wrote
Robinson Crusoe. These are supposed to be first
novels. The spirit of rebellion was very strong in
Samuel De Foe.

Samuel De Foe - 1660-1731.
He belongs to Yeoman class father was a butcher
and a non-conformist. He ridiculed the Church
by his pamphlets "The way with All Dissenters" and put
in jail, queen interfere in his behalf and got him release.
His position he started he earned never first journalist
(except for Addison + Steele). He edited "Seven Topics"
a magazine which features gossip + scandal. He knew the
Low people and wrote about them. He was factual,
realistic and plausible "he lies like the truth". He
takes good pains to prove a lie the truth. Beginning Robinson
Crusoe - 1719 based on Selkirks ship wreck begins
novel of incident. Fictitious autobiography. Captain
[illegible] Thomas Colonel Jack Captain

Samuel Richardson 1689-1761
He wrote Pamela - first novel of character. From a
middle class family his parents wanted him to study for
the clergy. Industrious + self-educated. He became
head printer in London. He worked way up to the top.
Like Horatio Alger. He understood women + revealed
their true emotions. Very pious. A great admirer.
He wrote his first book in almost all letter form
Clarissa Harlowe (1748) because of his experiences with
people. Pamela published in 1740.
Pamela - 1740, Clarissa - 1748 + Sir Charles Grandison
1752). Success achieved at a late age likewise
with all other 18th century novelists.

Harry Fielding - 1707-1754
A Gentleman's son. He was sent to Eton. He was
rough + spirited + adventurous. He went to Holland
to study law. He gambled and enjoyed himself immensely
The father stopped sending him money + he returned to
England and hung around with Literary Bohemians.
He wrote plays which Cesars would not pass. He
went into law practice and married a very unlikely
woman + stuck to her freely. He loved life and loved
to live well. He and his friends Thumb, Pamela
were a farce. Suspected of writing Shamela a satire
of Pamela. He believes in Satire + realistic story.
Comic epic in prose. He wrote Jonathan Wild - He was

a highway man the book is written in an ironic manner. Tom Jones - 1749 was Fielding's greatest works and a work into which he put all his experiences into. Amelia - 1751. He wrote fiction biography. Fielding was getting older + his health was failing.

George J. Smollett 1721 - 1771

He was a poor boy and he went to the University of Glascow to become a physician, a scotchman. He was hot headed pugnacious, realistic, and had hard time getting along with people. He apprenticed himself to a local physician. He was unsuccessful because of his temper and his realistic nature. He was unable to get along with people. He wrote to get London + wrote a play but no one would buy it. He enlisted in the navy as a physician and came to know the sea life very well. He married a young woman in Jamaica. He then wrote a book called Roderick Random, it is picaresque rogue, picture on social conditions. Later came Peregrine Pickle, "Ferdinand," "Count Fathom" "Humphrey Clinker" ← These books are better formed He is a practical joker, realist, robust humor, likes horse plays. He is an adventure novelist. He is unlike the other novelists. His books were among the

Travelogues.

Laurence Sterne 1713 - 1768

He was a clergyman not concerned with accuracy glib + dramatic. His father was an army officer stationed in Ireland. He learned stories from soldiers. Upon his father's death he received a scholarship to Univ of Dublin, very brilliant + studied for ministry. He had a parsonage in Yorkshire. He had a rich neighbor nearby from whence he got literary knowledge + wine + French Rabelais his favorite author. He was driven from parish + went to London. Essayist novelist extremely popular. especially with the women. He wrote Tristram Shandy Esq. but it was never completed.

From 1771 - 1811 (40 yrs) was a period of no great novels, a period of Romantic writing very imaginative

Horace Walpole. 1764 - He wrote Castle of Otranto" man about town story very eerie and based on make believe castle. It relies on supernatural + mystery element.

Miss Radcliffe - (Sicilian) Romance of the Forest "Mysteries of Udolpho" was written by her she started a more naturalness and isolated emotions.

School of Terror - Stories of mystery + Suspense
No famous books - did give people a change
from the Common place things. Books not
well done or known.
School of Theory - This was time of change
(Propaganda novel) There were a number
of novels around London they got
together + put their theories into story form -
William Godwin - "Poetical Justice"
He blamed the church, govt, army. Laws
very evil institutions to be gotten rid of.
Percy Bysshe Shelly came around to the
Godwin households and soon had 3 women
in love with him.

Jane Austin 1775-1817

She enjoyed writing books. She was
a clergyman's daughter + led a sheltered
life. She received a young ladies' education
as of that period. She kept her writings a
secret. Her first novel "Pride + Prejudice"

1811	Pride + Prejudice	She had a sprightly style
1813	Sense + Sensibility	+ a quiet humor
1814	Mansfield Park	
1816	Emma	
	Northanger Abbey - (burlesques the School	

Sir Walter Scott - 1771 - 1832

He is a great gentleman of Literature. He
loves life + loves to write about it. He
was born in Edinburgh. Wrote about chivalry
+ folk lore. Wrote very quickly. First
interested in poetry compiled English + Scotch
ballads. First book in 1802

1802 - Minstrelsy of the Scottish Border.
1805 Lay of the Last Minstrel - a narrative Poem
1808 Marmion
1810 Lady of the Lake
1814 Waverly Novels - Ivanhoe, Quentin Durward, etc
Makes chief characters usually fictitious.
Stories based on History. His stories are fictitious
and unfactual. 31 Stories in waverly
novels.

I. 1814 - 20 - 9 Scotch Stories. such as
Rob Roy, Guy Mannering, The Heart of
Midlothian, The Bride Lammermoor.

II 1822 - Outside of Scotland, Quentin
Durward, Talisman, etc.

Stories very inventive, recreates the past.

Dickens 1812 - 1870 - See Shelf -
Thackeray - 1811 - 1863 " " -

The Brontes.

Unnatural childhood Grey-old quickly. Sickly & weak & very unhappy youth. Poems by Currer, Ellis & Acton Bell

Jane Eyre - Charlotte Bronte
Wuthering Heights - Emily "
Shirley - Charlotte
Villette - Charlotte "
Professor " "

Charlotte
Emily 1818 - 1848 - When she was 30
Anne " Anne died after Emily
Miriam - Died first
Elizabeth - Died Recently

George Meredith 1829-1909

In 1859 revolutionary book by Darwin - set world in turmoil. Same year "Ordeal of Richard Feverel appeared. Meredith less gullible than Hardy. Former more educated. Where Hardy was emotionally upset & accepted anything, Meredith was strong & cautious. His book discusses emotions & opposes him to intellect. Realizes the need for a compromise. A cynic and a realist. Reality filled with Sentimentality. Dislikes hypocrisy and laughs at our weaknesses, false sentiment and false display of emotions. He had a great sense of humor. In 1861 - Evan Harrington

1879 Egoist
1885 Diana of the Crossways
1910 - Celt & Saxon (unfinished)

Son of a naval outfitter at Portsmouth sent to school in Germany. Intended to study Law. He was a great success for a long time. Slowly gained fame. 1849 married Miss Peacock. She was untrue & left him. As a revenge he wrote a series of poems called "Modern Love." He was very satirical about marriage. Not able to forget her. He remarried in 1864 a better woman. He fought for fame for 40 years. He was the opposite of Hardy because he didn't attain fame until his death. His books difficult to read. His dramatic humor - Employs subtle psychology. Has subtle enjoyment about human beings - As an intellectual - he cannot understand his meaning very well.

He is a realist - interested in human relations, interested in our inner consciousness why we do things. Best character of women in 19 cent. Doesn't make them sentimental but doesn't picture a bad woman. He takes the means - more themes doesn't have women laughed at women equal men. Novels comic in Spirit. Few ends in Fantasy. Critic in - too little plot & characters

typical obscure & difficult to read. Adds substance to a novel. Has hands on pulse of reality. Great interpreter of women's mind. Had own homely vein of life

Thomas Hardy 1840 - 1929

He was pessimist. Novelist in 19th Cent. Poet in 20. Religious trouble turned him pessimistic. Science destroyed religion. Could not see supernatural power. Does not believe in evil fate. Not a fatalist. Could not see divine & reason with Universe. Believed people to be victims of Chance. Fate is the combination of chances leading to Conclusion makes his characters suffer. His characters are guiltless as far as their responsibility for their fate. He pities his characters. His novels are called women's novels ~~if~~

1874 - Far from the madding crowd
1878 - Return of the Native
1886 - Mayor of Casterbridge
1891 - Tess of d'Urbervilles
1895 - Jude the Obscure.

Sums the poetry the "Dynasts"

1800 1900 19—

Pessimism

Malevolism

Unconscious ones become conscious order out of chaos. He ultimately became Monistic after being a Pessimist "Need for Order"

English 3

1. Definition - Is that type of writing which sets limits or bounds. -
2. Analysis - Is that form of exposition which breaks up a subject into Parts
3. Criticism - Is that form of exposition which attempts to evaluate. Estimation: -
   1. standards - objective
   2. appreciation - subjective
4. Process - Is that form of exposition which Tells how do something.
5. Editorial - Is that form of writing which gives a considered opinion on matters of timely interest.
   news - occurs in paper on some day
   Edit - " " " " next "
   Feat Art. - " " " " Sunday
6. Satire - Is that form of writing which pokes fun of a subject in a subtle manner. Not sarcasm, and is not blunt
7. Familiar Essay: - Is that type of writing which discusses anything, no matter how trivial and is treated in a friendly conversation way.
8. Local Color Sketch - Is an extended exposition of a community that has color and unity

9 Feature Article - Is that type of Popular exposition which informs entertainingly. (Forms)

3. { Report - fact
   { Article X means
   { Essay - Style

Explanation { def
            { anal → process

Evaluation { criticism
           { satire

Inquiry { analysis
        { definition

Justification { Essay
              { editorial argument (def)

Speculation { Essay editorial
            { analysis

Statement { anal
          { def

Reminiscence { local color effect
             { Familiar Essay

Correction satire (Essay - like)

Biography / any of above

Proof Paragraphing

1. Proof (Topic) Sentence
2. (Ends) clincher sentence

Exposition is that form writing which explains and depends on abstract words.

Informal Analysis - Is the causes and effects

Definition is where you place your subject into its group - classify your subject.

Formal definition - A dictionary or scientific analysis

Informal definition - Is a literary or scholarly attempt to define or analyze a thing.

The least important is the method of repetition.

Method to show origin of causes and effects is the historical sense.

Exposition of facts - The process differs from the narrative in the time element. a certain series of steps must follow each other. Concrete processes - How to make or do something. Abstract ... How to think

Exp. of fact in form of Article

1. Process when - what - How - to do, something
2. organization
3. Mechanism

Must be over technical. - A short principle should be in the opening paragraph.

1. Description of the Parts
2. Analysis " " "
3. working " " "

Expository Writing
Four Types —
1. analysis
2. Definition
3. Description
4. Narration.

—U.S. 11/1st — Soc. —
Eng. 3 — P.S. 1 —
Eng 42

Political Science

Chapters 1 to 7 incl
" 10 to 15 incl
" 16 (448-59)
" 17
" 32 (950-55)
" 33 - 34 incl

Chapter 1 & 2 The Constitution —
Checks & Balances —
Judicial, Legislature, Executive — 3 dept.
Courts are independent. ↔
English Constitution unwritten — a series of laws
Four methods for making amendments to the Const.
1. National Assembly — Granted by Certain V
2. 2/3 vote of Congress —
Suggested Changes
Congress with the approval of the people should be allowed to change it like a law
Amendment Problem
2/3 of the States to Ratify
There are 435 representatives
" " 96 Senators
Gerrymandering is dividing up of election districts by State Legislature in order to break up strongholds of opposition
At least 25 years old 7 years — citizen

The Best

3 years elected

is the U.S. He may be naturalized. He receives $10,002.04 yr
the Speaker as the Chairman. All revenue +
impeachment bills must originate in the House.
Is most powerful committee is the Ways & Means
committee. Conference Committee - used between
the Senate & House for ironing out difficulties
Floor Leaders - they like up the Party members.
Party Steering Committee - They do what the President lost
Floor Management - Any sort of meeting between the
different members of the Party - is called a Caucus
Committee of the Whole - All the members of the House
Senator 30 9 years. - U.S Citizen 6 years elected
President powers - ② appointments to legislation -
General Enforcement of the Laws ④ Command of the
military + Naval forces ⑤ Foreign Relations.
Federal Courts - Legislative & Constitutional - P. 206
Transport, Communication, Trade Labor & Employment
Controlled & regulated by Govt
Robinson Patman Act prohibits

Sociology I 1/22/1419

Chapt 1 - Introduction
Chapt 2 - Culture is man made environment
Language is important

Mr. Auerbach. -

3/4/42 Radio Course - I.

Assignment - Read Chapter F

Relationship of math to Radio.

1. Math language of Radio

2. " Quantitative & qualitative.

The Electron Theory

"Elektron" - Greek means Amber

Electron theory } All matter is composed of molecules - atom

The atom is the smallest subdivision of the element

Copper atom Cu.

Cu	at. wt	at. no.
Copper	44	29

The force of attraction

$F \propto \frac{1}{d^2}$ - Coulomb's Law

$F \propto q_1 q_2$

$F = k \frac{q_1 q_2}{d^2}$

$F \propto \frac{q_1 q_2}{d^2}$

$F \propto q_1 q_2$

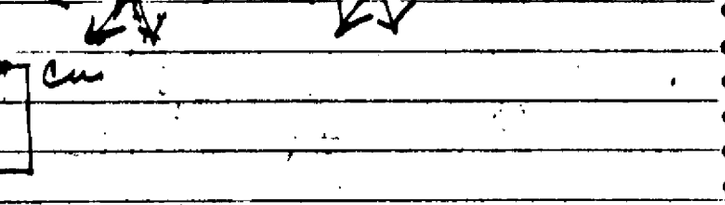
F

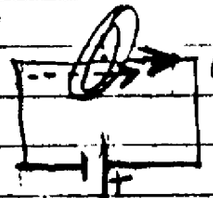
F	q_1	q_2
1	1	1
2	2	1
3	3	1
6	3	2

Electrons at rest

Static Elect – Electrostatic field

Current "electrons in motion" → Magnetic field uniform motion





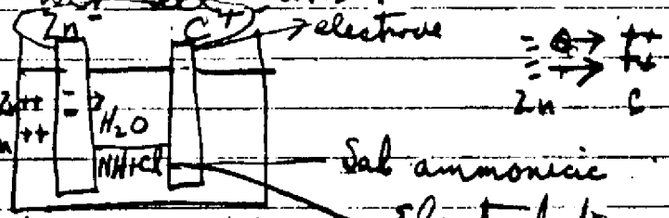
Electromagnetic field – accelerated motion

= radio

Sources of Electricity

1. Primary Cell – Wet Cell

Chemical



An ion is a charge particle

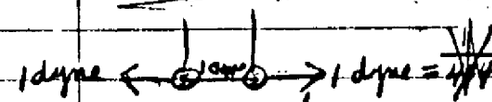
An electrolyte when dissolved in water will allow the passage of electricity

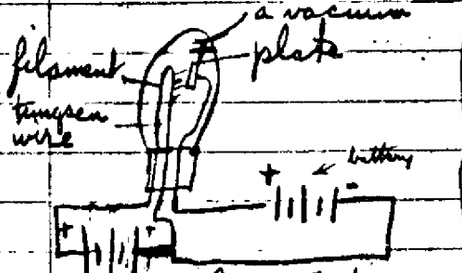
$NH_4Cl \rightleftarrows NH_4^+ + Cl^-$

$H_2O \rightarrow 2H^+ + O^=$

3/6/42

Types	Methods
1. Chemical	1. Friction
2. Mechanical	2. Dynamo
3. Thermal	





1 Coulomb = 6.28×10^{18} electrons

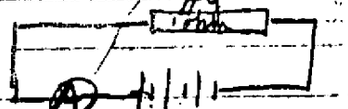
(quantity of charge)

1 ampere = $\frac{1 \text{ coulomb}}{\text{sec}}$ = 1 coulomb per sec

(current)

1 ohm = resistance of Hg 106.3 cms long 14.4521 gms uniform cross section at 0° cent.

1 volt = electromotive force which will produce 1 amp thru resistance of 1 ohm.



1 amp = 1 Volt

2 amp = 2 Volts

1.5 amps = 1.5 volts

The current in amperes = to the voltage in volts as the resistance in ohms

$I(\text{amp}) = \frac{E(\text{volts})}{R(\text{ohms})}$ $\quad I = \frac{2}{2} = 1 \text{ amp}$

1 watt (P) (unit of Power) = amount of power given to the circuit by battery when the voltage of 1 volt current goes through 1 amp through resistance of 1 ohm

$P(\text{watts}) = EI = E\left(\frac{E}{R}\right) = \frac{E^2}{R} = I^2R$

for a pure resistive circuit only

I $a^2 \cdot a^3 = a^5$ (+) base (a^x exponent)

$a^x \cdot a^y = a^{(x+y)}$

II $a^5 \div a^2 = a^3$ (−)

$\frac{a^y}{a^x} = a^{y-x}$ (must have same base for these rules to apply)

III $(a^x)^y = a^{xy}$ (X)

$(a^2)^3 = a^6$

IV $\sqrt[y]{a^x} = a^{\frac{x}{y}}$

$\sqrt{a^6} = a^3$

1,950,000 = 195×10^4

1,950,000 = 19.5×10^5

$$\begin{array}{r} 27.563 \\ \sqrt{759.734210} \\ 4 \\ 47\,|\,359 \\ \quad 329 \\ 545\,|\,3073 \\ \quad 2725 \\ 5506\,|\,34842 \\ \quad 33032 \\ 55123\,|\,181019 \end{array}$$

$$\begin{array}{r} .2779 \\ \sqrt{.078312} \\ 4 \\ 47\,|\,383 \\ \quad 329 \\ 549\,|\,5412 \\ \quad 4941 \\ \quad 471 \end{array}$$

$8i + \left(\frac{3}{2}\right)i = 10$

$2\left[8i + \left(\frac{3}{2}\right)i = 10\right]2$

$16i + 2 \times \frac{3}{4}i = 20$

$16i + 3i = 20$

$i = \frac{20}{19}$

① $\frac{x}{\left(\frac{1}{4} - \frac{2}{5}\right)} = \frac{1}{5} - \frac{4}{10}$

$\frac{x}{-\frac{3}{20}} = -\frac{1}{5}$ $\quad \frac{x}{\frac{3}{20}} = \frac{1}{5}$

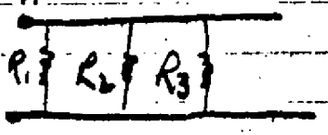
$x = \frac{3}{20}$

① $\left(\frac{1}{4} - \frac{2}{5}\right)\frac{x}{\left(\frac{1}{4} - \frac{2}{5}\right)} = \left(\frac{1}{5} - \frac{4}{10}\right)\left(\frac{1}{4} - \frac{2}{5}\right)$ $\quad -\frac{4}{10}$ $\quad \frac{2}{10}$

$x = \left(\frac{1}{5} - \frac{4}{10}\right)\left(\frac{1}{4} - \frac{2}{5}\right) = \left(-\frac{1}{5}\right)\left(-\frac{3}{20}\right) = +\frac{3}{100} = .03$

② $\frac{3x}{5} = 8x + \frac{2}{5}$

③ $R = \frac{1}{\frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}}$



$R = \frac{1}{\frac{R_1R_2R_3}{R_1R_2R_3} + \frac{R_2R_3}{R_1R_2R_3} + \frac{R_1R_2}{R_1R_2R_3}}$

$R = \frac{R_1R_2R_3}{R_2R_3 + R_1R_3 + R_1R_2}$

3/

HOMEWORK

I
① $53.14\overline{).00031}$
② $53.14\overline{)8275.13}$
③ $.0123\overline{).00031}$
④ $.0124\overline{)8275.13}$

II ① $x = \frac{a^0 \cdot a^5}{a^2}$; $\frac{y^{5.2} \cdot y^{4.8}}{y^3}$; $x = \sqrt[3]{a^3 b^6}$

$x = \frac{5.3 \cdot 10^5 \cdot 10^2}{10^8}$;

III $\sqrt{53.8172}$; $\sqrt{.005381}$

IV $\frac{3x}{5} = 8x + \frac{2}{5}$; $8x + 3x = 10 - x^0$

V $\frac{2 + \frac{1}{2} + 3.5}{(\frac{1}{4} + \frac{1}{5})(7\frac{1}{2} + 8.75)} \cdot \frac{(\frac{1}{4} - \frac{2}{5})(2 + \frac{7}{4})}{(\frac{1}{2} - \frac{1}{3}) + (2 - \frac{3}{5})}$

VI $x^2 + 2x + 1 = 0$

$\frac{4}{x+3} + \frac{2}{\frac{3}{4}} = \frac{8}{x+2}$

$4x^2 + 17x + 4 = 0$

$x^2 - x + 2 = 0$
$(x-2)(x+1) = 0$
$(x-2) = 0 \quad (x+1) = 0$
$x = 2 \quad x = -1$

$x^2 - 6x + 9 = 0$
$(x-3)(x-3)$

$ax^2 + bx + c = 0.$

$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

Homework

3-11-42 Henney P. 12 7-1, 8-1, 9 Read Pages 92-95

2. Simplify

$\frac{1}{4 + \frac{1}{4} - \frac{1}{5}}$; $\frac{a^0 + a^{-1}}{\frac{1}{a} + 9 + 2} = ?$

$\frac{(\frac{1}{5} - \frac{1}{4})(4 + \frac{6}{5})}{(\frac{1}{3} + \frac{1}{2} - \frac{1}{4})} = ?$ $\frac{\sqrt{i^3}(i^{\frac{2}{2}})(i^{\frac{1}{2}})}{(i^{\frac{1}{3}})^6 \cdot i^4} = ?$

3. Solve for i check by substitution

$i + \frac{1}{4} - \frac{1}{3} = 2i - \frac{1}{5}$; $\frac{i}{4} - \frac{i}{3} = -2$

$\frac{4}{i+3} = \frac{3}{i+2}$

4. Solve for i (check)

$3i^2 + 11i + 1 = 0$
$i^2 + 8i + 16 = 0$
$i^2 = 2i = -\frac{3}{4}$

5. Trig: (to be assigned in class)

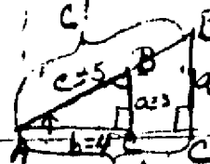
6. Add vectorially

$i_1 = 10\theta$ and $i_2 = 10 \sin(\theta + \alpha)$

Lay off with protractor 360° angle

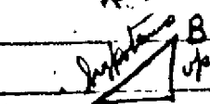
On page →

Algebra 3/9/42



$\frac{a}{c} = \frac{a'}{c'}$ $\quad \frac{b}{c} = \frac{b'}{c'}$

$\frac{8}{5} = \frac{6}{10}$ $\quad \frac{4}{5} = \frac{8}{10}$



$\sin = \frac{opp.}{hyp} = \frac{a}{c} = \cos B$

$\cos = \frac{adj.}{hyp} = \frac{b}{c} = \sin B$

$\tan = \frac{opp}{adj} = \frac{a}{b} = \cot B$

$\cot \tan = \frac{adj}{opp} = \frac{b}{a} = \tan B$

$c^2 = a^2 + b^2$

Look at tables for 60° 30° etc. angles

rationalization rationalizing

$\tan 30° = \frac{1}{\sqrt{3}} \times \left(\frac{\sqrt{3}}{\sqrt{3}}\right) = \frac{\sqrt{3}}{3}$

$\tan 300 = \frac{\sqrt{3}}{3}$

$\csc 60° = \frac{2}{\sqrt{3}} \left(\frac{\sqrt{3}}{\sqrt{3}}\right) = \frac{2\sqrt{3}}{3}$

Vectors

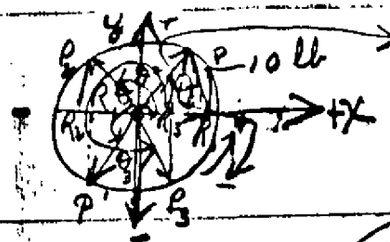
1. Scalar has magnitude - coulomb, a gallon,
2. Vector " " and direction - velocity

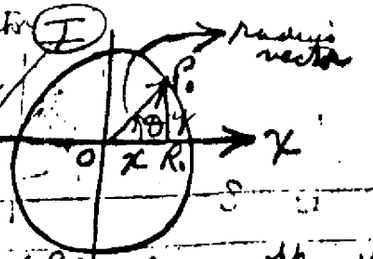
The vector symbol denoted by $\longrightarrow$

greater the arrow line the greater the magnitude

the head shows the direction

OVER





I $0 < \theta < 90°$

$y = P_0 R_0$

$r = O P_0$

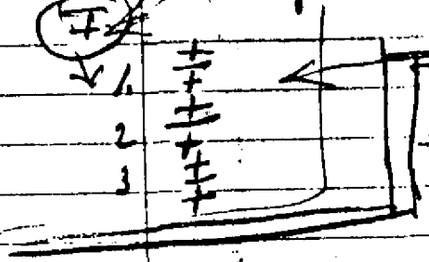
$x = O R_0$

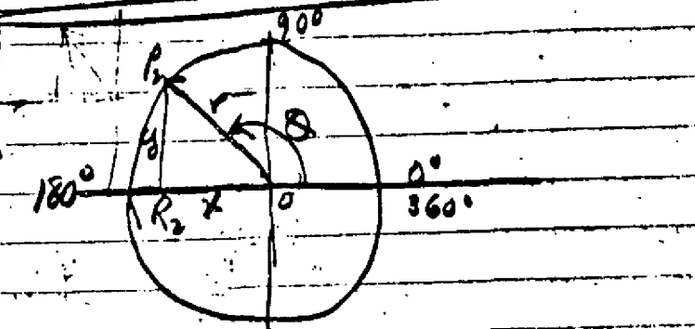
1. $\sin \theta = \frac{opp}{hyp} = \frac{y}{r}$

2. $\cos \theta = \frac{adj}{hyp} = \frac{x}{r}$

3. $\tan \theta = \frac{opp}{adj} = \frac{y}{x}$

radius vector is always positive $\Longrightarrow$ $r = +$ always





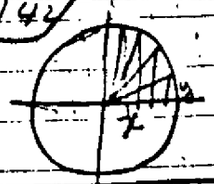
$\sin \theta_2 = \frac{y}{r} \quad \frac{+}{+}$

$\cos \theta_2 = \frac{x}{r} \quad \frac{-}{+} = -$

$\tan \theta_2 =$

I Homework 3/11/42

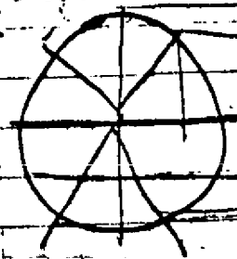
θ	Sin	Cos	Tan
0°			0
15°			
30°			
45°			
60°			
90°			∞
180°			0
360°			0



See page 92 + 93

Homework

I



15°/sec

10 volts

use formula

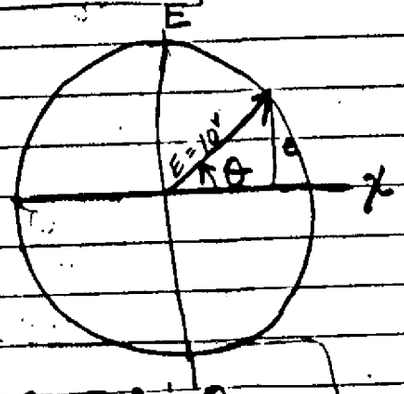
$e = E_m \sin K t$ (3)

See Page 90

60 cycles / sec in house

a complete cycles

t (sec)	Volt
0	110
1/240	0
2/240	-110
3/240	0
4/240	110



$e = E \sin\theta$

$\sin\theta = \frac{e}{E}$

e = Instantaneous voltage

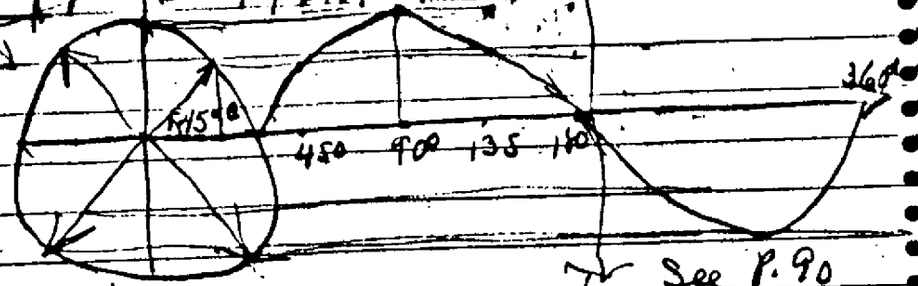
E - Constant

$\sin 45^\circ = .707$

t (sec)	θ	e
0	0°	0
1/8	45°	.707
2/8	90°	1

t	θ	e
	135°	.707
	180°	0
	225°	-.707
	270°	-1

$e = E \sin\theta = 1 \text{ volt} \sin\theta$



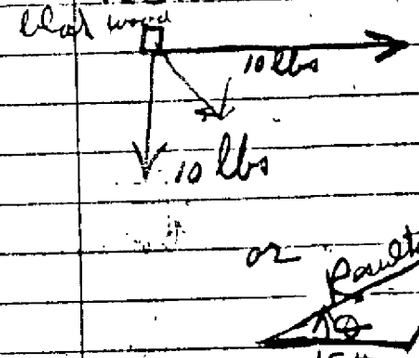
$\theta = kt$

$k = 150$ sec

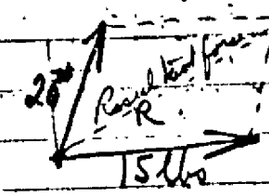
See P. 90

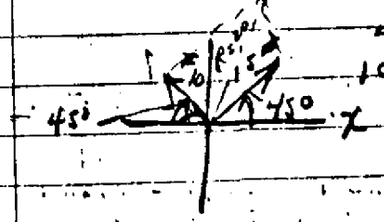
$e = E \cos\theta$

Vectorial addition.



Gives Parallelogram of forces

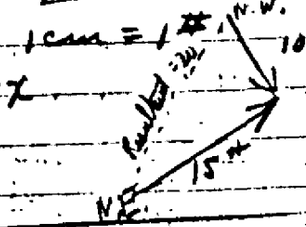


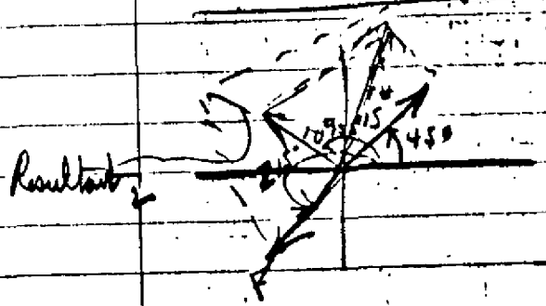


15# N.E

10# N.W.

1 cm = 1#





3/3/42

Homework

Solve for remaining parts

a	17		35		18	20
b				27		
c						10
A	45°	75°	15°			
B				60°	15°	30

2) and vectorially (use parallelogram method and scale of 1 cm = 1 lb.

(a)

F_1	θ_1	F_2	θ_2
10#	15°	15#	110°
12#	30°	17#	270°
7#	0°	6#	225°

(b)

E	θ_1	E_1	θ_1	E_2	θ_2	E_3	θ_3
—	—	7v	00	10v	45°	7v	195°
—	—	2	45°	3	900	5	180°
—	—	10	0°	5v	90°	5	270°

E = voltage, I = current

(c)

5a	0°	10v	0°	5v	90°	5v	270°
10a	0°	5v	45°	5v	315°	5v	0°

resonance I and E reactive are "in phase"

note I and E are subtracted vectorially

(3) amps | 0 | .05 | .1 | .15 | .2 | .5 | 1.0 | 1.25 | 2.00
volts | 0 | .2 | .4 | .6 | 1.0 | 2. | 4. | 5 | 8.00

= graph of Ohms Law $R = 4\Omega$

Plot the graph

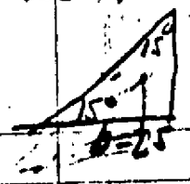
I milliamps	0	10	20	30	40	50	60	70	80	90	100
E volts	390	365	350	333	318	305	290	280	270	260	250

(4) Kenney P. 7 1-1, 2-1, 3-1

(5) Calculate resistance of 1000 ft. of AWG #4, #14

resistivity $K = 10.35$

Inclass 3/11/42



$\cos 75 = \frac{b}{c}$ 25

$\frac{31}{32}$

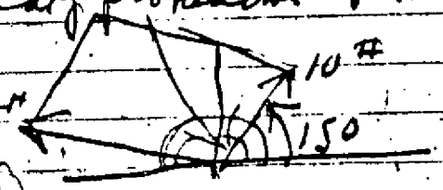
$\tan 75 = \frac{a}{25} \cdot 31.8 \times$ $a = 25 \times 31.8 = 78$

$c = \frac{75}{\frac{31}{32}}$

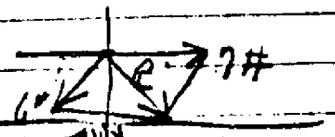
$\cos 75 = \frac{25}{c}$ $\frac{200}{31} = \ldots$ 7°

$c = \frac{25}{}$

Lab protractor & measure off angle



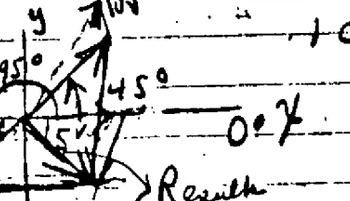
(2a)



1 cm = 1 lb

10 cm = 10 lb

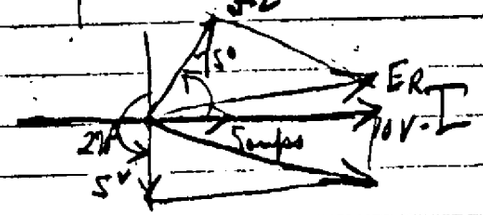
(2b)

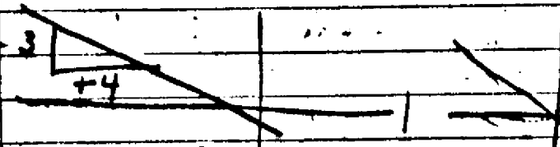


1 cm = 1 volt

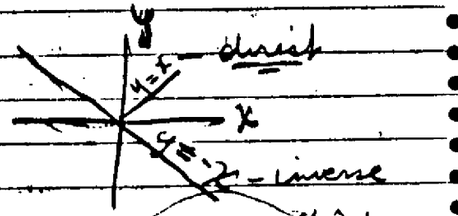
0.7

(c)



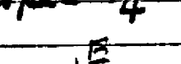


Slope $= -\frac{3}{4}$

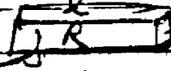


$y \propto x$ direct proportion

$y \propto \frac{1}{x}$ inverse proportion

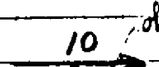


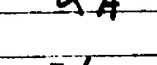
Slope $= \frac{\text{vertical rise}}{\text{horizontal run}}$



$R \propto l$
$\propto T$
$\propto \frac{1}{A}$

R = resistance
T = Temperature
A = area
l = length





A = 1 sq. mil — 10' — R = 1Ω

A = 5 sq. mil — 10 — $R = \frac{1}{5}\Omega$

#1 Ⓐ

#2 Ⓐ

$\frac{A_1}{A_2} = 1.26$

1.26 is the ratio between 2 successive areas of B&S wire corresponding to 2 successive sizes

Page (7)

A_1 — 10 — silver — R = 1Ω

A = 10 — copper — R = 1.06

A = 10 — steel — iron — R = 6

$R = K\frac{l}{A}$

K = Specific resistance
R = resistance in ohms

1 mill $= \frac{1}{1000} = .001$ | Area $A = \pi R^2 = \pi d^2$

$= \frac{\pi (.001)^2}{4} = .785 \times 10^{-6}$ Sq. inches.

d = .001 = 1 mill d = 1 mill → A = 1 circular mills

If d = 2 mill → A = 4 " "

$A = d^2$ " "

d = .040" d = 40 mills

$A = \frac{\pi (.040)^2}{4}$ sq. inches

A = 1600 circular mills

Increase in 1 in. gauge number increases R = 25%

" 2 " " " " " 60%

" 3 " " " " " 100%

" 10 " " " " " 1000%

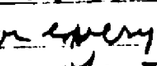
	d (mils)	A Cmils	R Ω/1000'
#18	40	1624	6.385
#19	36	1288	8.051
20	32	1022	10.15
21	28.5	810.1	12.80

$R = K\frac{l}{A}$

$R \propto \frac{1}{A}$ $\frac{1288}{1624} = \frac{1}{1.26}$

for every increase in gauge number of 3 the area decreases by ½ in circular mills. The area decreases for every increase in Gauge no. of 3 by 100% the Resistance goes up by 100%

K = The specific resistance of material with cross section of 1 circular mill in area and 1 ft in length



R = K

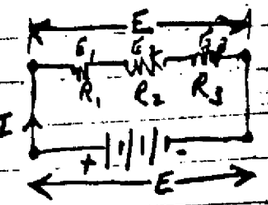
.01
1.06

= 19

64 C.M.

$d_x = \sqrt{\frac{864}{1.06}}$

back at column ① d mils



$E_1 + E_2 + E_3$
$I_1 R_1 + I_2 R_2 + I_3 R_3$
$I_1 + R_2 + R_3$

$= \frac{E}{R_1}$; $I_2 = \frac{E}{R_2}$; $I_3 = \frac{E}{R_3}$

$\frac{E}{R}$

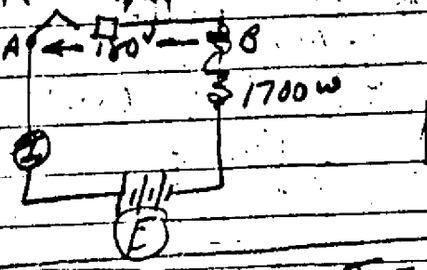
(OVER)

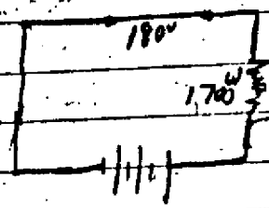
$I = I_1 + I_2 + I_3$

$\frac{E}{R} = \frac{E}{R_1} + \frac{E}{R_2} + \frac{E}{R_3}$

$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$

P. 22





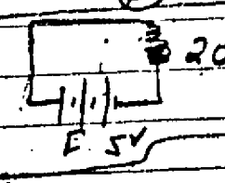
$E = 180 + E_1$

$E_1 = .018 \times 1700$

$E_1 = 30.6$

$E = 180 + 30.6 = 210.6$

P. 22 Prob. 3



$I = \frac{E}{R}$

$I = \frac{5}{20} = .25$

Prob 2-2

$R = \frac{E}{I} = \frac{45}{.001} = 45{,}000\ w$

Prob 3-2

$I = \frac{E}{R} = \frac{2}{0.06} = 33.33$

Prob 4-2

$I = \frac{E}{R} = E = 20 \times 10^{-3} = .02$

$R = 100^w$

$\frac{20 \times 10^{-3}}{10^2}$

$\frac{.02}{100} = .0002$

$R = R_1 + R_2 + R_3$

$100 + 100 + 100 = 300$

$E = I\,R = .0002 \times 300$

$E = .06^v$

P. 28 Prob 13-2

$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$

$\frac{1}{R} = \frac{1}{1.75} + \frac{1}{1.75} + \frac{1}{1.75} + \frac{1}{1.75} + \frac{1}{1.75}$

$I = 5 \times 1.75 = 8.75$

$\frac{1}{R} = \frac{1}{8.75}$ $R = \frac{E}{I}$ $R = \frac{2.5}{8.75} = .285$

$E = 2.5$

$\frac{2.5}{1.750} = \frac{2500}{1750}$

$\frac{1750}{750}$

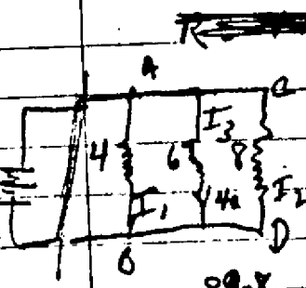
65

P. 24
Prob. 14-2

$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} + R_3$ Parallel

$R = R_1 + R_2 + R_3$ Series

Homework – 2/10/4
5-2 – P. 24
6-2 / 12-2 P. 26
15-2-16-2 P. 28-29



$E = 4 \times 6 = 24$

$I_1 = \frac{24}{4} = 6a$

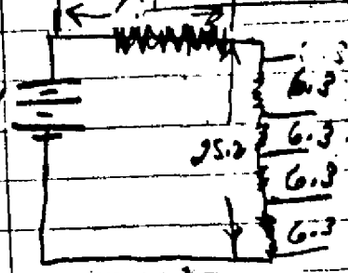
$I_2 = \frac{24}{8} = 3a$

$\frac{24}{4}$ $\frac{24}{6}$ $\frac{24}{8}$

$I = I_1 + I_2 + I_3 = 6 + 4 + 3$

$I = 13$

P. 26
Prob 6-2



$4 \times 6.3 = 25.2$

$R = \frac{E}{I}$ $\frac{1150}{25.2} = 411$

$\frac{115}{25.2}$

$\frac{}{89.8}$

$89.8 = .3 \times R$

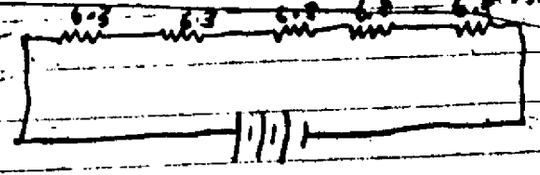
$E = I \times R$

$R = \frac{89.8}{.3} = 299$

299.2

P. 26
Prob 7-2

ans, 31.5



Prob 15-2

current
$I = I_1 + I_2$

$I_1 = \frac{15}{1000} = .015\,a$

$I_2 = \frac{15}{5.00} = .030$ $E = 500 \times .015$

$I = .045\,a$

Prob 3-1

$R_1 = R_2 = \frac{K_1 l_1}{A_1} = \frac{K_2 l_2}{A_2}$ $R_1 = \frac{K_1 l_1}{A_1}$ $R_2 = \frac{K_2 l_2}{A_2}$

$K_p l_p = K_I l_I$ $l_I = \frac{K_p l_p}{K_I} = 1.02$

$K_{p+} = 6.15$ $l_{p+} = 1$

$K_{I\,min} = 6.00$ $l_I = ?$

$R_1 = R_2$ $A_1 = A_2$

$R_1 R_2$ $K_1 = K_2$ $A_1 = A_2$ $K_2 = K_1$

$\frac{l_1}{A_1} = \frac{l_2}{A_2}$

Prob 16-2

$\frac{1}{R_E} = \frac{1}{30} + \frac{1}{60} = \frac{3}{60}$

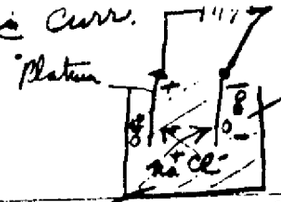
$I_1 = \frac{10}{40} = .25\,a$

$R_3 = 20$

$R = 20 + 20 = 40$

$E_2 = E_3 = \frac{1}{4} \times 20 = 5^v$

Effects of Electric Curr.
1. Chemical
2. Magnetic
3. Heating



NaCl
H_2O

$NaCl \rightleftarrows Na^+ + Cl^-$

$H_2O \rightleftarrows 2H + O^=$

cathode
$2Cl \rightarrow Cl_2 + 2E$

$Na + E \rightarrow Na$ $2Na + 2H_2O \rightarrow$ "
$\rightarrow H_2 + 2\,NaOH$

Joule = J = Unit of electrical energy liberated as heat

1 joule = 4.183 calories

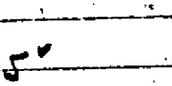
a proportion

Joule = J = Voltage × Current × time

Joule = EIt

with $P(watt) = \frac{J\,joule}{t\,sec} = EI$ volt amp

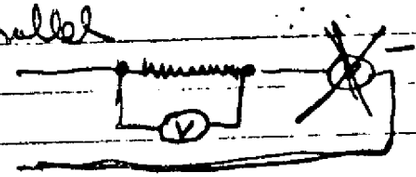
Experiment of Ohms Law



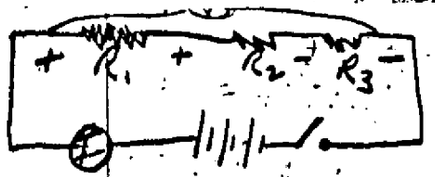
Experiment I
1. measure $R_1 + R_2 + R_3$
2. for one of the R determin the current for 3 diffent volta

Never connect voltmeter in series with resistance but in parallel

Path F



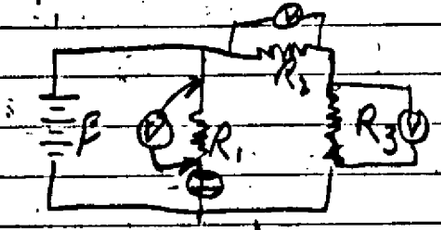
Ammeter is connected in series



Part II

(3) connect 3 resistance measure the current the voltage across + total voltage

Part III



● Calculate the the 3 resistance + plot E vs I

Determine the R used or the Resist in the Series connect + then total R from the E + V measurements

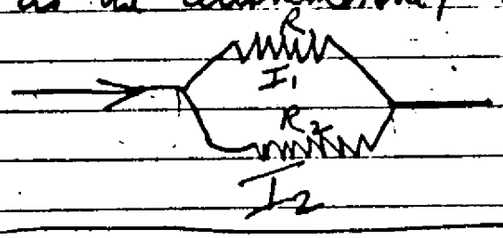
Use the measured voltage across the R added give total voltage. Describe any errors in experiment

Determine the power absorbed by each resistance + total power. $P = EI = I^2R = \frac{E^2}{R}$ + calculate those powers by these 3 formulas

Calculate the value of each resistance & the value of dissipation

does the current in the series branch equal the sum

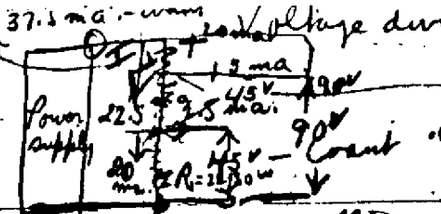
● the current in the parallel branches. Establish the fact that currents in parallel branches divide inversely as the resistance of the paths



Homework 3/20/42 Chapt III problem 1-5 inc

37.5 ma - max

2 volt voltage divider

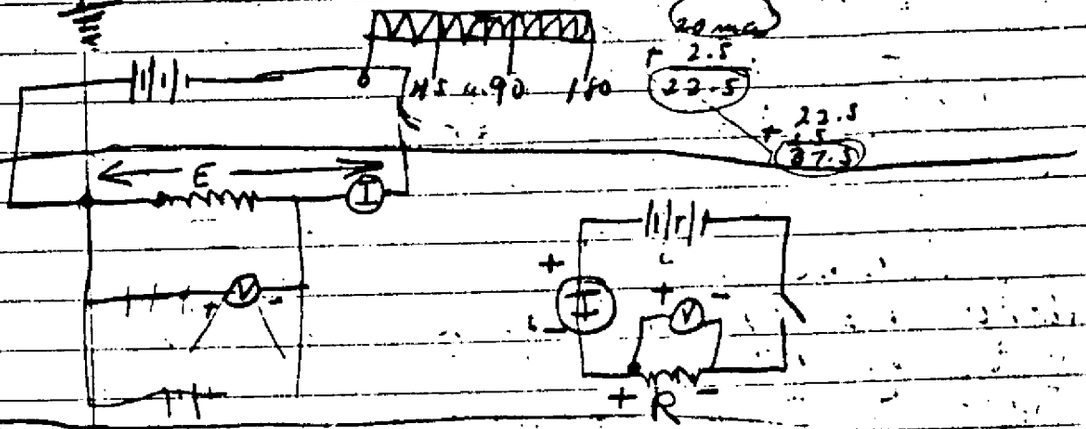


$R_2 = \frac{45}{.0225} = 2000\,\Omega$

$\frac{45}{.020} = 2250\,\Omega$

$R_3 = \frac{90}{.0375} = 2400\,\Omega$

Bleeder resistors



In lab 3/20/42

110 V

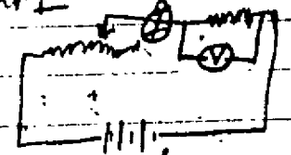
plot one against the other

V / I

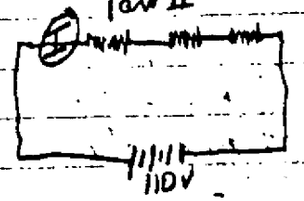
Voltmeter use 150 scale

Ammeter " 3 scale

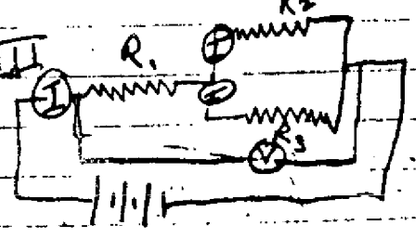
Part I



Part II



Part III



Part II $I = 1.5$ Amp $E = 78$ volts $R = \frac{78}{1.5} = 52$ $R_1 = 50\Omega$

I	1.5	1.7	1.9
V	78	88	101

make Graph

$R_1 = 50$

$I = 2.4 = R_2$ $R_2 = 23\Omega$

$V = 54$

I 2.75 $= R_3$ $R_3 = 24$

V 63

Part II $E_1 = 1.17^a = R_1$ $E_2 = .59^a = R_2$ $E_3 = 27^V$

$V = 1.17$ $V = 26$ $V = 36$

Current

$E_{1+2+3} = 111$ volts

Part III $R_1 = 2.8$ $R_2 = .93$ $R_3 = 1.9$

64 V voltmeter 44 V 45 V current = 2.8

$E = 44$ $E_2 = 45^V$

current 2.8 $= I$

$E = 107^V$

Incomplete 3/23/42

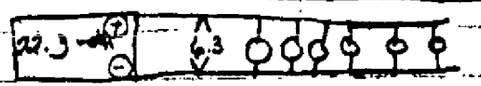
Probl. 10-3 P. 56 $P = I^2R = \frac{E^2}{R} = IE$

$.05 \times 180 = 9$ watts $= 9$ $\frac{\text{joules}}{\text{sec}}$

Efficiency $= \frac{\text{output}}{\text{Input}} = \frac{9}{x}$ or $40 = \frac{9}{x} = 22.3$

11-8 $R = 6$ Input → Output 100 amp. hrs

$I = 133$ amps $\times$ hrs $= 133$ $\frac{\text{amp. hrs}}{\text{hrs}} = \frac{Q}{I} = \frac{100}{.75} = 133$



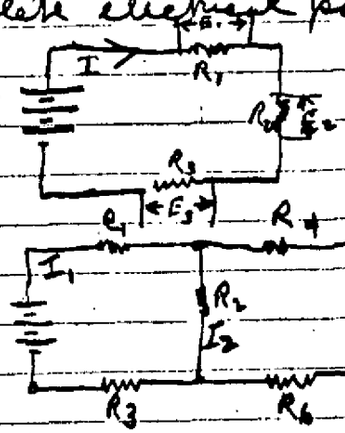
3.6 amps

$I = \frac{E}{R} = \frac{22.5}{6.3} = 3.6$ amps

Kirchoff's Laws

1. $\Sigma e = 0$ — voltage rise = +, voltage drop = −
2. $\Sigma i = 0$ — ① Entering current = +, leaving " = −

1. The algebraic sum of all the voltages around a complete electrical path is zero 0



$+E - E_1 - E_2 - E_3 = 0$

$E = E_1 + E_2 + E_3$

$E = IR_1 + IR_2 + IR_3$

$I_1 = I_2 + I_3$

$+E - I_1R_1 - I_2R_2 - I_1R_3 = 0$

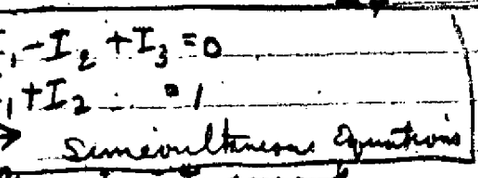
$+I_2R_2 - I_3R_4 - I_3R_5 - I_3R_6 = 0$

$+E - I_1R_1 - I_3R_4 - I_3R_5 - I_3R_6 = 0$

$\rightarrow -I_1R_3 = 0$

2. The algebraic sum of all the currents at a node or junction point is zero 0

$+I - I_2 - I_3 - I_4 = 0$

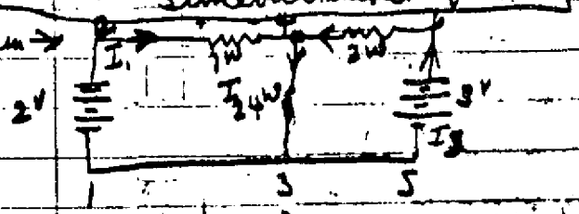


$I_1 - I_2 + I_3 = 0$

$I_1 + I_2 = 1$

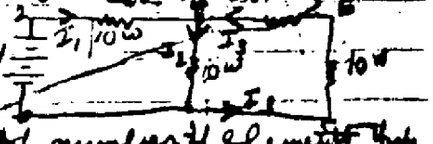
Simultaneous equations

Problem →



(OVER)

Branch Currents



Ind number of elements that exist in a series path between 2 nodes

$I_1 - I_2 + I_3 = 0$

$I_1 - I_2 + I_3 = 0$

$+10 - 10I_1 - 10I_2 = 0$

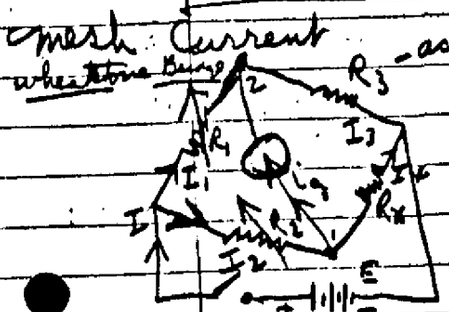
$+10I_2 + 5I_3 + 10I_3 = 0$

$+I_1 - I_2 + I_3 = 0$

$I_1 + 4I_2 = 0$

$-3I_3 + 2I_3 - 4I_2 = 0$

Mesh Current — accurate



$\mathcal{E}_g = 0$

$\frac{I_1 R_1}{I_3 R_3} = \frac{I_2 R_2}{I_x R_x}$

$I_1 = I_3$

$I_2 = I_x$

$R_x = \frac{R_2}{R_1} R_3$

$R_x = \frac{R_2}{R_1} R_3 = \left(\frac{R_3}{R_1}\right) R_2$

$R_x = \left(\frac{R_2}{R_1}\right) 1000$

$I_1 - I_2 + I_3 = 0$

$\ominus\ I_1 + 4I_2 \quad \pm 2$

$-5I_2 + I_3 = -2$

$4I_2 + 2I_3 = 3$

$\pm 10I_2 \ominus 2I_3 = \ominus 4$

$4I_2 + 2I_3 = 3$

$14I_3 = 7$

$I_3 = \frac{1}{2}$ amps

$2I_2 = 1$

$I_2 = \frac{1}{2}$

$I_1 = 0$

3/25/42 → cont'd

$+3I_2 + 2I_3 = +5$

$3I_2 - 6I_3 - 9I_4 = 0$

$-8I_3 + 9I_4 = 5$

$-8I_5 + 8I_3 - 8I_4 = 0$

$8I_5 + 17I_4 = 5$

$8I_5 + 6I_4 = 0$

$23I_4 = 5$

$I_4 = \frac{5}{23}$ amps

$I_5 = \frac{15}{92}$ amps

$I_3 = \frac{35}{92}$ amps

$I_2 = \frac{130}{92}$ amps

$I_1 = \frac{165}{92}$ amps.

Total amps coming from battery =

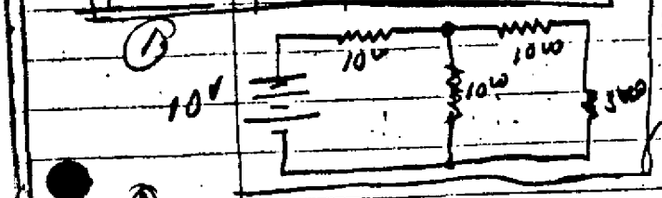
$I_5 = \frac{3I_4}{4} = \frac{15}{23} \times \frac{1}{4} = \frac{15}{92}$

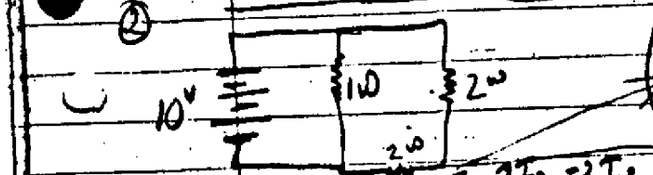
$\frac{40}{92} + \frac{5}{92} = \frac{35}{92}$

$I_2 = 2I_3 + 3I_4$

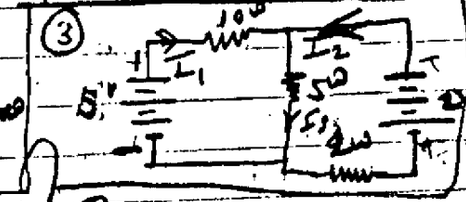
$\frac{70}{92} + \frac{60}{92} = \frac{130}{92}$

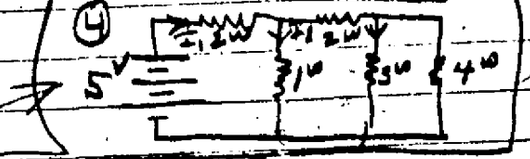
Faradays' Experiment





Homework for 3/25/42





Prob 4. ←

$2I_1 - 2I_2 - 2I_3 = 0$

$+5 - 2I_1 - I_4 = 0$

$+I_2 - 2I_5 - 3I_4 = 0$

$+3I_4 - 4I_5 = 0$

$+I_3 - I_4 - I_5 = 0$

Cont'd

Prob 3

$+5 - 10I_1 - 5I_3 = 0$

$-2 + 2I_2 + 5I_3 = 0$

$I_1 + I_2 - I_3 = 0$

$+3 + 2I_2 - 10I_1 = 0$

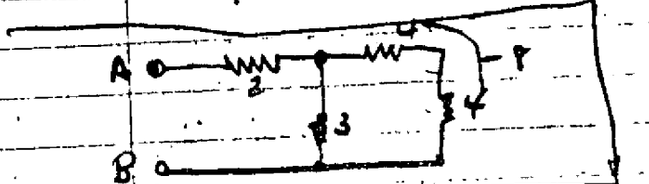
$-2 + 7I_2 + 5I_1 = 0$

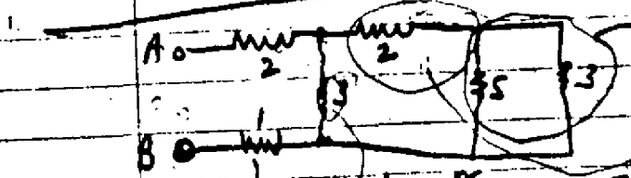
$+3 + 2I_2 - 10I_1 = 0$

$-4 + 14I_2 + 10I_1 = 0$

$-1 + 16I_2 = 0$

$I_2 = \frac{1}{16}$ amps





$R_1 = \frac{15}{8}$

$\frac{15}{8} + 2$

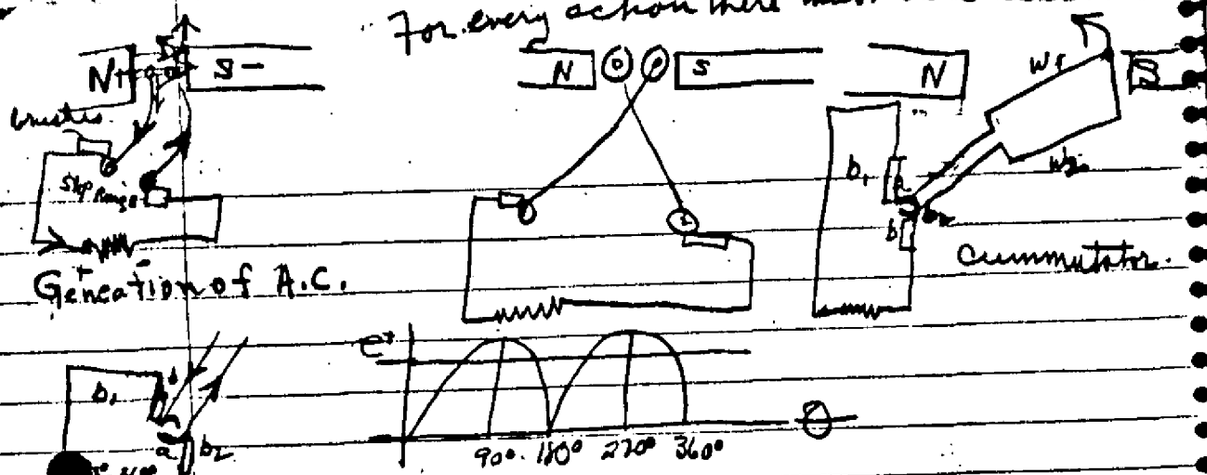
$\frac{1}{R_2} = \frac{1}{5} + \frac{8}{31}$

$\frac{55}{93}$

$R_2 = \frac{93}{55}$

Between A + B = $\frac{93}{55} + 3$

For every action there must be a reaction.



Im + lead = Solder
50% + 50%

P. 35

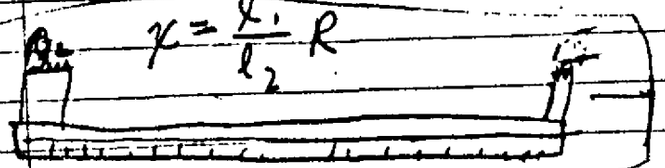
$$\frac{E}{\bar{E}} = \frac{I R_x}{\bar{I} R} \quad (R = R_x)$$

$$\frac{E_b}{E} = \frac{E}{E}\frac{R}{R_m} + \frac{\bar{E}}{E}$$

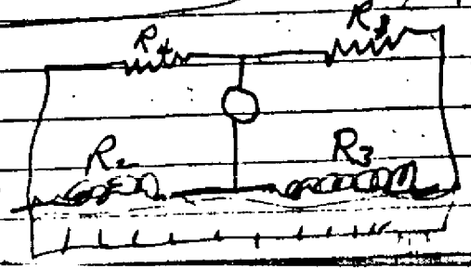
$$R = R_m\left(\frac{E_b}{E} - 1\right)$$

3/27/42

Wheatstone Bridge Experiment



$$\chi = \frac{l_1}{l_2} R$$



Wed $R_1 = 30.29$

$R_2 = 50.1 = l_1$

$R_3 = 49.9 = l_2$

$\frac{R_x}{R_1} = \frac{R_2}{R_3}$

$R_x = ?$

No. 12 $l_1 = 54.1$

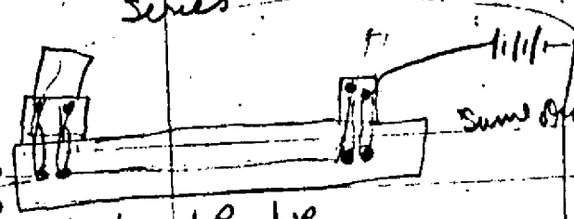
$l_2 = 45.9$

$R_1 = 30.29$

L_1	L_2	R_x	R_x
50.1	49.9	H	
54.1	45.9	12	
49.9	50.1	30	

Combined Resistances

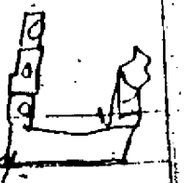
Series



L_1	L_2	R_x	R_x
76.3	23.7	46	

$R_s = R_1 + R_2 + R_3$

Parallel



Same principle for each one for Parallel

L_1	L_2	R_x	R_x
26.	74.9		

$$\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$$

Part 4 Ayrton's Voltmeter & galvanometer

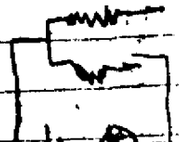
Ayrton's Voltmeter 209.24

L_1	L_2	R_{30}
90.9	9.1	

$$R = \left(\frac{E_b}{E} - 1\right) R_m$$

voltage of Battery $E_b = 2.24$

$E = 2.08$



Part 5

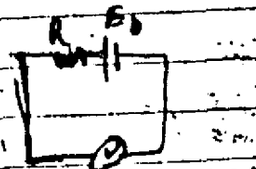
$$\frac{I_R}{I_\chi} = \frac{\chi}{R}$$

$I_R = .2$

$I_\chi = 1.9$

$R = 30.29$

with Commeter

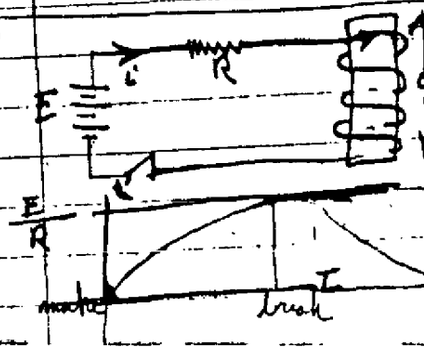


$E = E_b - I_R$

$IR = E_b - E$

$$R = \frac{E_b - E}{I} = \frac{E_b - E}{I R_m} \Rightarrow R_m = \frac{E_b - E}{E} R_m = \left(\frac{E_b}{E} - 1\right)$$

Indoor 3/27/42



e = result voltage = $e_1 + e'$

$E = LR = e_1$ = applied voltage

e' = back voltage (−)

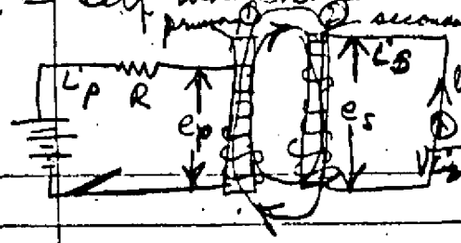
$e' \propto \frac{\Delta i}{\Delta t}$ emf (−)

Δ = change $e' = -L\frac{\Delta i}{\Delta t}$

1 henry unit of inductance

$-L$ = self inductance

primary secondary



$e_p = -L_p \frac{\Delta i_p}{\Delta t}$

$e_s = -L_s \frac{\Delta i_s}{\Delta t}$

$e'_p = -M \frac{\Delta i_s}{\Delta t}$

$e_s = -M \frac{\Delta i_p}{\Delta t}$

$P = e_p i_p \cos\theta_p$

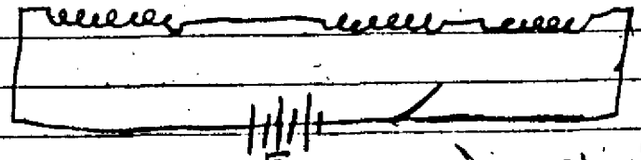
$P = e_s i_p \cos\theta_s$

Homework 3/30/42

Problems in Chapter 4

Prob. 1-4 to 5-4

Read chapt. V ⑤

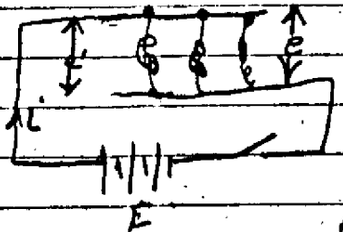


$e = e_1 + e_2 + e_3$

$= L \frac{\Delta i}{\Delta t} = L_1 \frac{\Delta i}{\Delta t}$

$-L \frac{\Delta i}{\Delta t} = L_1 \frac{\Delta i}{\Delta t} - L_2 \frac{\Delta i}{\Delta t} - L_3 \frac{\Delta i}{\Delta t}$

$L = L_1 + L_2 + L_3$

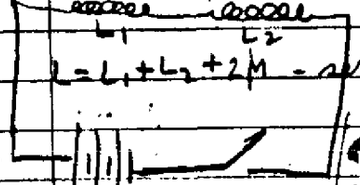


$i' = i_1 + i_2 + i_3$

$\Delta i = \frac{\Delta i_1}{\Delta t} + \frac{\Delta i_2}{\Delta t} + \frac{\Delta i_3}{\Delta t}$

$\frac{\Delta i}{\Delta t} = \frac{e}{L}$, etc $\frac{\Delta i_1}{\Delta t} = \frac{e}{L_1}$

$\frac{1}{L} = \frac{1}{L_1} + \frac{1}{L_2} + \frac{1}{L_3}$



$L = L_1 + L_2 + 2M$ - series aiding

$L = L_1 + L_2 - 2M$ series opposing

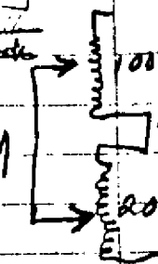
3/30/42 In Class

$L_0 = L_1 + L_2 + 2M$

$400\mu h = 100\mu h + 200\mu h + 2M$

$M = 50\mu h$

$T = \frac{50}{\sqrt{100 \times 200}} = \frac{50}{100\sqrt{2}} = \frac{.707}{2} = .353$



$M = T\sqrt{L_1 L_2}$

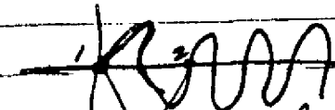
$= .6\sqrt{100 \times 200}$

$.6 \times 100 \times 1.414$

$84.84\ uh.$

$X_L = 2\pi f L$

frequency



$\frac{\text{cycles}}{\text{sec}}$ = frequency

$R_L = LXL$ reactance

chapter ⑥

P. 72+73

chapt ⑤

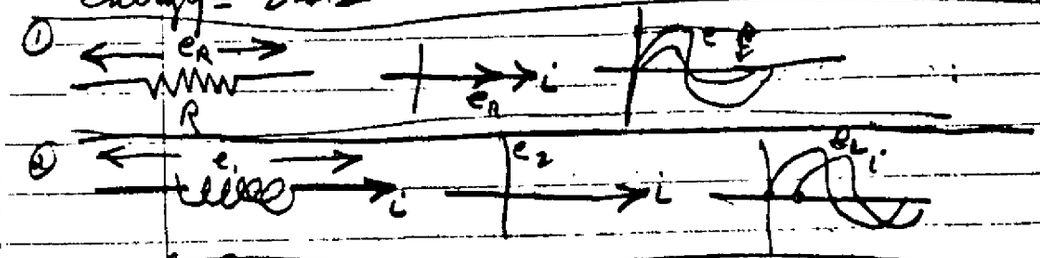
$P = \frac{EI}{2} = \frac{W}{T}$ (Joules)

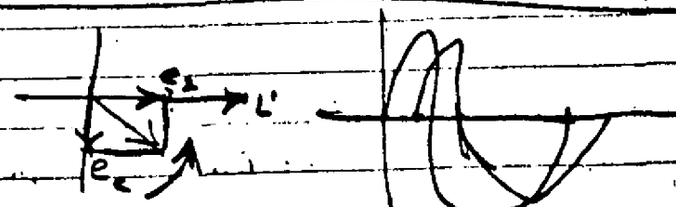
$J = \frac{EII}{2}$

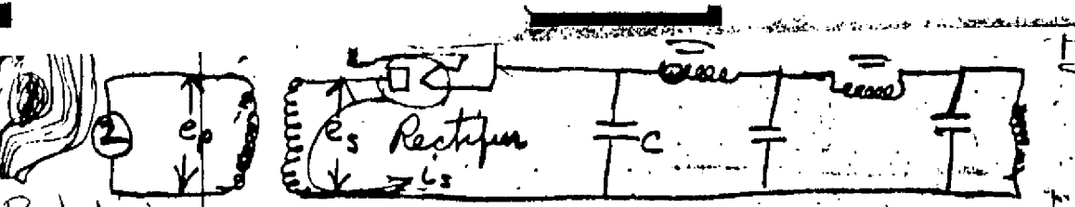
$I = \frac{Q}{t}$

$Q = It$

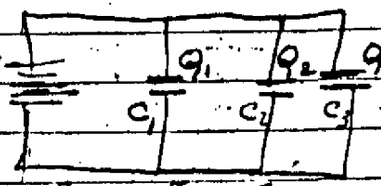
Energy $= \frac{1}{2} L I^2$







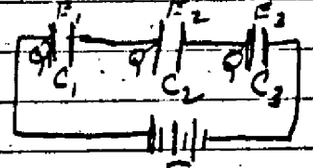
Ralph Weiner
Richard Weiner
Richard W.



Parallel

$Q = q_1 + q_2 + q_3$

$C = C_1 + C_2 + C_3$



In Series

$E = E_1 + E_2 + E_3$

$\frac{1}{C} = \frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3}$

Homework - 3/31/42

Chapt 4 + 5
Chapt 4
Reread chap V
+ prob 1-3 inc in chapt 5

Thursday

3/31/42

Chapt (4)
8-4

$i_s = 5 \times 1.75$

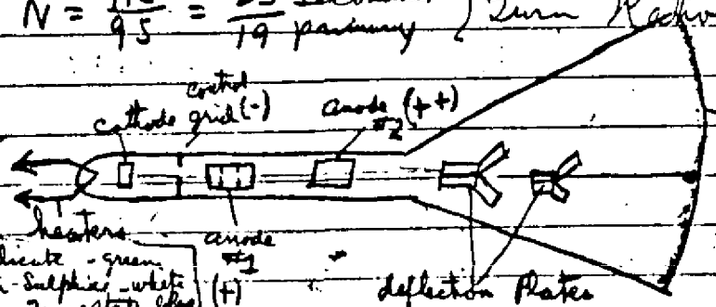
$e_p i_p = e_s i_s$

$i_p = \frac{2.5 \times 5 \times 1.75}{110}$

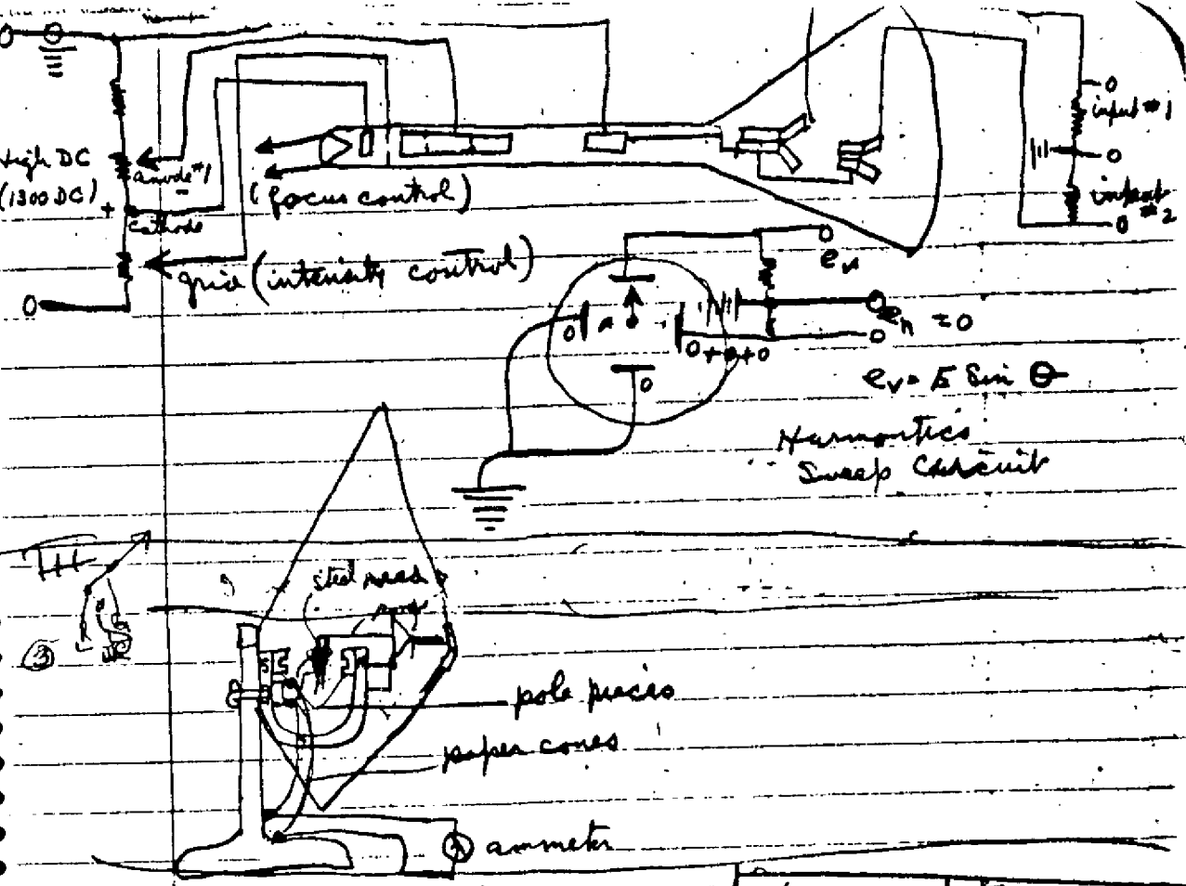
$N = \frac{115}{95} = \frac{23}{19}$ Secondary / primary } Turn Ratio

$\frac{e_s}{e_p} = \frac{N_s}{N_p} = N = \frac{\text{Turn Ratio}}{110} = \frac{1}{44} = N$

Prob
10-4



Zn SiO_4 Zinc Silicate - green
Ca S Calcium Sulphide - white
$Ca WO_4$ " Tungstate Blue



IV

$E_0 = I_0 \times 10^6$

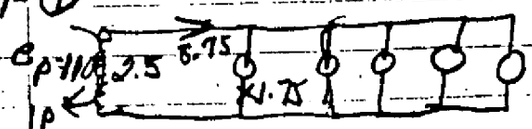
$Q_1 = 5 \times 10^{-6} \times E_0$

$Q_2 = 10 \times 10^{-6} \times E_0$

Energy $= \frac{1}{2} C E_0^2$

Homework for 4/3/42
all the problem
in chapt 5 worked
Chapt. 6

Chapt (4)
8-4



$\frac{N_p}{N_s} = \frac{e_p}{e_s} = \frac{110}{2.5} = \frac{44}{1}$

$e_p i_p = e_s i_s$

$i_p = \frac{2.5 \times 8.75}{110}$

$P_L = \frac{2.5 \times 8.75}{9}$

$P = 2.5 \times 8.75$ watts

$C = \frac{.0024}{220} = 10.9\ \mu f$ — 10.9μf 10w

$E_{ave} = \frac{220}{2} = 110^v$

$I_{ave} = \frac{110}{10} = 11.$ amps

$I = \frac{Q}{T}$ $T = \frac{Q}{I} = \frac{.0024}{11} = .000218$ sec.

$R = 20^w$ $I = \frac{110}{20} = 5.5$ amps

$P = I^2R = (5.5)^2 . 20$ $T_2 = \frac{.0024}{5.5} =$

10-5

5.5 110 .01 .04 P_2 P_1

$P_1 = .3P_2$

$\frac{500}{.3} = P_2 = \frac{5000}{3}$

$P = \frac{1}{2} CEN$ $P_2 = \frac{1}{2} \times \frac{1}{2} \times 10^{-9} \times E^2 \times 1000 = \frac{5000}{3}$

$E^2 = \frac{5}{18 \times 10^{-9}} = \frac{5}{\frac{18}{36}} \times 10^{+10}$

$E = \sqrt{\frac{10^{10}}{36}} = \frac{10}{6}$

$\frac{100000}{6} = 16667$

In Lab #3/42

(1) wave of 60 cycle current

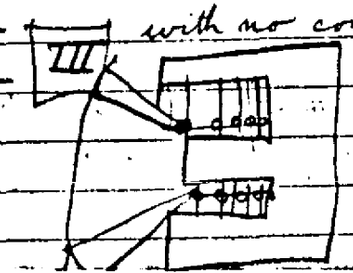
(2) wave of 400 volts D.C.

A.C. — Oscilograph @

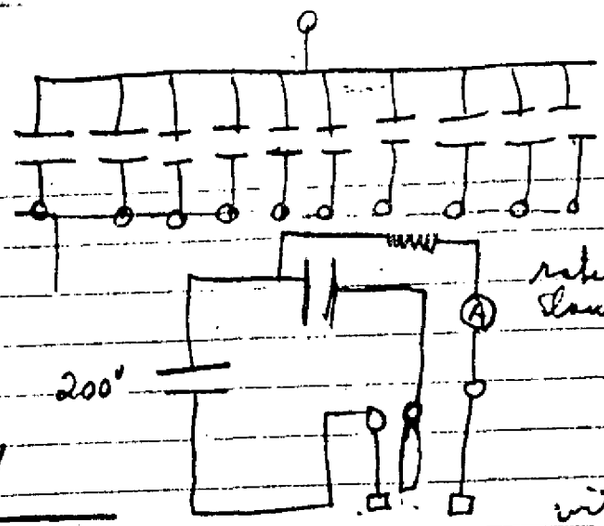
both condensers

with one condeser

with no condensers & choke coil

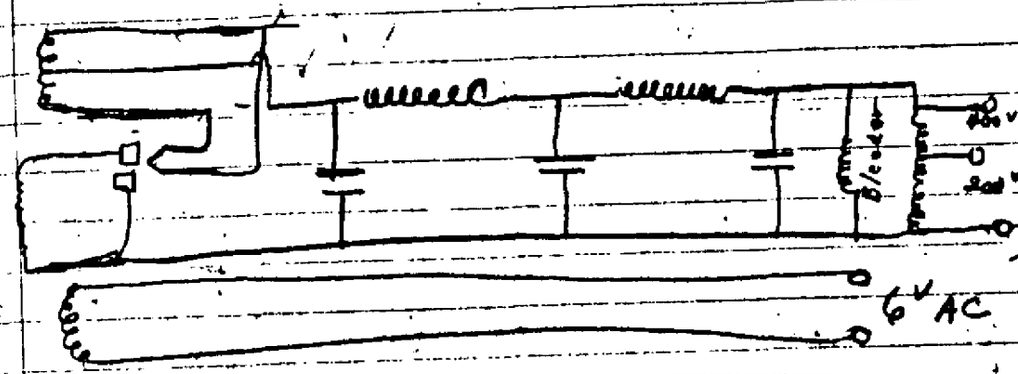


1 cut IV



with 10^{10} discharge much slower

with 5 a little faster



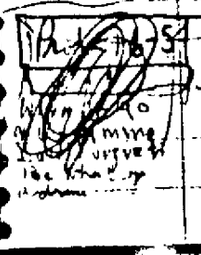
In class #3/42

$1\mu f = \frac{1}{1000000}$ farad $= \frac{1}{10^6} = 10^{-6}$ farads

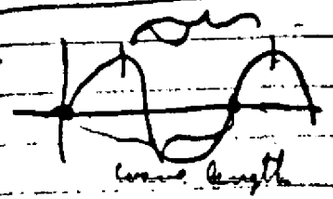
$1\mu\mu f = \frac{10^{-6}}{10^6} = 10^{-12}$ farads $\frac{1}{1000} f = 10^{-3} f$

$1 f = 10^{+12}$ $= 10^{-3} \times 10^{+12} = 10^9 \mu$

Chapt 5 Prob 14-5 — Can't be done — Ernotte



distance between two = wave length



P. 87
Prob 16-5

$(\Delta\lambda) \propto (\Delta C)$

Change in wave length squared is proportional to the change in the capacity

$C_1 = 500 \times 10^{-12}$ f | $\lambda_1 = 600$ meter $\quad \Delta\lambda = \frac{800}{600} = \frac{4}{3}$

$C_2 = ?$ $\quad \lambda_2 = 800$ meters $\quad \Delta C = \left(\frac{4}{3}\right)^2 = \frac{16}{9}$

$X_C = \frac{16}{9} \times 500 - 500 = 500\left(\frac{7}{9}\right) = 389$ μf

---

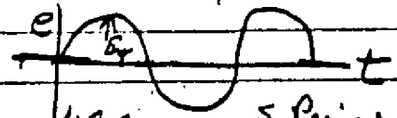
A cycle is that period when the wave goes through a certain series of events and then repeated to give the wave forms. An alternation is a $\frac{1}{2}$ of cycle.

A wave length the shortest distance between two points (in phase)

In phase

In class 4/6/42

$e = E \sin \theta = E \sin \omega t$

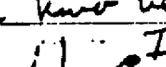


1. axis 5. Period
2. wave form
3 cycle
4. Frequency

Frequency is equal to cycles per second $= f = \frac{1}{T}$

Period is the numbers of seconds to make a cycle $= T = \frac{1}{f}$

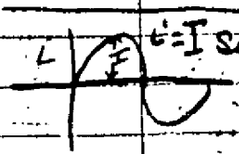
A phase is the fraction of the total period time which the wave has gone $= \frac{t}{T} = \frac{\theta}{360}$ The phase difference of two waves is the angle made by the two vectors $= \theta_1 \sim \theta_2$

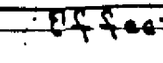


$i_{average} = \frac{2}{\pi} I$ (half cycle) $\quad i_{average} = \frac{I}{2}$ $\quad i_{average} = 0$ (full cycle)

$i_{average} = \frac{2}{\pi} I$ (half cycle)

Effective Value (I_E) D.C.



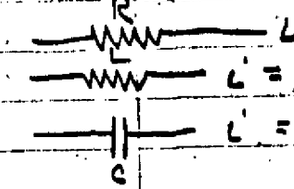


$\text{Power} = (i^2)R = I_E^2 R \quad I_E = \sqrt{(i^2)_{ave}} = \frac{I}{\sqrt{2}}$ (or $\frac{V}{R}$)

Effective value of a current is that value of the D.C. current

$I_E = \sqrt{[(I \sin\theta)^2]_{ave}} = \sqrt{I^2 (\sin^2\theta)_{ave}}$

$I_E = I\sqrt{(\sin^2\theta)_{ave}} = I\sqrt{\frac{1}{2}} = \frac{I}{\sqrt{2}} \quad \bar{y} = \frac{1}{\pi}\int_0^{\pi} (\sin^2\theta)\, d\theta =$



$i = I \sin\theta$ (1)

$i = I \sin\theta$ (2)

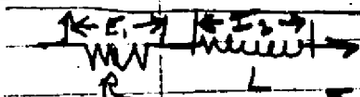
$i = I \sin\theta$ (3)

$e = E \sin\theta$
$e = IR \sin\theta$ $\quad E = IR$

$E = I X_L$
$E = E \sin(\theta + 90°)$
$E = I X_C$
$e = E \sin(\theta + 90°)$ $\quad e = I X_C \sin(\theta - 90$
$E = IR$

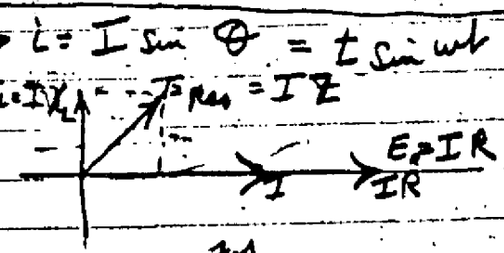
$X_L = 2\pi f L$

$X_C = \frac{1}{2\pi f C}$



$i = I \sin\theta = t \sin\omega t = I \sin 2\pi f t$

$R = 2\,\Omega$
$f = 60$ ~
$L = .1$ h
$i = 2 \sin\theta$
$I = 2$



1 amp = 1 cm
1 volt = 2 cm
Z = impedance

$E_L = I X_L$ $\quad (IZ)^2 = (I X_L)^2 + (IR)^2$

$Z^2 = X_L^2 + R^2$

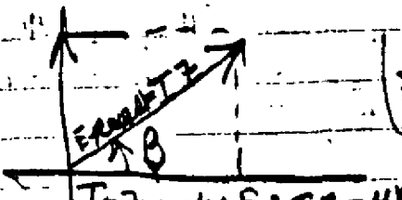
$Z = \sqrt{X_L^2 + R^2}$

$E_L = I X_L$

$X_L = 2\pi f L$
$= 6.28 \times 60 \times .01$
$= 3.768\,\Omega$

$E_L = 2 \times 3.77 = 7.54$

$I (X_L^2 + R^2)$



$e = E_m \sin(\theta + \beta)$
$e_{Rm} = I Z \sin(\theta + \beta)$
$i = I \sin\theta$
$\beta = \Sigma I$

1 volt = 2 cm
$Z = \sqrt{R^2 + X_L^2}$
$= \sqrt{2^2 + (6.28 \times 60 \times .01)}$
$Z = \sqrt{4 + (3.76)^2}$
$\beta = 2\sin^{-1}\frac{X_L}{R}$
$i = I \sin\theta$
$e_{Rm} = E_{Rm} \sin(\theta +$
$= I Z \sin(\theta +$

4/10/42

$E_{eff} = 110^v$

$X_L = 20\,\omega$

$I_{max} = 7.8$ amps $\rightarrow i = I_{max} \sin\theta$

$e = E_{max} \sin(\theta + 90)$

$E_{max} = 1.414 \times 110 = 155.5^v$

$I_{max} = \frac{E_{max}}{X_L} = \frac{155.5}{20^v} = 7.77$ amps

$6 = 7.8 \sin(-90+\theta) = 7.8$

$i = I_{max} \sin(\theta - 90)$

$\frac{6}{7.8} = \sin\theta$

$i = I_{max} \sin\theta$

$7.8 \times \cos\theta$

$\sin\theta = \frac{6}{7.8} = .77$

$\theta = 51°$

$e = 155 \times \sin(51 + 90)$

$155 \cos 51$

$155 \times .6293 = 97.5$

Prob 17 Chapter 6

$E_{eff} = 115^v$

4.5 amps I_{eff}

$X_C = \frac{115}{4.5} = 25.5\,\omega$

$80 = e = E_{max} \sin\theta = \sqrt{2} \cdot 115 \sin\theta$

$i = I_{max} \sin(\theta - \quad) = \sqrt{2} \cdot 4.5 \sin(\quad)$

$80 = 115\sqrt{2} \sin(\theta - 90)$

$\frac{80}{115\sqrt{2}} = \sin(\theta - 90)$

$= \cos\theta = .491$

$\theta = 60°30'$

$i = 4.5\sqrt{2} \sin 60°30'$

$6.4 \times .87 = 5.6$ amps

Prob 31 P. 115

34 volts R, 66 volts C

$\sqrt{34^2 + 66^2}$

C: $I = \frac{E}{X_C}$

R: $I = \frac{E}{R}$

X_L: $I = \frac{E}{X_L}$

34 / 34

L

$E_R = 34$

E

Price
629 Cutherspoon Bldg
Junction + Walnut

Penn 4436

R, L, C

$e = E_m \sin\theta$

L + C are constant

$I_m = \frac{E_m}{Z} = \frac{E_m}{\sqrt{R^2 + (X_L - X_C)^2}}$

$= \frac{E_m}{\sqrt{R^2 + \left(2\pi fL - \frac{1}{2\pi fC}\right)^2}}$

$X_L - X_C = 0$

$X_L = X_C$

$2\pi fL = \frac{1}{2\pi fC}$

$f^2 = \frac{1}{4\pi^2 LC}$

$f = \frac{1}{2\pi\sqrt{LC}}$

$I = \frac{E_m}{R}$

$4\pi^2 f^2 LC = 1$

4/13/42

f	R	L	C	E_M	I_{max}	E_{max}
500	5 ω	.001 h	50 μf	?	5 a	
500	5 ω	?	50 μf	Same	?	?
500	5 ω	.001	?	"		?
?	5 ω	.001	50 μf	"		?

$X_L = 2\pi fL = 6.28 \times 500 \times .001 = 3.14$

$X_C = \frac{1}{2\pi fC} = \frac{10^6}{6.28 \times 500 \times 50} = 6.37\,\omega$

$E_L = IX_L = 5 \times 3.14 = 15.7$

$E_R = IR = 25^v$

$IX_C = E_C = 31.9$

$E_m = I_m\sqrt{R^2 + \left(2\pi fL - \frac{1}{2\pi fC}\right)^2}$

$E_m = 5\sqrt{25 + 6.28 \times 500 \times .001 - \frac{1}{6.28 \times 500 \times 50 \times 10^{-6}}}^2$

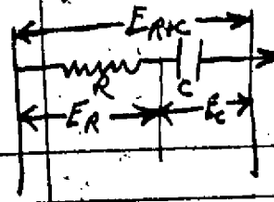
$Z = \sqrt{R^2 + (X_L - X_C)^2}$

$X_L = X_C$

$2\pi f\left(\frac{1}{2\pi fC}\right) = \frac{1}{2\pi fC}$

See next page

4/8/42 | Resistance & Capacitance



$i = I \sin\theta$

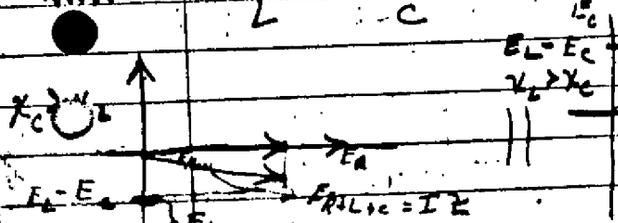
$Z = \sqrt{R^2 + X_C^2}$

$E_{Res} = \sqrt{E_R^2 + E_C^2}$

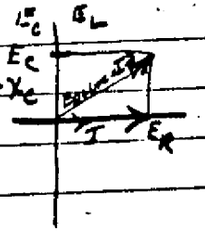
$E_{R+C} = IZ$

$\beta = \tan^{-1} \frac{X_C}{R}$

$e_{R+C} = IZ \sin(\theta - \beta)$



$i = I \sin\theta$



$\tan\beta = \frac{I(X_L - X_C)}{IR}$

$\beta = \tan^{-1}\left(\frac{X_L - X_C}{R}\right)$

$\sqrt{E_C + E_R}$

Problem

$i = 2 \sin\theta$

$f = 60$ cycles/sec

Find E_{R+C}

$X_C = \frac{1}{2\pi f C}$

$X_C = \frac{1}{377 \times 120}$

$L \cdot C \cdot R$

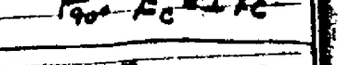
$2 \times 2.2 \times 2.2$

4.4

$E_{R+C} = IZ = \sqrt{E_R^2 + E_C^2} = \sqrt{4^2 + 4.4^2}$

Homework
Prob 9 to 18
Chapt 6
Mon 4/13/42

If $i = \sin\theta = I \sin 2\pi f t$	$C_R = IR \sin\theta$	$C_L = I X_L \sin(\theta + 90)$	$e_C = I X_C \sin(\theta - 90)$
If $e = E \sin\theta = E \sin 2\pi f t$	$i_R = \frac{E}{R} \sin\theta$	$i_L = \frac{E}{X_L} \sin(\theta - 90)$	$i_C = \frac{E}{X_C} \sin(\theta + 90)$
$\theta = \omega t$	$Z = \sqrt{R^2 + X_L^2}$ = Impedance	I $E = IR$	$E_L = IX_L$ I



Homework 4/13/42

$Z = \sqrt{25 + 3.23^2} = \sqrt{25 + 10.43} = \sqrt{35.43} = 5.95$

$E = \sqrt{25^2 + (16.2)^2}$

$E = IZ = 5 \times 5.95 = 29.8$

$\sqrt{625 + 262.4} = 29.8$

$I = \frac{E}{Z} = \frac{E}{\sqrt{R_L}}$

$X_L = X_C = \frac{29.8}{5} = 5.96$

$L = \frac{1}{2\pi f \cdot 2\pi f C}$

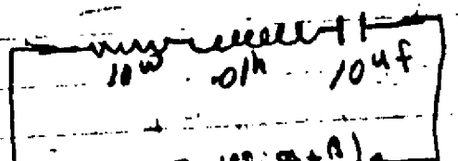
$L = \frac{1}{6.28 \cdot 6.28 \times 500 \times 500 \times 50 \times 10^{-6}}$

$f_1 = \frac{1}{4\pi^2 f^2 L}$

$f = \frac{1}{2\pi} \sqrt{\frac{1}{LC}}$

$\frac{1}{6.28\sqrt{50 \times 10^{-9}}}$

Problem in class



$i = I_m \sin(2\pi f t)$

$f = 1000$ ~/s

$I_{mm} = ?$

$L = ?.00253$

$L = \frac{1}{2\pi f \cdot 2\pi f C}$ $\frac{1}{}$

$L = \frac{1}{6.28 \times 1000^2 \times 10 \times 10^{-6}}$

$L = \frac{1}{39.7 \times 1000^2 \times 10 \times 10^{-6}}$

$I_{mm} = \frac{E}{R} = \frac{10}{10} = 1$ a

23

14

$\theta = \omega t$

$E_{R+L} \rightarrow$ ~~wwwwww~~ $\rightarrow i = I \sin \omega t$

$E_{R+L} = \sqrt{E_R^2 + E_L^2} = IZ$

$Z = \sqrt{R^2 + X_L^2}$

$\beta = \tan^{-1} \frac{X_L}{R}$ $\quad P.F. = \cos\beta = \frac{R}{Z}$

$i = I \sin(\theta \mp \beta)$ $\quad I_{R+L}(\sin\theta)$ $\quad I_L = \frac{E}{X_L}$

$C = C \sin\theta$ $\quad R$ $\quad L$ $\quad i_R$ $\quad i_L = I_L \sin(\theta - 90°)$

$= \frac{E}{X_L} \sin(\theta - 90°)$

$I_R = \frac{E}{R}$ $\quad i_R = I_R \sin\theta$

$= \frac{E}{R} \sin\theta$ $\quad I = \sqrt{I_R^2 + I_L^2}$

$\tan\beta = \frac{I_L}{I_R} = \frac{R}{X_L}$ $\quad Z = \frac{E}{I_{R+L}}$ = impedence

Problem

$f = 2000$ $\quad L = .001^h$ $\quad R = 10^\omega$ $\quad E = 10^v$

$I_R = ?$ $\quad I_L = ?$ $\quad Z = ?$ $\quad \beta = ? \cdot 1.26$

$X_L = 2\pi f L$ $\quad X_L = 10$

$6.28 \times 2000 \times .001 = 12.56$

12.56^2 $\quad Z = 259 +$

$I_R = \frac{E}{R} = \frac{10}{10} = 1^a$

$I_L = \frac{E}{X_L} = \frac{10}{12.56} = .8$

$I = \sqrt{1^2 + .8^2} = \sqrt{1.64} = 1.28$

$I_{R+L} = 1.28^a$

$Z = \frac{10}{1.28} = 7.8^\omega$

$\frac{10}{12.56} = .8$

$\tan^{-1} .8$

$= 38°$

$i = I \sin\theta \rightarrow$ ~~wwwwww~~ $\rightarrow L = I \sin\theta$ Series

$Z = \sqrt{R^2 + X_C^2}$

$E_{R+C} = IZ = \sqrt{E_R^2 + E_C^2}$

$\beta = \tan^{-1} \frac{X_C}{R} =$

$C = E_{R+C} \sin(\theta - \beta)$

$\theta = 2\pi f t$

$X_C = \frac{1}{2\pi f C}$

Series

Parallel

$\beta = \tan^{-1} \frac{R}{X_C}$

$i_{R+C} = I_{R+C} \sin\theta + \beta$

$I_C = E/X_C$

$I_R = E/R$

$I_{R_1} = \frac{E}{R_1}$ $\quad I_C = \frac{E}{X_C}$ $\quad \frac{1}{X_L} \left(\frac{R_1 R_2}{R_1 + R_2}\right)$

$i_{R_1} = I_{R_L} \sin(\theta - \beta)$

Parallel

$\beta = \tan^{-1} \frac{I_L}{I_{R_1} + I_{R_2}} = \sin^{-1} \frac{R_1 R_2}{X_L (R_1 + R_2)}$

Prob

$E \sin\theta$ $\quad R$ $\quad C$ $\quad R = 10^\omega$ $\quad E = 10^v$ $\quad f = 2$ [illegible] $= 2 \times 10$

$C = .01^{uf}$

Find $\beta = ?$ $\quad I_R = ?$ $\quad I_C = ?$ $\quad I_{RC} = ?$ $\quad Z =$

$I_R = \frac{E}{R} = \frac{10}{10} = 1^a$

$I_C = \frac{E}{X_C} = \frac{10}{1} = 1.25^a$ $\quad \frac{1}{2\pi f C} = 6.28 \times 2 \times 10^{+6} \cdot .01 \times 10^{-6}$

$I_{RC} = \sqrt{1 + 1.56}$ $\quad 12.6 \quad 9.92$

$I_{RC} = \sqrt{I_R^2 + I_C^2}$ $\quad .01 \quad 1000.$

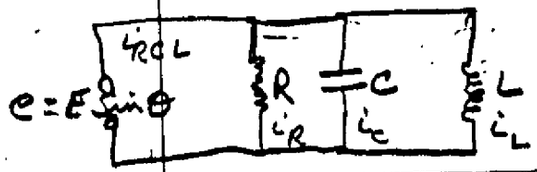
$I_{RC} = \sqrt{2.56} = 1.6^a$ $\quad .126 \quad 992$

$Z = \frac{E}{I_{RC}} = \frac{10}{1.6} = 6.2$ $\quad 7.95 = 8$

$\beta = \tan^{-1} \frac{R}{X_C} = 1.25$

$52°$

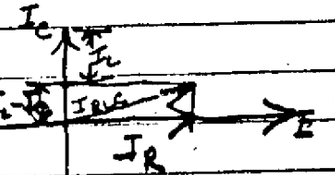
Current in a parallel Circuit



$i_R = I_R \sin\theta$

$i_L = I_L \sin(\theta - 90)$

$i_C = I_C \sin(\theta + 90)$



$X_L = 2\pi fL$

$X_C = \frac{1}{2\pi fC}$

$X_C = \frac{1}{2\pi fC}$

$X_L = 2\pi fL$

$I_R = \frac{E}{R}$

$I_C = \frac{E}{X_C}$

$I_L = \frac{E}{X_L}$

$I_{RCL} = \sqrt{I_R^2 + (I_L - I_C)^2}$

$Z = E / I_{RCL}$

$\beta = \tan^{-1} \frac{I_L - I_C}{I_R}$

$R_{CL} = I_{RCL} \sin(\theta \pm \beta)$

Prob: $E = 10^V$, $X_C = 10^W$, $X_L = 5^W$, $R = 15^W$

Find: I_{RLC}? I_R? I_C? I_L? β? Z?

$I_{RCL} = \sqrt{I_R^2 + (I_L - I_C)^2} = 1.2$

$I_R = \frac{E}{R} = \frac{10}{15} = \frac{2}{3} = .66$

$I_C = \frac{10}{10} = 1 = \frac{E}{X_C}$

$I_L = \frac{10}{5} = 2 = \frac{E}{X_L}$

$Z = \frac{10}{1.2} = 8.3$

$\frac{1.2}{\sqrt{1.44}}$

$\beta = \frac{2-1}{.66} = \frac{1}{.66} = 1.5$, $\tan^{-1} 1.5 = 56°$

6.6 / 396 / 396 / 1/3.5 6

.66 / 100 / 66 / 34

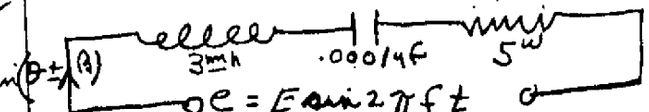
Homework

Pg 4 (117-118-119-131

4/15/42

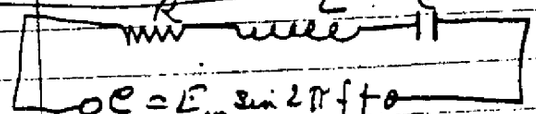
$i = I \sin(\theta \pm \beta)$

I	$I_{Resonant}$
β	Z
E_C	
E_L	



f = 900,000 cps

E = 5^V



L + C are constant

$X_L - X_C = 0$

$X_L = X_C$

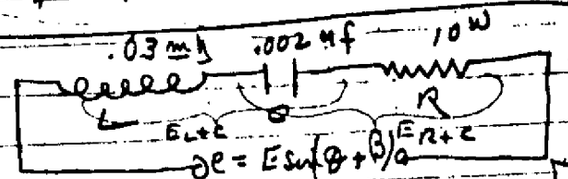
$2\pi fL = \frac{1}{2\pi fC}$, $4\pi^2 f^2 LC = 1$

$f^2 = \frac{1}{4\pi^2 LC}$ — $f = \frac{1}{2\pi\sqrt{LC}}$

$I = \frac{E}{Z}$ $\frac{E_m}{Z}$

$Z = \sqrt{R^2 + (2\pi fL - \frac{1}{2\pi fC})^2}$

$Z = \sqrt{R^2 + (2\pi fL - 2\pi fC)^2}$



E = 20^V

f = 500 K.C.

Desk

Find

Ω_R =

E_C =

E_L =

β =

I =

$I_{Resonant}$

E_{L+C}

E_{R+C}

$Z = \sqrt{R^2 + (X_L - X_C)^2}$

$I = \frac{E}{Z} = \frac{E}{\sqrt{R^2 + (X_L - X_C)^2}}$

When Z = R in a resonance circuit → $I_R = \frac{E}{R}$ =

$E_{L+C} = E_L - E_C$

$E_C = I X_C$

$E_L = I X_L$

$E_{R+C} = \sqrt{E_R^2 + E_C^2}$

$E_R = IR$

$\beta = \tan^{-1} \frac{(X_L - X_C)}{R}$

4/15/42

$Z = \sqrt{R^2 + (X_L - X_C)^2}$

$R = R$

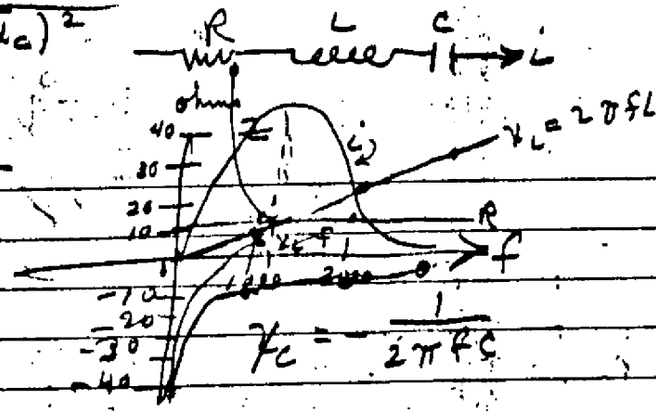
$X_L = 2\pi f L$

$X_C = \frac{1}{2\pi f C}$

$R = 10$

$L = .001\ h$

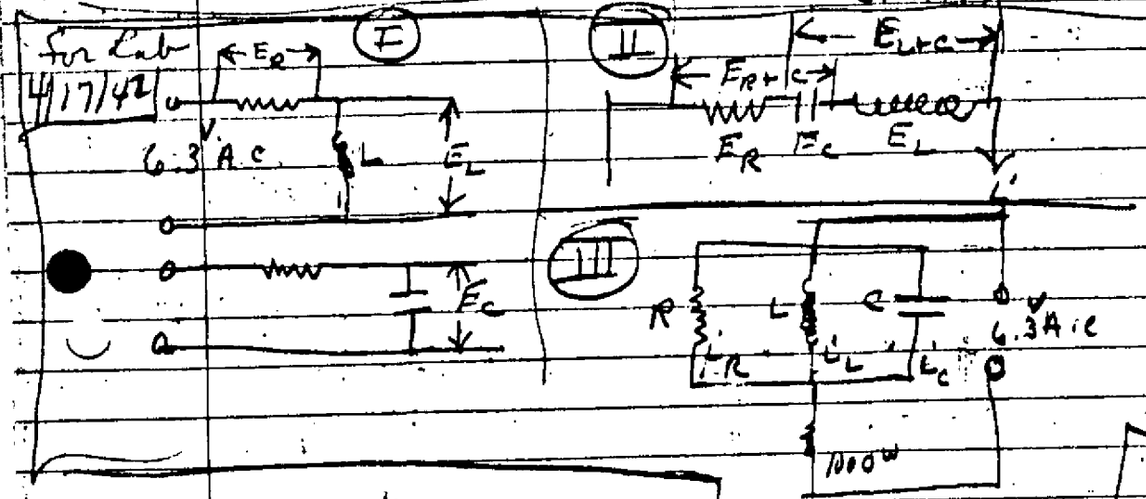
$C = 15\ \mu f$

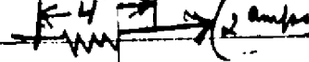


impedance

Z	ohms X_L	f
$Z = \sqrt{10^2 + (0 + \alpha)^2}$	6.28	1000
$\sqrt{10^2 + (4.32)^2}$	12.56	2000
$\sqrt{10^2 + (7.2)^2}$	18.84	3000
$\sqrt{10^2 + (15.31)^2}$	0	

Z	R	ohms X_C	f
$-\alpha$	↓	$-\infty$	0
+5.68	10	-10.6	1000
17.21	↓	-5.35	2000
		3.53	3000





$P_{inst} = e\,i = E \sin\theta \times I \sin\theta$

$P_{inst} = EI \sin^2\theta$

Homework
for 4/17/42
Prob 1-7

$P_{average} = P_{inst}$

$= (EI \sin^2\theta)_{ave}$

$P_{ave} = EI (\sin^2\theta)_{ave}$

$i = I \sin\theta$ (const) $\rightarrow EI \cdot \frac{1}{2} = \frac{E}{\sqrt{2}} \cdot \frac{I}{\sqrt{2}}$

$i' = 1 \cdot \sin\theta$

$i'^2 = 1^2 \cdot \sin^2\theta$

$i'^2 = 1 \sin^2\theta$

$P_{ave} = E_\varepsilon I_\varepsilon$

(effective values)

4/17/42

$i = \frac{E}{R}$

$= I \sin\theta \cdot E \sin\theta$

$P_i = IE \sin^2\theta$

$P_{ave} = IE (\sin^2\theta)_{ave} = \frac{IE}{2} = \frac{I}{\sqrt{2}} \times \frac{E}{\sqrt{2}} = I_\varepsilon E_\varepsilon$

$P = E_\varepsilon I_\varepsilon \cos\beta$

$I = \frac{E}{Z}$; $\beta = \tan^{-1} \frac{X_L}{R}$

$E' = E \cos\beta$

$P = EI \cos\beta$

$P_{ave} = E_\varepsilon I_\varepsilon \cos\beta$

$P_i = e_L = E \sin\theta \times I \sin(\theta - \beta)$

$(P_i)_{ave} = P_{ave} = \frac{EI}{2}[\cos\beta - \cos(2\theta - \beta)]$

$P_{ave} = \frac{EI}{2} \cos\beta = \frac{E}{\sqrt{2}} \frac{I}{\sqrt{2}} \cos\beta$

$P_{ave} = E_\varepsilon I_\varepsilon \cos\beta$

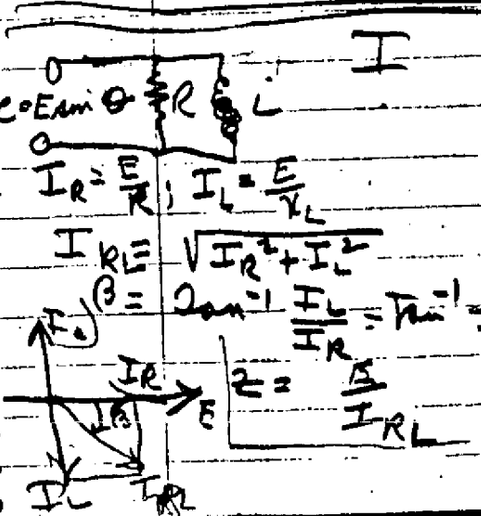
$P_{ave} = IE' = I_\varepsilon E_\varepsilon \cos\beta$

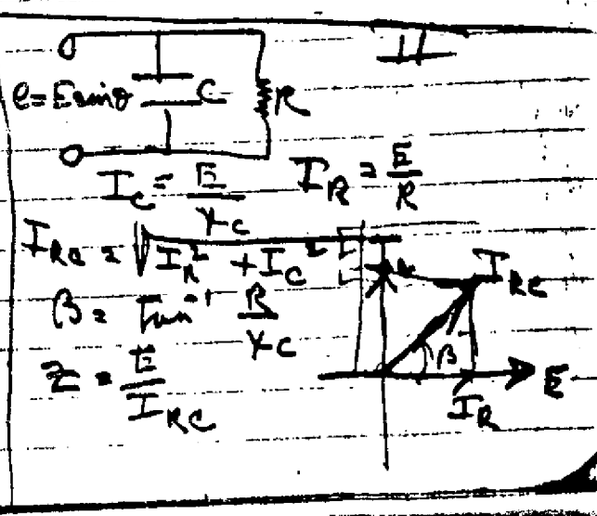
$P_r = E_\varepsilon I_\varepsilon$

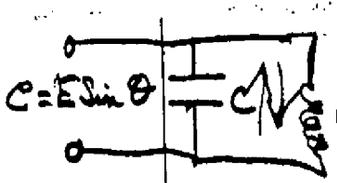
$= I_\varepsilon^2 R$

velocity = frequency × wave length = $\frac{r}{T} \leftrightarrow \frac{r}{T} = \frac{\text{wavelength}}{\text{Time}}$

frequency = $\frac{1}{T}$





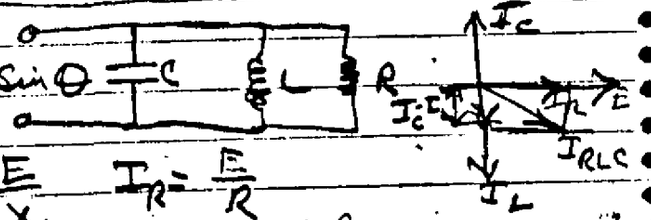


$I_C = \frac{E}{X_C}$ $I_L = \frac{E}{X_L}$

$I_{LC} = I_L - I_C = 0$

$Z = \frac{E}{I_{LC}}$

Resonance
1. minimum current
2. $X_L = X_C$
3. Unity power factor



$I_C = \frac{E}{X_C}$; $I_L = \frac{E}{X_L}$ $I_R = \frac{E}{R}$

$I_{RLC} = \sqrt{I_R^2 + (I_L - I_C)^2}$

$Z = \frac{E}{I_{RLC}} \rightarrow \frac{E}{\sqrt{I_R^2 + (I_L - I_C)^2}}$

$P_{ave} = \frac{(I_{RLC})}{\sqrt{2}} E_{Effect}$

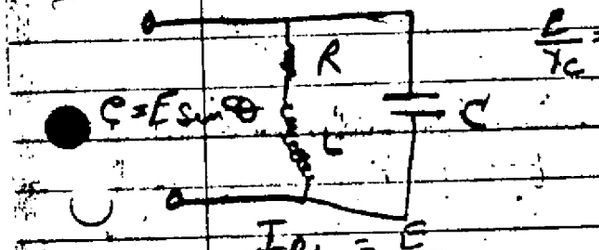
Resonance
$I_L = I_C$ $I_{RLC} = I_R$

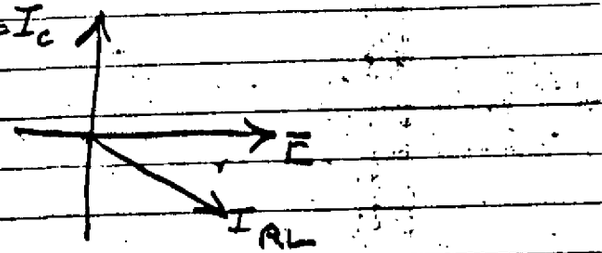
$\frac{E}{X_L} = \frac{E}{X_C}$

$f = \frac{1}{2\pi\sqrt{LC}}$

$\cos\beta = 1$

$X_L = X_C$



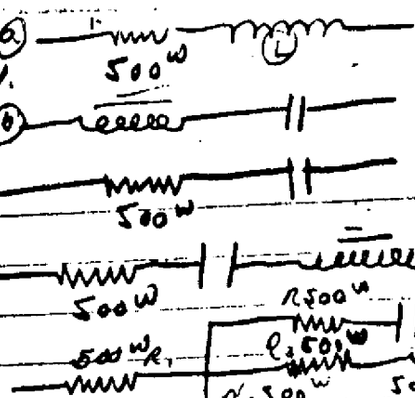


$I_{RL} = \frac{E}{Z_{RL}}$

$\cos\Psi = \frac{X_L}{Z_{RL}}$

$I_{RCL} = \sqrt{I_R^2 + (I_L - I_C)^2}$

In Lab 4/17/42



determine Z of each circuit

Expanded (4)

determine total impedance & I for each diagram & plot vectors diagram for combined

1 (a) $f = 60$ $E = 6.1^V$ $L = 5.4$ $R = 1$

1 (b) $E = 6.1^V$ $L = 5.9$ $C = .65$

2. $E_R = .9^V$ $C = 5.4$ $E = 6.1$

3. $E_R = .05$ $E_L = 5.3$ $E = 6.1$ $E_C = .7$

$E_{R+C} = .6$ $E_{L+C} = 5.4$

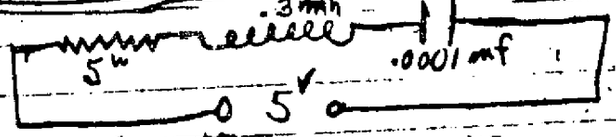
4. $R_1 = .95$ $R_2 = .9$ $R_3 = .05$ $R_4 = .3$ $R_5 = 4.2$ $E_a = 4.4$

$E_L = 4.4$ $E_{R_2C} = 4.95$ $E_{R_3L} = 4.95$

$E_{R_4R_5} = 4.8$ $E_{R_{2,3,4,5}LC} = 4.9$ $E_{max} = 6.2$ Hope max current

4/20/42

Prob 6-7



$I_{res} = \frac{5}{5} = 1 \text{ amp}$ $f = 900,000$

$E_C = I X_C = 1 \cdot X_C$

$I_{res} = .09$

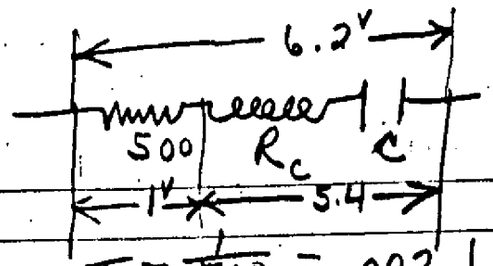
$I_C = \frac{1}{2\pi f C}$

$C_2 = .00005 \text{ mf}$

$= \frac{1}{6.28 \times 9 \times 10^{-5} \times 5 \times 10^{-1}}$

$= \frac{10^6}{45 \times 6.28}$

4/20/42



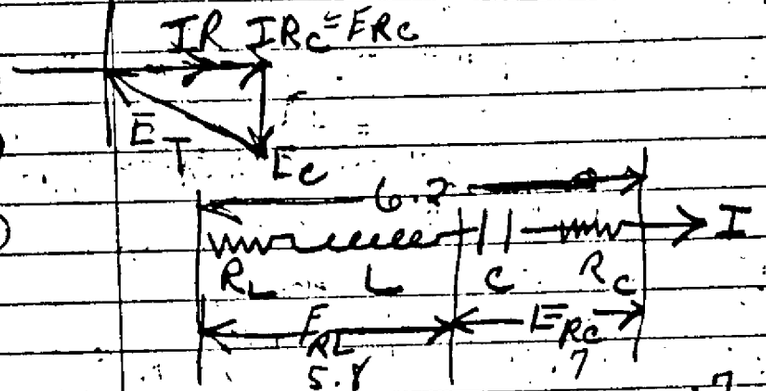
$E_c = I X_c$

$X_c = \frac{E_c}{.002}$

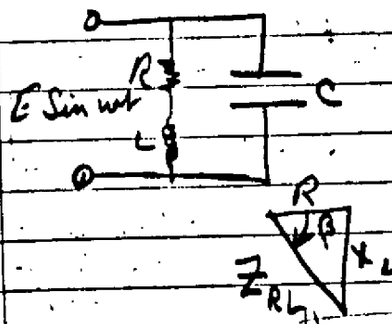
$\frac{I R_c}{.002} = R_c$

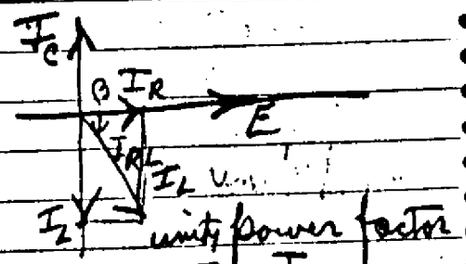
$I = \frac{1}{500} = .002$ | 2 ma.

$Z = \frac{5.4}{.002} = \frac{E_c}{I}$



$W = 2\pi f$





unity power factor

$I_L = I_c$

$\sin\beta = \frac{I_L}{I_{RL}}$

$I_{RL} \sin\beta = I_c$

$\sin\beta = \frac{I_L}{I_{RL}}$ | $\frac{E}{Z_{RL}} \times \frac{X_L}{Z_{RL}} = \frac{E}{X_L}$ | $\sin\beta = \frac{I_L}{I_{RL}}$ | $I_{RL} \sin\beta = I_c$

$\frac{X_L}{(Z_{RL})^2} = \frac{1}{X_c}$ $\quad \frac{X_L}{R^2+X_L^2} = \frac{1}{X_c}$; $\frac{2\pi fL}{R^2+w^2L^2} = \frac{1}{\frac{1}{wc}} = wc$

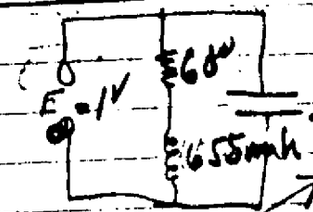
$Z_{RL} = \sqrt{R^2+X_L^2}$ $\quad \frac{L}{C} = R^2+w^2L^2$ $\quad \frac{L}{C} - R^2 = w^2L^2$

$Z_{RL} = R^2+X_L$ $\quad \frac{1}{LC} - \frac{R^2}{L^2} = w^2$ $\quad f_r = 799$ cps

$Z = \frac{E}{I}$ $\quad 2\pi f = w = \sqrt{\frac{1}{LC} - \frac{R^2}{L^2}}$ $\quad I_{RL} = \frac{E}{Z_{RL}}$

$f = \frac{1}{2\pi}\sqrt{\frac{1}{LC} - \frac{R^2}{L^2}}$ $\quad R = 0$ $\quad f = \frac{1}{2\pi}\frac{1}{\sqrt{LC}}$

Prob.



$Z_{RL} = \sqrt{R^2+X_L^2}$ $\quad I = I_{RL} + I_c$

f	X_L	X_c	X_L^2	Z_{RL}	I_{RL}	θ_{RL}	I_c	I	$Z = \frac{E}{I}$
700									
750									
800									
850									
950									
1050									

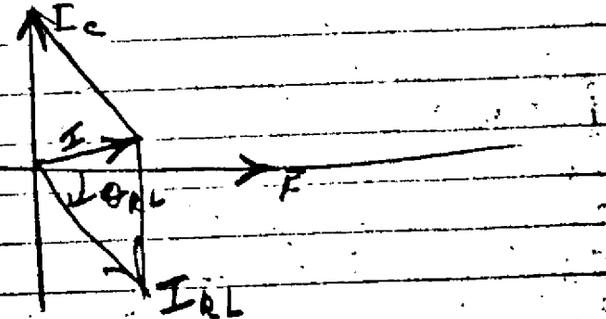
$X_c = \frac{1}{2\pi fc}$

$X_L = 2\pi fL$

$R = 50w$

Liquor Board

260. Sr. 15



Chapter 7

9-12

16-18 inc.

21-22

4/22/42 Exp. 5

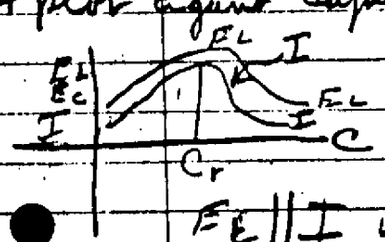
f = constant, vary capacity

32 Ω — mw — Hz — 0 V

Measure E_L, E_R + E_a + I $\quad I = \frac{E_R}{R} = \frac{32}{R}$

Change capacity, measure I, E_L, E_R, E_c again. Tabulate & plot against capacity

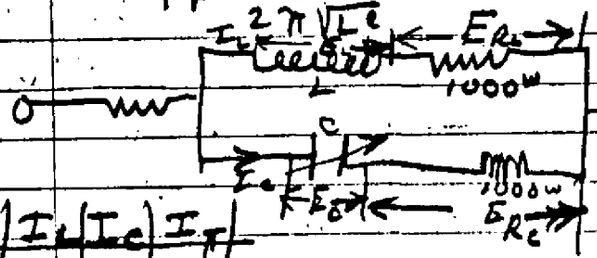
C	E_L	E_R	E_a	I

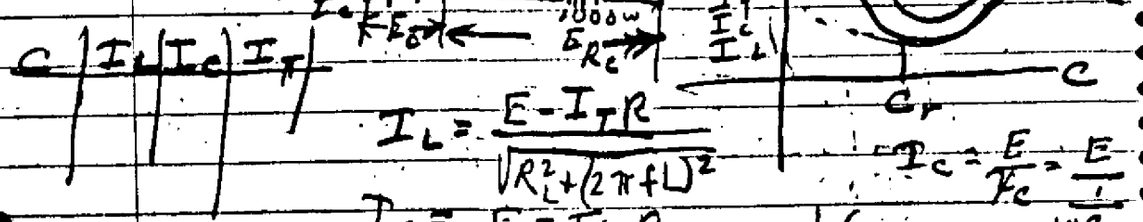


E_E || I use different scales so that they don't coincide

= distorted curve. Max. at Resonance. To calculate

$f_r = \frac{1}{2\pi\sqrt{LC}}$





$I_L = \frac{E - I_T R}{\sqrt{R_L^2 + (2\pi f L)^2}}$ $\quad I_C = \frac{E}{F_C} = \frac{E}{\frac{1}{wc}}$

$I_C = \frac{E - I_T R}{\sqrt{R_C^2 + \left(\frac{1}{2\pi f C}\right)^2}}$ $\quad I_C = E\omega C$ when no Resonance

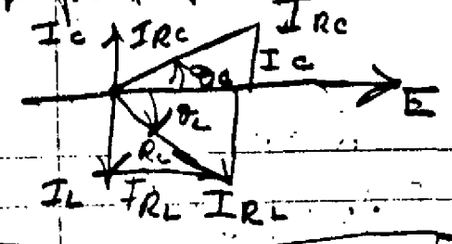
Parallel Resonance

$I_C = I_L$ $\quad I_{RC}\sin\theta_C = I_{RL}\sin\theta$

$\frac{E}{\sqrt{R_C^2+X_C^2}} \times \frac{X_C}{\sqrt{R_C^2+X_C^2}} \Big| \frac{E}{\sqrt{R_L^2+X_L^2}} \times \frac{X_L}{\sqrt{R^2+X_L^2}} \Big| \frac{X_C}{R_C^2+X_C^2} = \frac{X_L}{R_L^2+X_L^2}$

$\frac{1}{wc\left[R_L^2 + w^2L^2\right]} = \frac{wL}{R_L^2 \times w^2L^2} = \frac{1}{wc\left[\frac{R_C^2\omega^2C^2+1}{\omega^2C^2}\right]} \Big| \frac{wL}{R_L^2 \times w^2L^2} = \frac{wc}{1+w^2R_C^2C^2}$

f_r for Unity Power factor



$L + w^2 L R_C^2 C^2 = C R_L^2 + C w^2 L^2$

$w^2\left[L R_C^2 C^2 - C L^2\right] = C R_L^2 - L$

$w^2 = \frac{C R_L^2 - L}{L R_C^2 C^2 - C L^2} = \frac{C R_L^2 - L}{LC(C R_C^2 - L)}$

$w = \sqrt{\frac{1}{LC}\left(\frac{C R_L^2 - L}{C R_C^2 - L}\right)}$ $\quad w = 2\pi f$

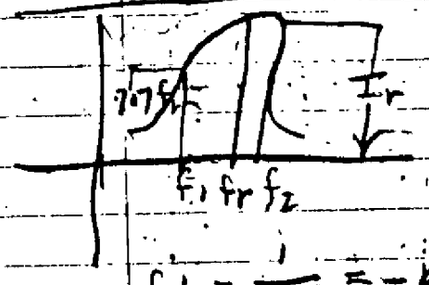
$F_r = \frac{1}{2\pi}\sqrt{\frac{1}{LC}\left(\frac{C R_L^2 - L}{C R_C^2 - L}\right)}$

$Z_{LC} = \frac{E}{I_{LC}} = \frac{E}{I_L - I_C} = \frac{E}{\frac{E}{X_L} - \frac{E}{X_C}} = \frac{X_C X_L}{X_C - X_L} = \frac{1}{2\pi f C} \times \frac{2\pi f L}{\frac{1}{w C} - wL} =$

$= \frac{L}{C} \cdot \frac{wC}{1 - w^2LC} = \frac{wL}{1 - w^2LC}$

$I = \frac{E}{Z} = \frac{E}{\frac{wL}{1-w^2LC}} = E\left(\frac{1-w^2LC}{wL}\right)$ $\quad w_L = \frac{1}{wC}$ $\quad w^2 = \frac{1}{LC}$

$Z = \frac{w^2L^2}{R} = \frac{L}{CR}$



$.707\, I_r = \frac{I_r}{\sqrt{2}}$ $\quad I_r = \frac{E}{R}$

$I = \frac{E}{\sqrt{R^2 + 2\pi f L - \frac{1}{2\pi f C}}}$ $\quad \frac{I_r}{2} = \frac{E}{R\sqrt{2}}$

$= \frac{E}{\sqrt{2R^2}}$ $\quad R^2 + \left(2\pi f L - \frac{1}{2\pi f C}\right)^2 = R^2$

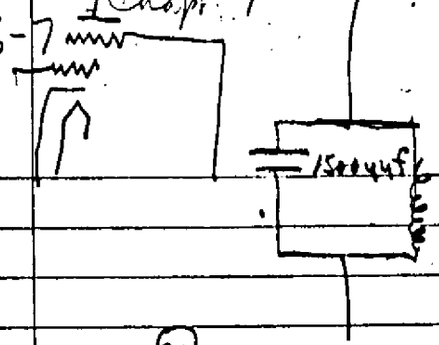
$2\pi f_1 L - \frac{1}{2\pi f_1 C} = -R$ $\quad 2\pi f_2 L - \frac{1}{2\pi f_2 C} = +R$

$\frac{2\pi f_1 L}{f_2} - \frac{1}{2\pi f_1 f_2 C} = -\frac{R}{f_2}$ $\quad \frac{2\pi f_2 L}{f_1} - \frac{1}{2\pi f_1 f_2 C} = \frac{R}{f_1}$

$2\pi L\left[\frac{f_2}{f_1} - \frac{f_1}{f_2}\right] = R\left[\frac{1}{f_1} + \frac{1}{f_2}\right]$ $\quad \frac{2\pi L}{R} = \frac{\frac{f_2}{f_1} + \frac{f_1}{f_2}}{\frac{f_2^2 - f_1^2}{f_1 f_2}}$

$\hookrightarrow = \frac{\frac{f_1 - f_2}{f_1 f_2}}{\frac{f_1 + f_2}{f_2 f_1}}$ $\quad \frac{2\pi L}{R} = \frac{f_1^2 + f_2^2}{f_2^2 - f_1^2} = \frac{f_1 + f_2}{f_2^2 - f^2} = \frac{1}{f_2 - f_1} = F_2 + f_1$

Prob 16-7 Chapt 7



$Z = \frac{L}{CR}$ $\quad \lambda_r f_r = c = 300 \times 10^6$

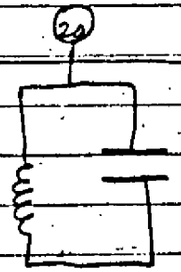
$\lambda_r = 1000$ meters

$R = 30^w$

$f_r = \frac{300 \times 10^6}{1000}$

$f_r = \frac{1}{2\pi\sqrt{LC}}$

$Z = 4180^w$



Problems in work

$R = 16^w$

$\lambda = 400^m$

$L = 170\,\mu h$

$f_r \lambda_r = 300 \times 10^6$

$f_r = \frac{300 \times 10^6}{400}$

$f_2 - f_1 = \frac{R}{2\pi L} = \frac{16}{2\pi \times 170 \times 10^{-6}}$

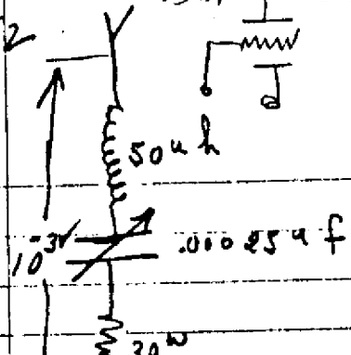
$\frac{\omega L}{R} = \frac{2\pi f_r L}{R}$

4/24/42 $f = 60$ cycles $\quad R = 500$ $\quad$ Series + Parallel Resonance

$L = 7^h$

f	L	R	C	E_C	E_L	E_R
60	7	500	.2	53	52	2
60	7	500	.4	20	52	2
60	7	500	.6	5	44	2
60	7	500	.8	4	44	2
60	7	500	1.	3	42	2
60	7	500	2.	2	42	2
			5	1	42	2

4/27/42 Prob 9 Chapt 7



$E = \frac{10^{-3}}{30} \cdot 2\pi \cdot (2 \times 10^6) 50 \times 10^{-6}$

$\frac{12.56 \times 50 \times 10^{-3}}{30} = \frac{2\pi \times 10^{-3}}{I_r} \qquad I_r = \frac{10^{-3}}{30}$

E_L

$\lambda_r = 150$ meters $\quad f_r = 300 \times 10^6$ $\quad \lambda f = 300 \times 10^6$

$f_r = \frac{300 \times 10^6}{150} = 2 \times 10^6$ c.p.s.

$f_r = \frac{1}{2\pi\sqrt{LC}}$

$C = \frac{1}{(2\pi f_r)^2 L} = \frac{1}{(6.28 \times 2 \times 10^6)^2 \times 50 \times 10^{-6}}$

$= \frac{1}{(12.56)^2 \times 10^{12} \times 50 \times 10^{-6}}$

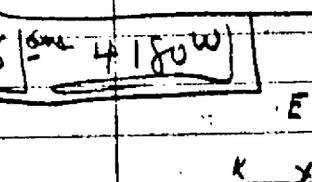
$C = \frac{10^{-6}}{157.7 \times 50}$

$.000126 \times 10^{-6}$

Prob 10 $P_r = I_r^2 R = \left(\frac{10^{-3}}{30}\right)^2 30 = \frac{10^{-6}}{30} = .033$

Prob 12-7 ans. 79.5 $\quad$ 11-7 ans 15,900^w

16 ans 4180^w



$C = \frac{1}{L}\left(\frac{1}{\omega^2}\right) - C_o$

$C = Kx - C_o$

$C = K \cdot 0 - C_o$

$C = -C_o$

$L(C + C_o) = \frac{1}{\omega^2}$ $\quad \omega L = \frac{1}{\omega C}$ $\quad \omega = 2\pi f$

$\omega^2 = \frac{1}{LC}$

$LC = \frac{1}{\omega^2}$

$Z = \frac{\omega L}{1 - \omega^2 L C_o} = \omega L_a$

$L_a = \frac{\omega L}{1 - \omega^2 L C_o} = \omega L_1$

$C = \left(\frac{1}{\omega^2}\right)\left(\frac{1}{L}\right) - C_o$

$C = \frac{K}{L} - C_o$

17) ans.: 100uh, 450uuf, 2g2000 | 21) 2.12 w

18) ans.: 0.0106 uc | 20) ans.: 15000, 50 | 22) $\frac{S_1}{S_2} = 1.33$

17) F = 750 KC $.045 = LC$

$R_L = 10^w$ $.045 = 100 \times 10^{-6} \times 450 \times 10^{-12}$

$R_C = 1^w$ $Z = \frac{R^2 + \omega^2 L^2}{R}$

C = 450 mmfa

L = 100 ufh $\frac{121 + (6.28 \times 75 \times 10^4 \times 10^{-4})^2}{11}$

Prob 18-7

C = 450 uuf

f = 750,000 cps

I

10×10^{-6}

$X_C = \frac{1}{2\pi fC} = \frac{1}{6.28 \times 75 \times 10^4 \times 450 \times 10^{-12}} = 472$

$\frac{1}{1^2 + 472^2} = \frac{1}{472} = .0021$

$Z_{RC} = \sqrt{R^2 + X_C^2} = \sqrt{1^2 + 472^2} = 472$

Prob 19

R = 16 L = 170 mh $f_r = \frac{1}{2\pi\sqrt{LC}}$

$f_2 - f_1 = \frac{16}{2\pi L} = \frac{R}{2\pi L}$ $\frac{170}{6.3}$ 1600

$f = \frac{16}{6.28 \times 170 \times 10^{-6}}$ 1007

15,000, 50

$S_r = \frac{W_r L}{R}$ $f_2 - f_1 = 15000$

$f_r = \frac{1}{2\pi\sqrt{LC}}$ $f_1 = vel = 300 \times 10^6$ meters / sec

$f_r = 500$ KC

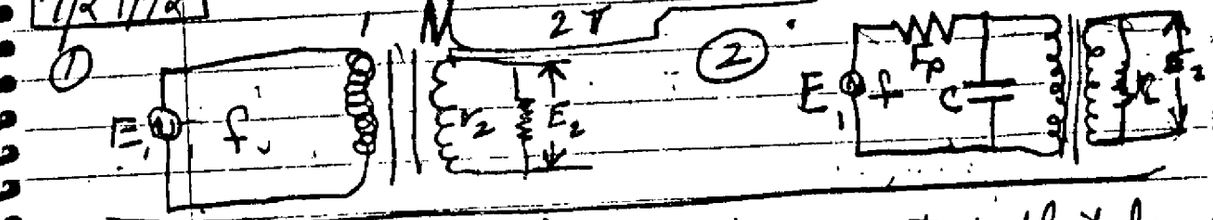
$L = \frac{1}{4\pi^2 f_r^2 C}$

3/29/42

$R = (f_2 - f_1) 2\pi L$

$R = \frac{(f_2 - f_1) 2\pi}{4\pi^2 f_r^2 C}$ 4.24 w

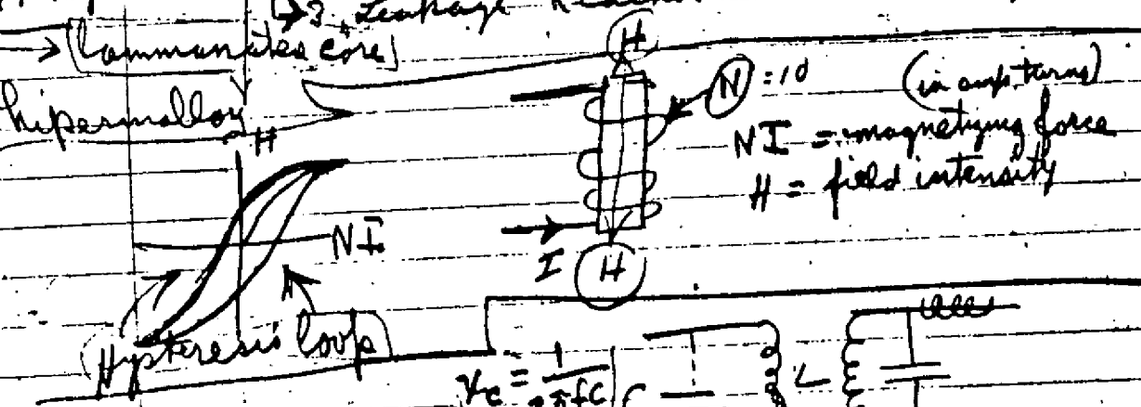
2π



Core losses
1. Eddy currents
2. hysteresis
→ [Lamminated core]
hipermalloy

Winding losses
1. Distrib capacit
2. primary Inductance
3. Leakage Reactance

important at high frequencies
" " low "
" " high "

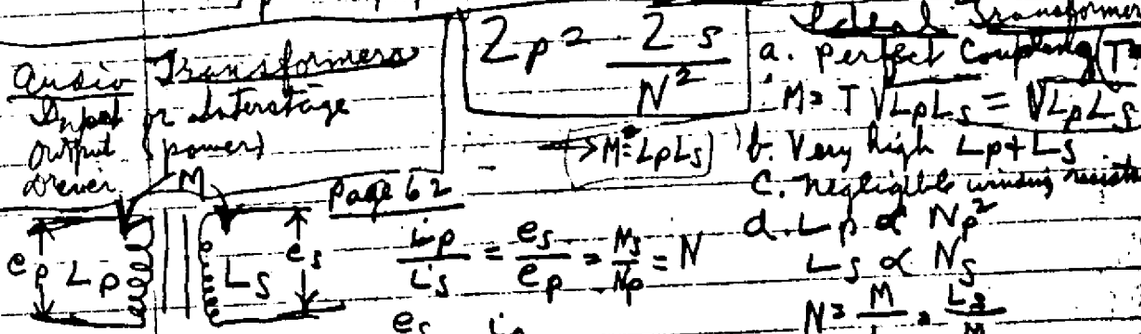


$IX_p = 2\pi f_1 L_p I$

$X_C = \frac{1}{2\pi fC}$

Audio Input Output driver

Transformers or interstage (power)



$Z_p = \frac{Z_s}{N^2}$

$\Rightarrow M = L_p L_s$

Page 62

$\frac{L_p}{L_s} = \frac{e_s}{e_p} = \frac{M_s}{M_p} = N$

$\frac{e_s}{e_p} = \frac{L_p}{L_s}$

$e_s L_s = e_p L_p$

Ideal Transformer

a. perfect Coupling ($T = 1$)

$M = T\sqrt{L_p L_s} = \sqrt{L_p L_s}$

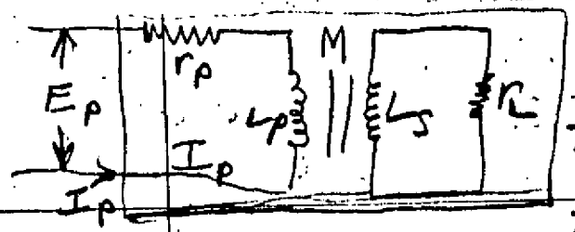
b. Very high $L_p + L_s$

c. negligible winding resistance

d. $L_p \propto N_p^2$

$L_s \propto N_s$

$N = \frac{M}{L_p} = \frac{L_s}{M}$



$$Z_p = \frac{E_p}{I_p} \qquad I = \frac{E}{r_p + r_2}$$

$$Z_p = \sqrt{R^2 + \chi^2} \qquad I^2 r = \frac{E^2 r}{(r_p + r)^2} = P_r$$

$$Z_p = \frac{Z_s}{N^2} \qquad r = r_p$$

$$E_p = \sqrt{(r_p I_p)^2 \mp (X_p I_p - X_m I_s)^2}$$

$$E_p = \sqrt{(r_p I_p)^2 + (\omega L_p I_p - \omega M I_s)^2}$$

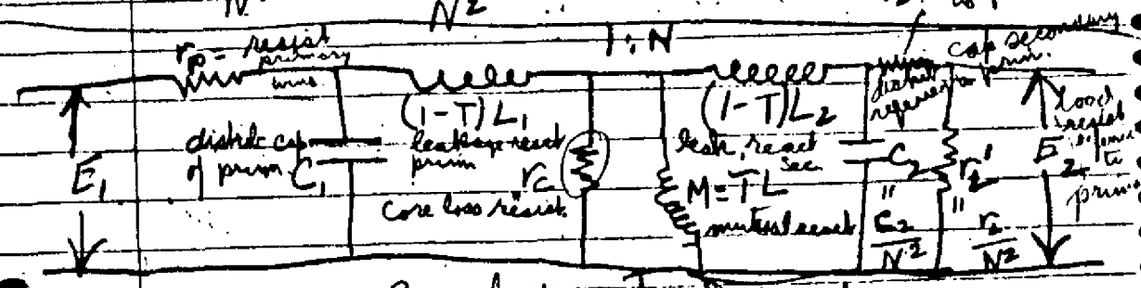
$$0 = \sqrt{(r_L I_s)^2 + (\omega L_s I_s - \omega M I_p)^2}$$

$I_s X_s$ → $r_L I_s$ ↓ $I_p X_M$

$$E_p [Z_p] I_p \qquad Z_p = \sqrt{\left(r_p + \frac{\omega^2 M^2 r_L}{r_L^2 + \omega^2 L_s^2}\right)^2 + \left(\omega L_p - \frac{\omega^3 M^2 L_s}{r^2 + \omega^2 L_s^2}\right)^2}$$

$$2_p \sqrt{(r_p)^2 + (\omega L_p)^2} \quad \text{(without couples)}$$

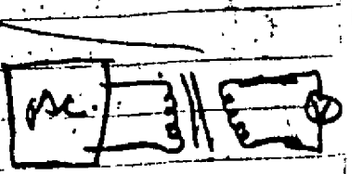
$$r_t = \frac{r_L}{N^2} \qquad X_t = \frac{X_s}{N^2}$$



Equivalent network Transformer

Lab 5/1/42

30	30	28
60	30	28
100	29.5	27.5
200	29	27
300	28.5	2[illegible]
400	28	26.5
500	28	26.5
600	28	25
700	28	25
800	28	25
900	28	24.5
1000	28	24
2000	27	18
3000	26.5	13
4000	26.	9.5
5000	25	7 (with condenser) / 23 (without condenser)
6000	24	22.5
7000	24	22
8000	23	21
9000	22	20.5
10000	21.5	20
11000	21	19.5
12000	20	19
13000	20	18.5
14000	19.5	18
15000	19.5	18



Waiter, Shipper, Route | dispatcher for Trucking Co | Bookkeeper, Truck Driver
Grocery Clerk

Read (P. 63-67) (249-251) (288-290)
also chapt IX p. 165-180

T = absolute Temp = $(^\circ C + 273)$ $\quad I = N q = A T^{\lambda} \epsilon^{\frac{W_0}{KT}}$

$\epsilon = 2.7183$ $\quad \lambda = 1$

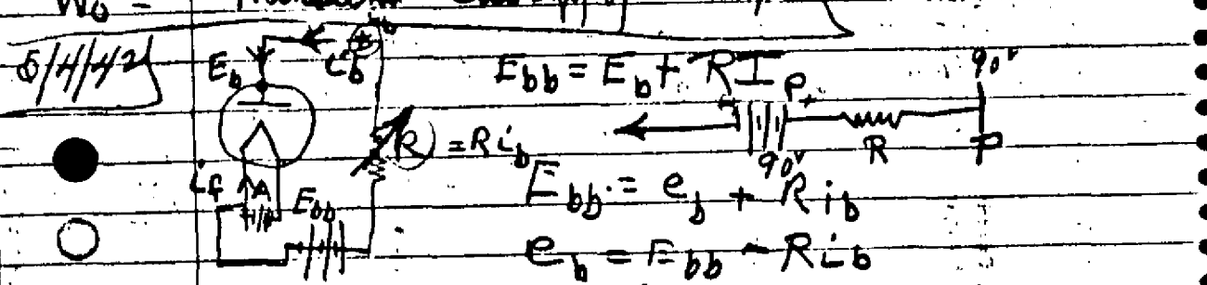
$K = 1.36 \times 10^{-6}$ ergs.

A = area of material

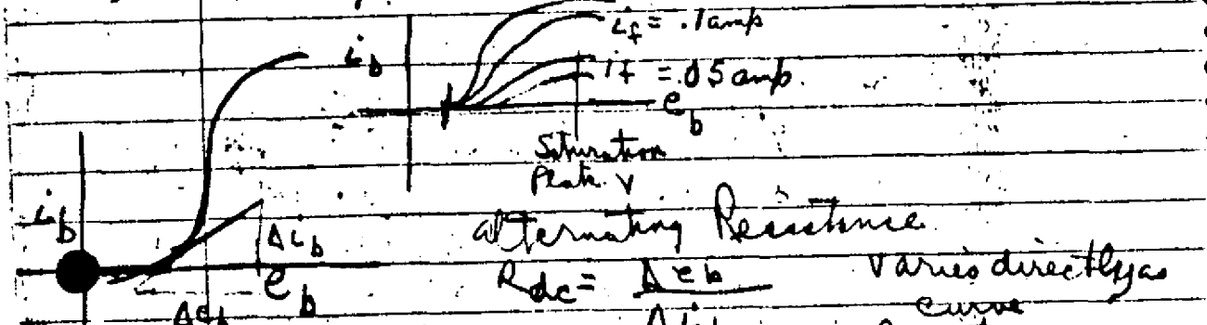
N (charge) = number of electrons (number of charges)

W_0 = Minimum Energy of escape

6/4/42



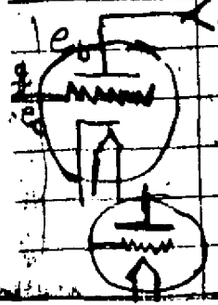
9.102 Voltage (or Plate) Saturation ($e_b \sim i_b$)



Alternating Resistance

$R_{dc} = \frac{\Delta e_b}{\Delta i_b}$ varies directly as curve

A.C. Resistance varies as does plate voltage



Triode Characteristics

plate characteristics ($i_b \sim e_b$) – e_c constant

grid " ($i_g \sim e_c$) – e_b " "

grid plate mutual " ($i_b \sim e_c$) – e_b " "

i_f constant

equiv volt = +

$e = e_b + \mu e_c$

$100^v = 130 + 3(-10)$

$i_b = A(e_b + \mu e_g)$

assignment chapt. IX prob 1-7

Finish chapt IX

$e = e_b + \mu e_c$

$105 = 120 + 3(-5)$

mutual conductance =

P. 198 Prob. 2-9

$\mu = 8$ $\quad e_c = 3$ $\quad i_b = 3\text{ma}$ $\quad - e_b = ?0$

$e_c = 0$ $\quad i_b = 8\text{ma}$ $\quad - e_b = ?0$

$e_c = 0$ $\quad i_b = 3\text{ma}$ $\quad - e_b = ?$

$\mu = \frac{de_b}{de_c}$ $\quad i_b = \text{Cond}$

$\gamma = \mu = -\frac{\Delta e_b}{\Delta e_c} = -\frac{\delta e_b}{-3} = \Delta e_b = 24$

$e_b = 90 - 24 = 66$

Ohmite Manufacturing Co.
Chicago Illinois U.S.A.

Ohms Law Calculator

E_p	I_p ma	I_p	E_p
21	1	1	90
41	2	2	95
58	3	3	108
75	4	4	120
89	5	5	132
90	6	6	140
100	7	8	160
120	8	10	177
123	9	12	194
140	10	14	212
160	12	15	220
178	14		
182	15		

$E_G = 4.5^v +$

$E_G = 3$

multiply .5

$E_G = 0$

I	E
1	87
2	104
3	115
4	122
5	132
6	137
8	155
10	167
12	180
14	192
15	200

I_p	E_p
1	58
2	72
3	86
4	97
5	107
6	117
8	136
10	154
12	171
14	188
15	196

E_p	I_p	I_p	I_p
20	0	0	1.6
40	0	.2	3.3
60	.1	1.1	4.9
80	.9	2.5	7.0
100	2.2	4.2	9.4
120	3.9	6.	11.5
140	5.8	9.4	14.8

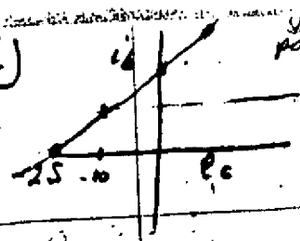
$E_g = 4.5, 3, 1.5$

E_c	I_p
14	0
13	.3
11	1
9	2.2
7	3.7
5	5.5
3	7.8
2	8.9
1	10
0	11.1

$350 E_p$

assignment P. 391-408

1)



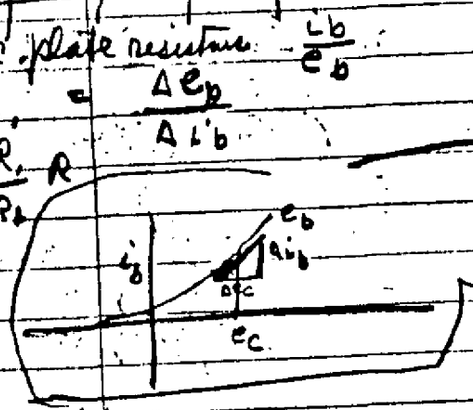
Van Dyke page 174

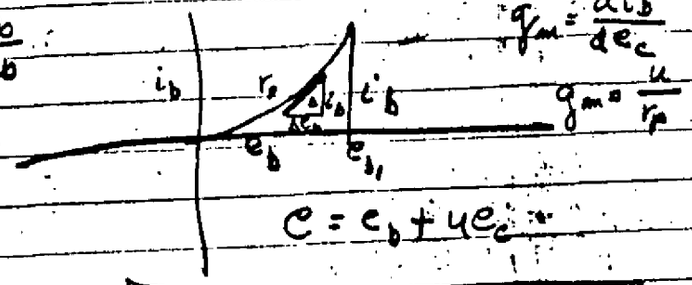
i_b	e_0	e
47	0	100
34	-5	80
25	-10	60
0	-25	0
60	5	120
72	10	140

dc plate resistance $\frac{i_b}{e_b}$

$AC_p = \frac{\Delta e_p}{\Delta i_b}$

$R_p = \frac{R_1}{R_2} R$





$g_m = \frac{di_b}{de_c}$

$g_m = \frac{u}{r_p}$

$e = e_b + u e_c$

$g_m = \frac{\Delta i_p}{\Delta e_g}$

5/11/42 — Exam —

1) Using fig. 120 at $e_b = 100^v$, $u = 4$

(a) plot the transfer characteristic (i_b to e_c)

(b) Calculate R_p^{ac}, R_{dc}, A_v, g_m, power-loss in tube at $e_b = 100^v$, $e_c = -10^v$

Soc 6 continued

Chapt X — Family Life + Relation of the minority

Why are minorities considered to have a lower sex ratio than they really have? 1. Customs vary 2. Environment 3. Judging them on group basis + prejudice 4. Minority group judged by ideal standards of dominant group instead of the actual standards of the dominant group. 5. Minority groups more liable to belong to lower income groups + causes the man to send wife + daughter out to work. 6. New minorities (Negro, Indian) do not have a tradition to moral conduct. Do not have a definite conception of their role in society. 7. The laws sometimes have little meaning for the members of minority group. 8. Laws are inconsistent - their enforcement also. - Intra-race; Inter-racial relations. 9. Sex ratio of Negroes - 90-95-97 men to a hundred women.

Filipinos - 1500 men to 1 woman.

Marriage - Standards - Determined by those of dominant group.

Birth Rates - Foreign born rate is higher than native stock. But this idea has changed in the last 20-25 yrs. The two extremes are approaching one another. 1. More natives in rural parts, native stock may have a higher rate in time as it is going past the immigrants now. 2. also sterility may be increasing in cities.

Negro Birth Rate. - Has been + still is higher but has been declining faster

		W	N
N	1920	23.5	27.0
W	1933/40	18.7 / 19.9 (white)	21.0 also 19.20

Mainly due to majority of negroes entering urban life.

Illegitimacy Rates 1. Negro Rate - Very high - 125 in 1,000
2. Foreign Rate - 5 in 1,000 3. Native Rate 16 in 1,000.
In city one can get away with illegitimacy. But in the country it is almost impossible to get away with it. 1. Negro has never had the same opportunity to develop moral standards. 2. Colored family mainly matriarchal 3. They look at illegitimacy in a different

way upon us. ... should be directed our moral (copy, discipline) ...
Because this is the means by which we perpetuate the group.

Chapt. VI - Race mixture - 2 approaches 1. Possibilities
1. offspring inferior to Parent 2. Offspring in between Parent 3. Offspring superior to Parents 4. Differences between the races do not matter
the offspring. 1. what does the feeling of contempt to mixture do to
the dominant group. Race mixture harmful 2. greater Unity
2. Less mental conflict 3. Less cultural conflict. 4. Dominant
group acting on a higher plane. other Side
Dangers of Superiority Feeling. 1. Intolerance (Cynicism to bigotry)
2. Freezing existing conditions into a rigid class (caste system) destroy
3. Instead of dominant group raising standards of behavior may
use this as an excuse for unjust, & undeserved, inhuman conduct.
4. Lower group may rebel. Refusal of one group to permit
equal mixture may cause ban. Possibilities 1. Differences
in races or mind cause non-production (endings). Individuals
will differ within themselves less than they will as race mixture.

(Below) → ways of Testing Superiority of different Races
1. cultural comparison
2. Comparison of Races which are in same geographic area
3. Physcological Tests
4. Scholastic activity
5. measurement of physical anthropology

Material Traits

1. Speech 2. war 3. Religion 4. Mysticism (Science) 5. Art (Social prog.

Race & Ability

Physical Anthropology - Hair shade - Shape of head
jaw prothesion, stature, bodily proportions, etc. May have
some bearing such as Size of brain? - Findings of Brain Capacity
Penckers 1524) Criminal 1438 } 69 Negro brain
on the average smaller than those of the whites. Judge by year of evolution in various racial groups. Cannot really say Negroes are more like apes than the whites.

Psychological Tests - Popular in U.S. because we have a passion for putting things in numbers. Environmental circumstances the higher the social & economic positions, the higher the intelligence (on an average) Therefore we may presume that the negro is inferior to the white person on the average. Army findings - (1) Northern whites (2) Northern Negroes (3) Southern White (4) Southern Negro
Average Age - Negro - 10.4 White - 13.1 Otto Feinberg
Associate Type of education has a great deal to do with it. -
Superior negroes migrated out of the South. Finebergs denies
This, but his studies cast doubt upon their validity
4 Conclusions of findings. (1) Negroes are inferior on all
mental tests. (2) This inferiority is shown by a higher proportion
of inferior scores & smaller of superior ones. (3) The differences
between N+W increase with age. (4) Similarly in Social
status decreases differences. (5) Scholastic Ability - Urban White
best - Urban Negro - Rural White-best - Rural Negro last
Urban Negroes-best Rural white. - Generally the colored do
almost as good as the whites in the beginning but soon fall back.
Reasons:- (1) No tradition of education in the family. (2) Children
needed to help support the family. (3) Give up under racial
prejudice. Realize hopelessness of their position.
Summary - (1) Whites superior but this superiority may be due to more
favorable environmental circumstances.

Chapt. 13 - Segregation in Education - Negroes in School

1930 -	60	71
20	58	67
10	45	65
1900	31	60
1890	32	
80	32	
70	9	

5/12/42 Prospects of Relationships between Dominant and Subordinate Groups here in here in this country

People generally want to believe that their group is superior All living (under any circumstances) provides frustrations. Everything cannot be satisfied – therefore we are frustrated to a greater or less degree. Therefore it will be taken out upon some groups which are believed to be different. Must blame someone. There is no panacea. No quick or complete solution to the problems. Many redirect persecutions against another group, but basically it is still here – the direction alone has been changed. Some believe in panaceas – ① Extinction ② Segregation ③ amalgamation – biological mixing of the stock so that outstanding characteristic will disappear ④ Cultural Assimilation – popular here – has worked fine in some minorities. But with others not (Jews)

Are ways which may help reduce effect of the problems – not panacea.

The Negro – Two definite castes in the U.S. middle line does not exist. Have classes in classes, but Negro develop in his caste. White upper → ← upper middle → ← middle lower → ← lower high – higher than Negroes etc.

Principle of Booker T. Washington – Stay on your own side of the fences.

Nazi System

Aryans

Neg Jews Poles Stud
1 1/3 2 3

Never can achieve a status to the lowest of the Aryan groups.

Education – Use it to tell people how to do things correctly. But formal school room education can never really prove a solution to these problems. But if both formal and informal education is used it may do some real good. Minority must be educated as well as the majority. Indoctrinate from birth on. Caste systems.

We can say reasonably that some cultures are [illegible] others. Those who dominate believe themselves to be superior. Effect Culture greatly. Man can kill or advance a certain culture. Is superiority of culture due to people in it or to its environmental circumstances. Which is most important? (unanswerable)

2. Compare races in same area Negroes & Whites in U.S. Whites are superior to Negroes here in any sphere. Why – may be due to greater ability, descrimination, less time, etc. But Culture here superior to Africa – Whites here superior. But being negro here, he will assimilate this & be equal

Soc. 6 — Minorities of People

World —
1. Sun
2. Dust Particles
Earth 2 billion years old
Subcellar life starts in 2nd billion
800,000 different Types of life
Two Theories on ~~Evolut~~ Organic Evolution
I Organic Evolution
a. Segregation - Negroe VS white
b. Overproduction
c. Struggle for existence
d. natural and Sexual Selection
e - Survival of the fitted
II - - - Mutation pressure
(The disappearance of organs which are not vital to our existence
1. ape and missing link
2. Dryopithecus man
3. Cro - Magnon - first man to think
4. Grimalade man
Is man superior to other organism — ?
1. mans weakness
2 a. Clumsy in action
b. Selfish and ruthless, etc.
Conclusion :- The criteria of superiority is ability to

I Groups of People
A. Whites
a. Nordic or Teutonic
Long headed, tall, blond + chest
B. Mediterranean
opposite except long headed
II Colored
A. Negroe
a. Kinky hair, flat nose, e
B. Yellow
Straight hair and short
C. Red Race
Indians and Eskimo
Round heads, black hair, dark eyes,
Future
1. Six elements of Race Prejudice
2. Reasons why prejudice is directed to particular groups
3. Varieties of Race Prejudice
4. Excuses for " "
5. Facts about groups against which we are prejudice
6. Questions on Book
1. Elements
A cultural reaction (not hereditary)
B. Arise from real or assumed differences (e.g. group differs from another)
C Emotional Response emotion
D. may exist without social or economical
arise from " " competition

Function of Prejudice - To Strengthen dominate Group

II Reasons:-
1. Distrust of Strangeness
2. Conditioned emotional responses

III Basis for Prejudice
1. Belief in difference
2. Conditioning against certain group
3. Believe they offer competition to our social or economic well being
4. Common Hate unites group (amusement)

III Varieties of Prejudice
Inter Race prejudice
Contra Race "

IV Reason for Prejudice
1. Vulgar Simple Reasons (People always wants to remove "Why" was in an act they don't care how or what brought it about.

Germa Philosophy
Race = Blood + Soil + History
Race is an achievement a possession

Chapt I
I. Prejudice results from Social condition
(It is not innate.
2. Amount of Eng + France.
3. Young children do not show prejudice

chapt. II.
1. Reason for migration
2. " for Increase in Population.
- Main raise in N.W. European stock
- Birth rate due to low death rate

Today this is reversing

Births	1921	1941
U.S	24.3	18.8
Japan		30.6

Deaths

	1941
U.S.	11.0

a Statalyze or decline population is not good.

U.S. composition
White 118 million
Native Born native par 74 million
Foreign Born Foreign " 11 million 500,000
Native " " " 17 "
" " Mixed " 8 "
Foreign Born 1 " 200,000 Germans
" " 1 " 624,000 Italians
Negroes 14 "
Chinese 74,000
Japanese 127,000
Filapinos 50,000
Indians 350,000
Mexicans 1 million

Birth Rate decline etc. is more a social problem rather than economic.
Difference between old and new immigration at first from N or W. Europe Then from eastern part of Europe
Since 1930 immigration has been less than emigration
previously immigration was for economic reasons
Now it is for political persecution.

Chapt 3
Minority Farmers

Problems:-
Share croppers S.E part of U.S. South produces a profit sharing scheme after civil war + freedom of slaves among sharecroppers profit sharing the theory is highly produced but the system is not very good. ~~His~~ the S.E. has lost a great deal of its former power and richness this causes misery amongst the sharecroppers. Whites outnumber Negroes in the total number of " " but proportionately the " outnumber the whites. Immigrant as a farmer — not very good.

1. Usually go Urban
2. ones who went to city first and then to the farm were very successful even more so than native farmers. Those who came straight to the farm from Europe failed hideously because they were not able use the old method. Japanese - highly successful.

Summary:- The new immigrant have not sent much to the farm but those who have gone have done very well. Negroes also have done very well in the South. They also have their own farms. Japs have been very successful and acquired farms in spite of the laws against them.

Chapt 4. Industry & Labor

I The Negro

	Agric	Domestics	Manufact	Trade & Trans	Professional	Clerical	Mining
Negro	36.1	28.6	15.6	10.3	2.5	0.7	1.9
U.S.	21.3	11.3	28.6	20.7	6.5	8.7	2.0

The Women + Are they a minority?
If so — why?
Negroes are not prejudiced against as women:
They are more discriminates against their customs. They have accepted their position of subordination -
In Labor

2. foreign born - middle
3. native — Highest jobs.

All occupational descriminations are disappearing as in the foreigners. But the negroe problem will never totally die out.

Four factors against the Negroe
1. Repulsion of whites to them.
2. They dont receive opportunities

Traits
1. More emotional
2. " violent morally

Is it a cultural or biological mix up?

Minorities in Labor - as Built up by Prejudices perpetuated
1. It is said that they did away with the old handicrafts
result mass production
2. They come over here make some money and go home
3. The weakened bargaining power of labor
4. cause of over population
5. Basis of Descrimination by Labor Groups. as fear of competition. This is a narrow point of view but not enough to cause them to be kept out.

3/12/42 Hourly Exam.

3/17/42 Physical Segration does not always mean Social Segration
" " works against the People who are Segrated
" " helps to build up hates and fears and set up Stereotypes which with contact help to distort the stereotypes and create doubts which in time may change ones opinion. Segration tends to slow down assimilation. Sometimes plowsticks in hard times. The Klan and other similar organizations come to the fore.

3/19/42 Segration has explosive possibilities. In 1882 - finds ... exclusion Law excluded all ... mental ... and those

who would become public charges Law against contracting labor
In 1917 - People having mental defects, illiterates, diseases, political radicals
prostitutes & literacy test, also paupers prohibited. almost 2 million
a year came after the war. The Quota Act 1921 provided 3% of the number
born in a country but living in the U.S in 1910 would be permitted to enter.
In 1924 which was 2% of people in 1890 in U.S. In 1924 we got present
immigration law. The quota of any country is to be in the same
ratio to the total number of immigrants as the number of people
of that national origin as the total population of 1920

X	immigrants admitted in any one year	= 6,000,000 F.B. + Desc. = 120,000,000 -
150,000		

Assimilation is slowed down and so is opposiveness of dominant group.

Study of Peoples —

1910	NWNP	F.B.	NWFP	NWMP
Density	73	226	108	104
Crime	82	86	91	116
Spending	104	138		
Feeblemindedness	108	30	165	190

Rural natives and urban immigrants effect this
Chart. Chart doesn't prove a great deal because of the
circumstances and prejudice against the immigrant
Abolish blanket test and have officers decide on each separate
case as individuals not as members of any group. All the amount
of immigration depends upon the social & economic conditions of the
country. States of Chinese & Japs
1862 - Coolie restriction, 1868 Burlingame Treaty -
free immigration but denies the right to become naturalized
1880 - Regulate limit, or impose Chinese laborers but not able to prohibit
1892 - Suspended for 10 yrs 1892 - Likewise 1902 - indefinite
1917 - Barred Zone - All of Asia in Zone Barred from immigration
Japs excluded in this act. 1924 Congress - exclusion of
Japs excluded in the act. 1907 - Gentlemen's Agreement
all Aliens who cannot be citizens. 1907 - Gentlemen's Agreement

(this did not work) In 1924 - Congress gave Japan a quota thus
making her equal to European countries. Filipinos & Indians
segregation 50 a yr.

Citizenship with Restrictions

Capacity of people to become citizens due to difficulty
of questions & not wanting to study & length of test.

citizenship - Indians - treated as seperate nations with the
nation also the present made treaties with them - 1887 Dawes Act
This act a form of enticement to the Indians - previously land had
been held by tribe. This act provides for land to be divided
individually & grant citizenship to Indians. Would hold title of land
& they were to be given citizenship when they became civilized &
adopted the habits of civilized people. In 1906 Burke
No Indian would get his citizenship until he receives the title
to his land. Could get title when he demonstrates competency
Children are citizens if parent are. Citizenship must be conferred
upon a group by Congress. Never conferred on Orientals. Always
war service made them eligible Also a woman could marry a
citizen and be one. Now (1924) all Indians born in the U.S
are automatically citizens. Negro - 13th amend - free then
14th amend - all persons born in U.S are citizens (Exclusions of
Indians, Children of foreign representatives) 15th Amend - Right of citizen
to vote shall not be denied because of race, color, creed or previous servitude
Jus Sanguinis - A citizen determined by Blood - are what your parents are -
Jus Soli - Law or principle of the soil. Citizen of country where born
No compromise - very often conflict

Means of Citizenship 1. By birth 2. By 14th Amend 3. Born or acquired
of territories or possessions of the U.S. 4. If born abroad are naturalized
if of child of U.S. But if either parent is an alien child must live there for
5 yrs before 18 yrs + then take oath at 21 yrs of age. 5. By marriage
Before 1922 a wife became a citizen by marrying a citizen if he married
alien was. If a woman citizen married an alien she lost her citizenship
Cable Act - 1922 A wife must become naturalized with husband (alien

1934 wife needs 3 yrs residence. A woman does not lose her city when she married a alien unless she formerly renounces it. A woman may not renounce her city if war is declared with the country involved. (Also on 1 yr afterward)

Chapt 7 Crime & minorities - Negroes 1/10 of population

2/ Rate of real crimes are much greater than their proportion in our population. Indexes of Crime - 1/ Cannot find out real crime - depend on Indexes (arrest rate may go up or down without change in real crime (note) 2/ The arrest rate weighted against minority. Negroes arrested on suspicion greater than whites. 3. Low Status of minority groups then chances of arrest are greater. Aliens have an important state in arrest - fear of deportation. - therefore attempt to widen cops. In dominant group takes away. Negroes get justice but white get justice plus breaks. 4 Number of minorities in jails & prisons. Indexing because minorities cannot pay fine which is an alternative to a jail term. 5 Many times they receive no alternative. 6 Also they rarely get a parole, suspension of sentence or suspension. 7 Also the minorities are liable to get longer sentences. 8 Index recorded crime rate is a category of crimes known to police

Nobody knows what causes crime.

1 Divisions - 1/ Crime a product of social conditions. - Deal with social system, not with the criminal. Therefore crime is a product of cultural Environment - The criminal is merely a person (natural born - knight)

2/ Some inherent differences between individuals .·. one may succumb more quickly to environmental factors more quickly than the other. (Constitutional Psychopathic Inferiority) Summary of Indexes: The real crime rate of minorities is not as great as the recorded record (i.e. Negroes) Whether one is a criminal or not depends on the type of crime, when committed, and his economic and social position (negroes have no chance) Immigrants have been accused of being criminal - The latest arrivals, are always picked on. The national Commission of law enforcement & observance pointed this out. The Wickersham report - foreign born have a lower criminal rate than the native stock.

Negroes much higher - Foreign Born committed different types of crime usually involved violence & dealt with personal or within home matters for gain. Criminal Law - Purposes 1. Trying to be changes from the old vengeful idea 2/ Reformation of men 3/ Protect Society. a. Protect by putting in jail. b. To deter others. Insane in Law - Study: Psychiatry. Coercive mob action by whites does not always imply dearth of crime. Indians & Chinese equal the negroes proportionately. Very little rapid now now about 10 per/yr. not a serious matter 1. Illegal 2. might get wrong man 3. Shows lowness of civilization

Chapt 9 Vitality of minorities

Greater death rate among foreign born & negro death rate high. N.W. N.P. less by their percentage in population. Infant mortality high among Polish. organic heart disease intemperance killer of negro. Negro more venereal disease. Disease brought by outsiders. dominant group blame minority for bringing in ill-health. Indians susceptable to certain diseases. Changed conditions - transitional period must be completed. Inadequate medical attention, funds, program & large territory to be covered. Lack of hygiene knowledge by negro, Indian & Immigrant. Don't know about balanced diet & good outdoors & fresh air. Aren't allowed certain things. Jobs given immigrant aren't good for health. (mines, etc.) No racial immunity for disease. No minority to blame for diseases or carrying disease

Robert Brafford-She mothers

Dec 1 3/12/42 The Golden Bough — Oregon Seed - Pearl Seed

Louis Wirth — (a Sociologist) Polygamy moment in Peking

Dec 2 3/19/42 - miss Welch's book success

Thomas Mann's - Cook — gypsy — andry

Ernest Hemmingway - The Sun also Rises

unequivocal sexual unions = marriage

The family is the practice of marriage or the resultant of marriage

more or less - more or less.

She was about 22 yrs old black Hair with curls at the front & combed back hanging down her neck. She was about 5'3" Red brown eyes of a small mouth. Her features well offset her face kind of long. She was pregnant in a very other family (good looking). Four freedoms [Preston James - Book on South America]

Manheim - Ideology — freedom from want

" from fear

" of Religion

Ford - abolition property " " speech

She was tall about 5'10 blond hair, blue green eyes like the sea well shaped a polish or slavic face - light complexion well dressed. Blond hair.

Women don't intermarry because of the double Standard and the rules set up by different groups, women are unpredictable to disease.

4/21/42 @ Mating between Parent Stocks

5 of negro mulattoes

15/16 - Phys are mulattoes

19/20 Ph.D's " "

3/4 - 4/5 college

9/10 - Bishops

mulattoes less discriminated against. Caucasian Law - filial Regression

② The offspring will deviate less from the median group than the parents Example (Edward Zangwill) Parent offspring → melting Pot Idea" through the inter-relationship of a great number of strains dispersion to everyone Stream. ③ The offspring is superior to both ④ The qualities of the offspring depends upon the individuality of the parents

65-4307-1-B-5(49)

SAC

7/13/50

SA RICHARD E. BRENNAN

HARRY GOLD
ESPIONAGE - R

Exhibit 65-4307-1-B-5(49)

This exhibit, consisting of the "Chemical Equipment Preview" magazine for July 7, 1942, was exhibited to GOLD on June 19, 1950.

GOLD stated that the name in pencil on the cover "ART SIMMERS" was undoubtedly written by the Chief Engineer at Pennsylvania Sugar Co. where SIMMERS was employed. GOLD said that it was the practice of Pennsylvania Sugar Co. to write the names of certain employees on the covers of these journals in order to make proper distribution of them.

REB:DMH
65-4307

NW 28.

notable Chemical Products related to common corrosives

and carbon bearings

Orwell & Complex aluminum Tert Chemicals - Non Chlor Freons.

weld Halide

Little air Products Co

also Silicon Bronzed copper

a & N 18-8 Stainless Steel

carbon oxy-acetylene welding

Comparison with 1/2" pipe

Stainless acids & HF

Weld rods 1/4" plate

Diff kinds of any kind ferrous & non ferrous metals with oxy-acetylene fabrication

All welds

Al filler plates

Solvents

1. octyl alcohol
2. Et Hexanol - octyl aldehyde
3. octyl acetate > Et. Hexanol
4. Me n-amyl Ketone
5. Et-Butyl alc.
6. Et-Butyl acetate

C & C Chem Corp.

new synthetic solvents for lacquers

Products from Liq. Chlorine

Chemical Heavy plates - frames

Rubber plates

U. S. Stoneware Co.

acid proof & Waterproof cements

Alberene Stone Litharge & Glycerine

Complex Val Fold Bottom 4 1/2 Wall

(52-1307-1-8-5 (52))

Vitamin A
1 mg vitamin
from 6-10 tons
fruit juice
oppositions
on hydrochlorides
in vehicle
merck & co.

---

acetoacetanilide
E & C Chem Corp

---

ascorbic acid
vitamin C
pure x tabs
merck & co.

---

chemical engineering
co.

ceramic - metal
reliability

ceramet - high
thermal conductivity
Ceramet metal Chem

ceramics
ceramic - whole
particularly wear
resistant with
glaze for food
chemicals
& foods

N.C. pump
explosive and
valve Electron
& Instrumentation

Titanium
alloy mfg. co
"Ti"
catalysts
nitrogen rocks N.Y.
zirconium nitride
coat: at 1% in
steels
roger adams
lab

complex colloids
vitamin
(complex etc.) for
dehydrate nitro
cellulose water or
in solid mix
lacquers &
plastic coat in
the vehicle

---

iron - quinine
570 lbs of
Na ascorbate
with 70%
quinine alkaloid
good for/dehydration
action & vitamin
various uses
thermolabile

Requiring 7
workers
catalyst Hydrog
action of fruits
included tips

---

alkyl thiouil
alkyl thiouracil
use to withdraw
material
from use
levels.

6/3/60
#52

65-4307-1-B-5 (52)

7/13/50

SAC

SA RICHARD E. BRENNAN

HARRY GOLD
ESPIONAGE - R

Exhibit 65-4307-1-B-5(53)

This exhibit, consisting of three sheets of yellow paper bearing names and addresses, was shown to GOLD on June 19, 1950.

GOLD identified this as an old Christmas card list and stated that the list probably dated back before 1942. GOLD went through this list and identified all names appearing thereon as being individuals who are employed by the Pennsylvania Sugar Co. in Philadelphia, GOLD's former employer.

REB:DWH
65-4307

65-4307-1-B-5(53)

Chas Pollard
119 E Magnolia Ave

Idelong Dobbins
2704 Cryden St

Joseph Lollis
1012 Dickson St

Regina Lockabaugh
1844 E. Golden St
Sa 8435

Richard Bowen
1820 75th Ave

Cecil Gilbert
5500 Beaumont Ave
Sa 0046

John N Dittman
1424 E. Kirkwood Pl.

Lyle E. Fox
2023 W. Lincoln St.

Simon Fleming
90 W. Heath Harrow Dr.
Edgewood Park, Pa
Broomall PO

Walter Kachele
5846 N. 4th St

Joe Huber
1540 Euclid Pl

Mary Neuberger
5207 N. Kenmore
Apt 5196

Rob Bowden
2219 S. Bonsall St

Ronald F. Baird
5722 N. Lawrence St

John B. Adams, Jr.
1201 Ridge St (Co-owner
& Howard St)
Del 7219

Art Simmons
Clarion PO

Walter Riehle
2608 Ingersoll St

6/3/20

SELECTIVE SERVICE

OFFICIAL BUSINESS

NOT DELIVERED IN 5 DAYS
RETURN TO

STAMP OF BOARD OR ADDRESS OF SENDER

No. 1

PENALTY FOR PRIVA... TO AVOID
PAYMENT OF POSTAG...300

Local Board No. 65 | 82
Philadelphia City | 101
| 065
5th St. & Wyoming Ave.
Philadelphia, ...

65-4307-185-54

65-4307-1-85(54)

65-4307-1-B-5 (64)

From: Dr. M. RABACCHI
& A.P. DeSanctis and Son
Phoenixville, Pa

PHOENIXVILLE PA
APR 14
1 PM
1949

THIS SIDE OF CARD IS FOR ADDRESS

Mr
Harry Gold
Heart Station of the Philadelp
General Hospital
Curie & Spruce Sts
Phila, Pa

65-4307-1-B-5 (64)

Phoenixville. 4-13-1949

Dear Henry.

Hope you are doing very well, as usually and really I found a good helper in your lab. I feel pretty here and am occupied in analysis of raw stuff. It is in the beginning every job looks difficult, I don't think so. Did you help me finding a good flask for this purpose? Last week I was in Philadelphia short time and it was not possible to drop in and see you, but I will be there as soon as possible. I hope your father is in good health and I wish you will have a happy Easter in your Family. Today is the P.G.H. please my best regards and greetings to everybody in the P.G.H.

Remaining always thankful to you very truly yours

Maria

65-4307-48-5-(68)

ESTABLISHED 1918

A. F. BYRON

INNIS, SPEIDEN & CO.
401 NO. BROAD STREET
PHILADELPHIA, PA.

CHEMICALS
WAXES
GUMS

ISCO

6/5/50
PM

SAC

7/13/50

SA RICHARD E. BRENNAN

HARRY GOLD
ESPIONAGE - R

Exhibit 65-4307-1-B-5(66)

This exhibit, consisting of 37 3" x 5" index cards containing names, addresses and other miscellaneous information, was shown to GOLD on June 19, 1950.

GOLD identified this as an indices which was kept by him and MORRELL DOUGHERTY during the period when they were both employed at the Pennsylvania Sugar Co.

Inasmuch as GOLD identified each name and explained each piece of information contained on the cards as applying solely to work done at the Pennsylvania Sugar Co., no further explanation of this entire list is being contained in this memorandum.

REB:DMH
65-4307

65-4307-1-B-5(66)

American Instrument Co. Shepherd 3790
8030 Georgia Ave. - Silver Spring, Md.

Mr. James Whiting - Pen. 7377
705 Real Estate Trust Bldg.
Mr. Gilfoyle Came from Washington - Manhattan OK.
Called Whiting about Coil - 11/23/43 -

JEC
6/3/50 CI

American Type Culture Collection –
Georgetown University,
School of Medicine
3900 Reservoir Road
Washington, D.C.

Phone –
Will send pN information on #4124 – 4132

TFC
6/3/50 (2)

Bacardi - Ron Companie
Santiago - Cuba

Visit - 10/2/45 -

Mr. M. Machiran - Chemist

Mr. J. A. Ortiz - Chief Engineer

TFC
6/3/50 (3)

Bowers and Morris Corporation Ship Co
930-936 N. Front St.
Philadelphia, Pa

Samuel McIlvaney
President

Market 4988

TFC
6/3/50 (4)

Bleyman - Claire - Dewey 4416
2549 So. Galloway St.
N 2048 N. 7th Street
Quartermaster Testing Lab.
Hired:- April 1945 -

Mahoney - 1511 No. Franklin St.

TFC
6/3/50 (5)

Brown Instr Co.
5060 Wayne Ave
Phila. 44, Pa.

Victor 0300

J. C. MacConville

RFC
4/15. (6)

W. B. ~~Robinson~~ Coleman Bay. 7715

9 [illegible] Rivington Ave.

Mr. Mitchell

[illegible]
6/9/50 (T)

Collins - Mary Tenn. 1644

2004 Godfrey Av. Phila.

Kalmus Laboratories (Mr. Mitchell)

Hired: 9-4-45

TPC
6/3/50. (8)

Davis, Joseph Dec. 6350

-Ifc (9)
6/3/20

Dougherty - Morrell E. San. 8183
5517 Litchfield St. Phila. (43)
1929

TPC (10)
6/3/50

Drever Corp. Nebr. 4845
748 C. Ventura St.

Obtained from these people - 5# activated alumina (no charge)

Name given to me by Mitsuwa of the Aluminum Co of America.

TFC 4/3/50 (11)

Exmen & Amend
3rd. Am 18th to 19th M. N.J. Ct.

T&C
6/3/5- (12)

Harris - Pol -

None - Bel. 2947

Stone - 2863 - Howard

PPC
6-3-50 (16)

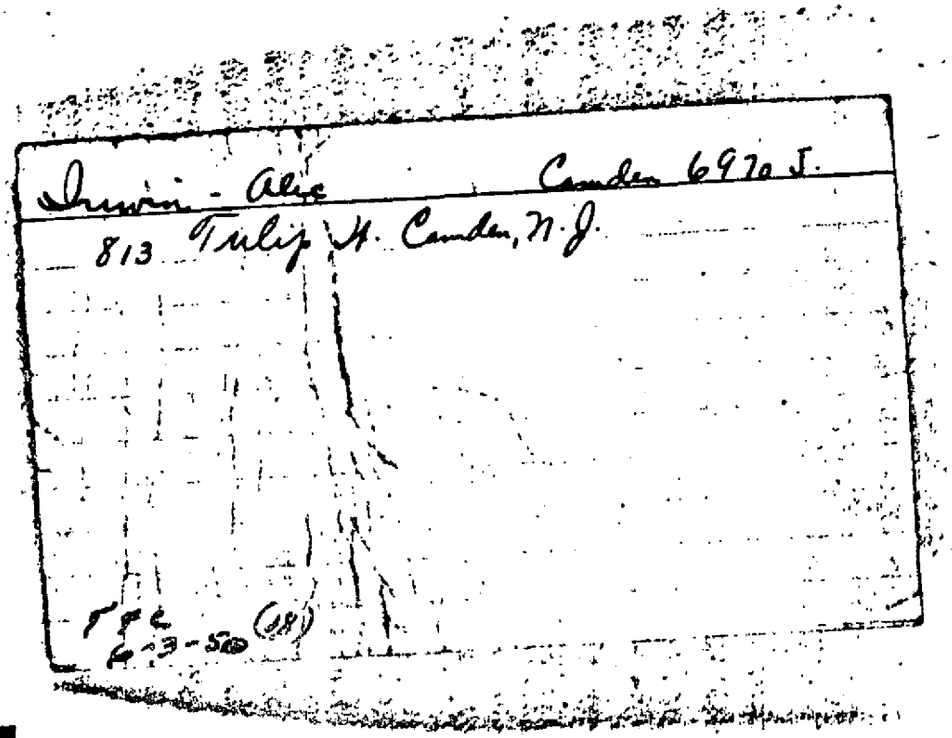
Ingersoll-Rand Company

Phila. 3, Pa.

1600 Arch St.
Locust 7535

A. K. (Nod) Wynne

MEC
6-30-60 (17)


Irwin - Alice Camden 6970 J.
813 Tulip St. Camden, N.J.

La Motte Chemical Products Co.
Towson, Baltimore, Md.

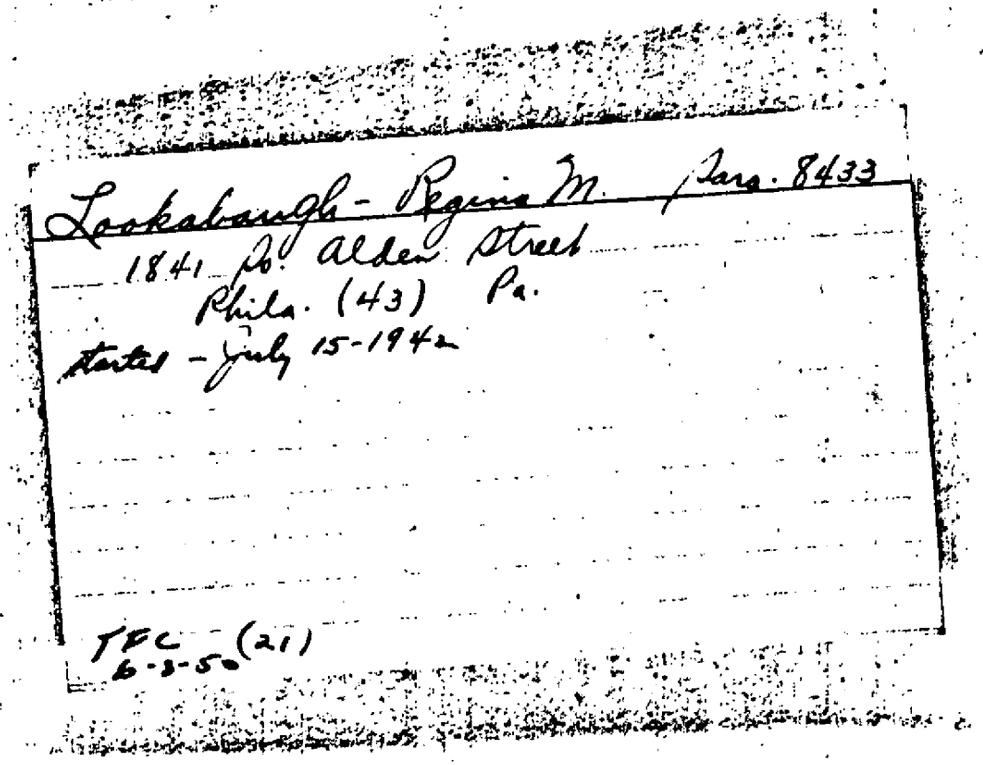
Miss Welch or Mr. Fenning
Towson 1700

ordered 1 complete soil testing kit 35.00
test N - Ca - P - H - for Mr. Abrams.

TPC
C-3-50 (20)

Dr. W. A. LaLande
Penna. Salt Research Lab.
Wyndmoor Rd.

TDC
6-3-5- (19)



Lookabaugh - Regina M. Sara. 8433
1841 So. Alden Street
Phila. (43) Pa.
started - July 15-1942

TFC
6-3-50 (21)

Lee, Yung-Chek

Continental Plant

Publicker Commercial Alcohol Co.

—Snyder Ave & Swanson Sts.

TFC
6-3-50 (2a)

Mr. Lee Yungcheh
Y.M.C.A. Broad & Arch St.

Publicker Alcohol - Dewey 7200
Snyder Control Lab.

Miss Mary Gallagher
5023 Locust St.
Granite 3447
BPC 6-8-50 (23)

Mario-John M. & Co. Lom. 9666
528 Arch Street - Phila. Pa.

TFC
6-3-50 (24)

Red Star Yeast and Products Co.
3915 Wisconsin Ave
Saginaw 1214
no answer call Pil 3738
~
Pil 9466

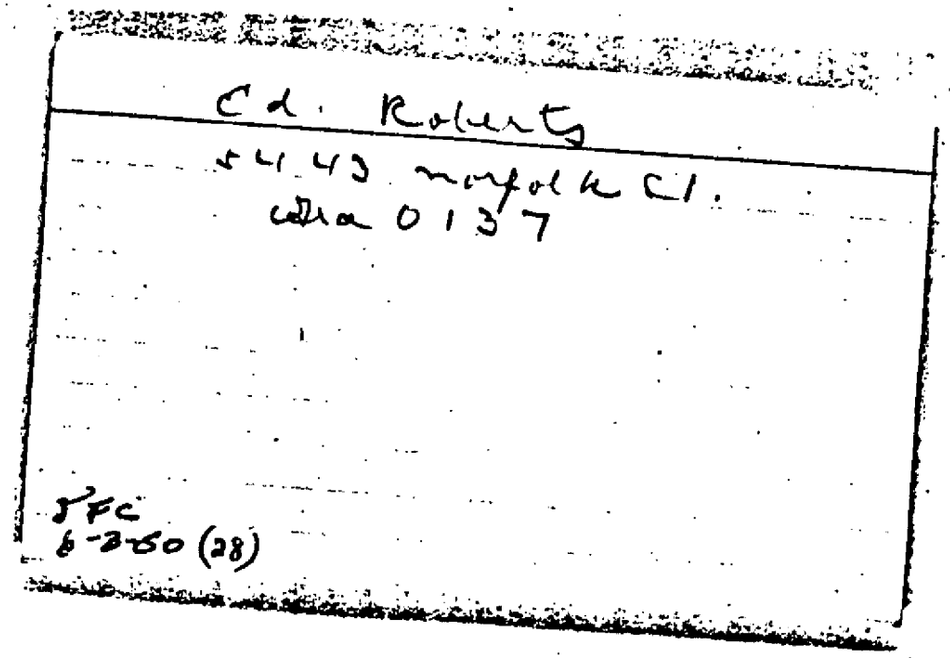
FTC
6-3-50 (26)

Precision Thermometer & Inst. Co.
1434 Brandywine St. Rit 6671
Mr. Wm O. Laverell

JFC
6-3-50 (25)

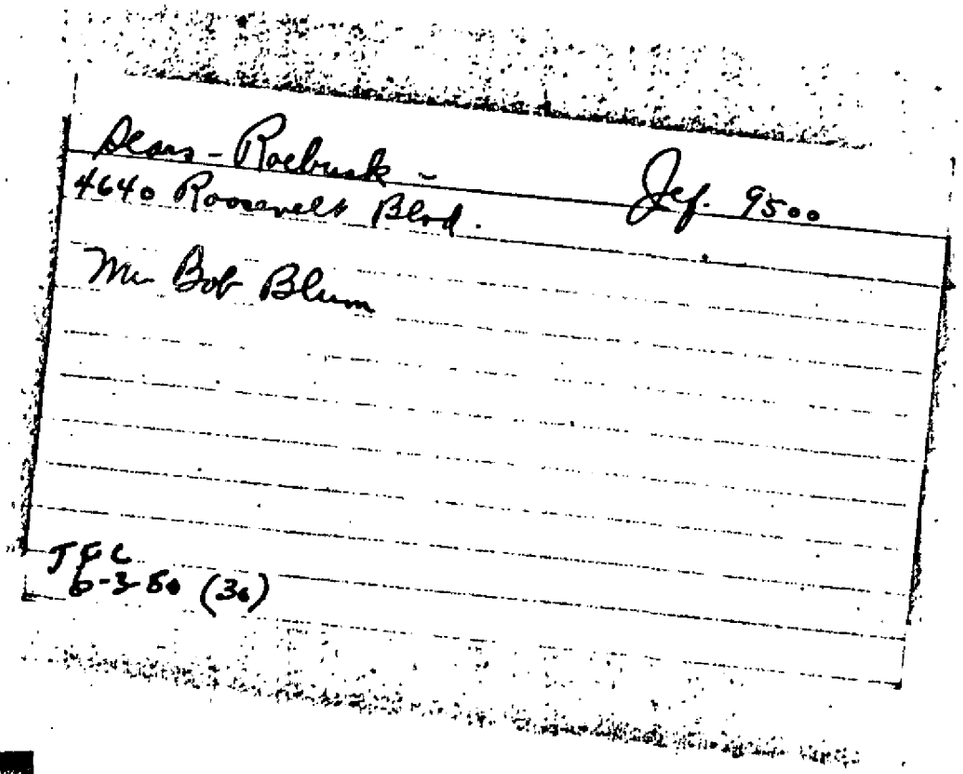
Reich - Dr. G. T. Loc 1152
1015 Packard Bldg.
15th & Chestnut Sts.
Phila. Pa.

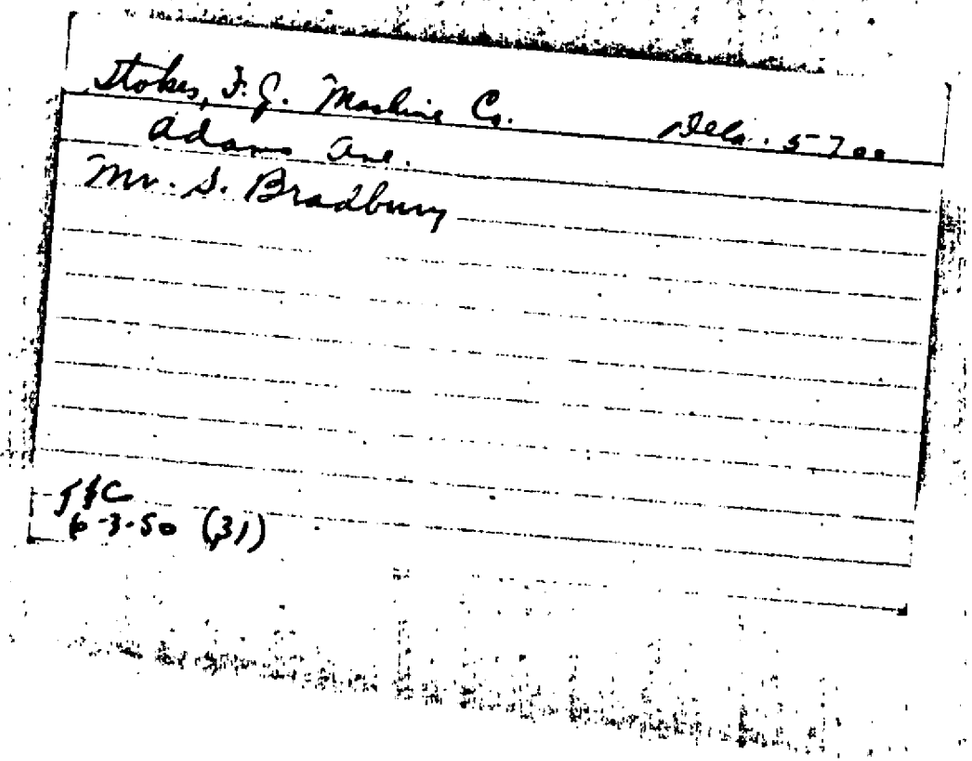
TFC
6-3-50 (27)


Ed. Roberts
4143 Norfolk Ct.
Atlanta 0137
SFC
6-250 (28)

Schwarz Laboratories, Inc. Murray Hill-2-0007
202 East 44th St.
New York (17) N.Y.

FFC
6-3-50 (29)


Sears-Roebuck — Jef. 9500
4640 Roosevelt Blvd.
Mr Bob Blum
TFC
6-3-60 (36)


Stokes, J. J. Machine Co. Dela. 5-7000
Adams Ave.
Mr. S. Bradbury
FTC
6-3-50 (31)

Arthur H. Thomas - Com. 5760
Swanson & South sts.

Call Mr. Kish for general information
" Miss Bantekl for expediting

TFC
6-3-60 (32)

Turco Products-INC. Mal. 6789
401 No. Broad St. Phila. (8) Pa.
Mr. W. J. Nixon.

TFC
6-3-50 (33)

Valleti - Frank - Lom. 0302

103 Holmes St.

TFC
69-50 (24)

Victory Exterminating Co. Mr. Stauffer Mr. Demuth EVE. 0295

~~410 No. 40th St.~~ 3930 Hyde Park Ave.

8/25 - Entire first floor - (Roof results)

9/1 - 1st floor repeated - formalin bridge (Roof).

9/8 - did not appear.

9/15 - 5th floor (office drawing from Lists) also put out pot for roof

9/20 - 2 men - 9 to 4 - did 6th. 5th. 4th fl. - 3rd fl. and also Palmetto office + Govt. office - will be back for another all day job about Oct. 1st.

9/28 - 5th floor offices - approx. 1 hour.

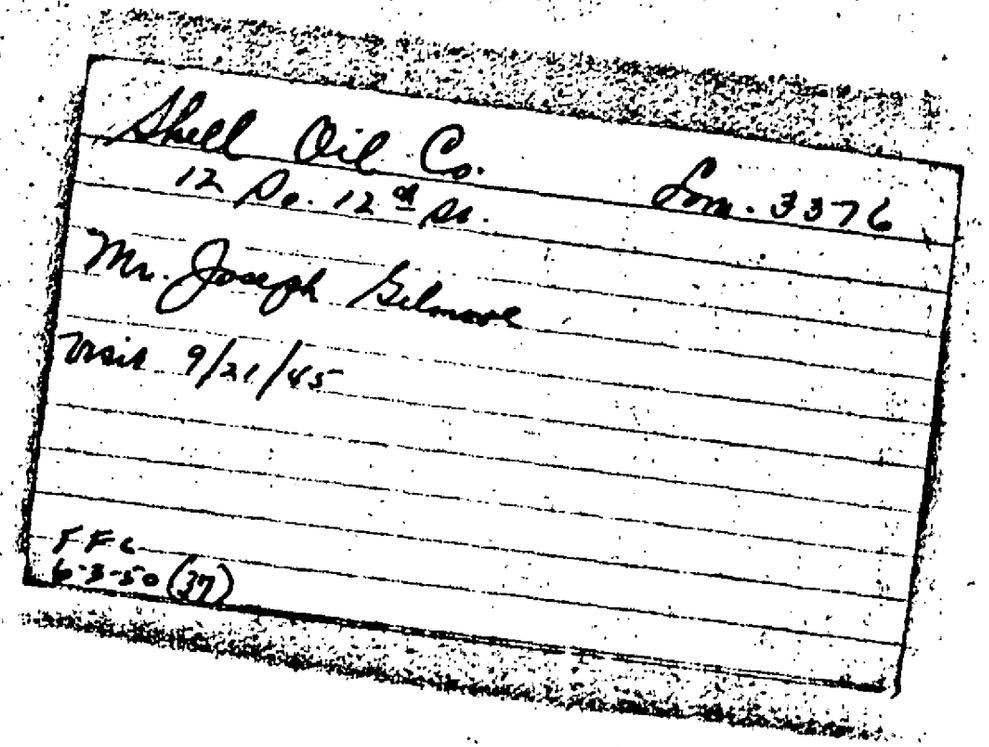
RFC 6-3-50 (35)

Winthrop Chemical Co. Industrial Div.
New York, N.Y.

"Rocoal"
Roth. Reese - 1523 N.16-01. File 6655

Results very good - seemed to help considerably

TFC
6/2/50 (3H)


Shell Oil Co. Lse. 3376
12 Pe. 12 Qu.
Mr. Joseph Gilmore
Mail 9/21/45
FFC
6-3-50 (37)

65-4307-1-B-5(67)

#67

MARKET STREET AT FORTY-SIXTH
NORTH WEST CORNER
PHILADELPHIA

October 27, 1943.

Dear Harry: You make it
difficult for me to tell you
that I cannot see you again.
Please don't think
that I have failed to appreciate
your thoughtfulness and pleasant
ways. You were always an
agreeable companion, and I
feel sure that there is some one
very special waiting at the end
of your rainbow.

May happiness and
success be your lot always —

Sincerely —
Marion

TTC 6/3/50 65-4307-185(67)

7/13/50

SAC

SA RICHARD E. BRENNAN

HARRY GOLD
ESPIONAGE - R

Exhibit 65-4307-1-B-5(68)

This exhibit, which consists of a booklet entitled "Tales Told in the Long House", was exhibited to GOLD on June 19, 1950.

GOLD said that this booklet is typical of the type given away at the Exposition of Chemical Industries which is held annually at Grand Central Palace in New York City. GOLD believes that he undoubtedly secured this booklet at that source.

REB:DWH
65-4307

65-4307-1-B-5(68)

7/13/50

SAC

SA RICHARD E. BRENNAN

HARRY GOLD
ESPIONAGE - R

Exhibit 65-1307-1-B-5(69)

This exhibit, which consists of twelve items, was shown to GOLD on June 19, 1950.

These items will be identified by number in accordance with search memo dated June 7, 1950.

(1). SAMUEL GOLD's employer.

(2). GOLD does not know the origin of this card and attaches no significance to it.

(3). GOLD said he made many purchases at John Wanamaker's.

(4). GOLD identified Dr. L. L. BREUER as being a practicing physician in the neighborhood of BROTHMAN's Elmhurst laboratory. Upon one occasion GOLD took CY SILBERSTEIN to Dr. BREUER's office for medical attention when the former had cut his hand at work.

GOLD does not recall the significance of the name "HANN".

(5). GOLD said this concern was a supplier of raw materials for the A. Brothman Co.

(6). Relative to the Republic Filters, Inc., GOLD said that TOM BLACK had an idea for purifying and removing bacteria from various solutions. GOLD said this firm manufactured equipment for such processes. GOLD said that he undoubtedly had the card because, as he previously stated, he and BLACK had the idea that they might use this process if they ever went into business. GOLD also said that he may have received this card at one of the chemical expositions in New York City.

(7). GOLD said that he bought overshoes and laboratory equipment from the Levick Co.

REB:DWH
65-1307

(8). GOLD said that this concern did legitimate business with the A. Brothman Co.

(9). GOLD was unable to identify LAMBERT.

(10). This is GOLD's former employer A. Brothman Associates.

(11). This is a card of GOLD's known friend MORRELL E. DOUGHERTY.

(12). GOLD said that this telephone number would appear to be in South Philadelphia and is probably that of some individual with whom he went to school.

Contains papers & cards bearing names of individuals found upper RH hand rear drawer Harry #69 Gold's desk.

HRR 6/3/50

65-4307-1-B-5 (69)

L. L. BREUER, M.D.
PHYSICIAN & SURGEON

OFFICE HOURS: 1-3 6-8
EXCEPT WED. & SUN.

85-43 55TH AVENUE
ELMHURST, L.I., N.Y.

ACHESON COLLOIDS CORPORATION
PORT HURON, MICHIGAN

M. E. DOUGHERTY, SERVICE ENGINEER
LAND TITLE BUILDING
PHILADELPHIA 10, PENNSYLVANIA

PHONE: LOCUST 7158

HUMBOLDT 2-5397

J. G. STONE

REPUBLIC FILTERS, INC.
(FORMERLY AMERICAN SEITZ)

17 STONE STREET
NEWARK 4, N. J.

CIRCLE 5-8510

J. TREIHAFT

D. H. LITTER CO., INC.
MANUFACTURERS' AGENTS
RAW MATERIALS

242 WEST 55TH STREET
NEW YORK

WALNUT 0202
MAIN 2428

ESTABLISHED OVER 80 YEARS

RICH'D LEVICK'S SON & CO.
RUBBER GOODS
SYNTHETIC PRODUCTS

REPRESENTED BY

720 CHESTNUT STREET
PHILADELPHIA 5, PA.

157 West 49th STREET
Circle 5-7940

RESTAURANT

Glucksterm's

"IN THE HEART OF NEW YORK"

LIQUORS

WINES

FAMOUS FOR OUR STEAKS AND CHOPS

P. O. BOX 8085
BLOOMFIELD, N. J.

Scientific Glass Apparatus Co. Inc.

JOHN J. LAMBERT
1739 BRIDGE ST.
PHILA.

'41

WITTENHOUSE 1000
EXT. 1523

JOHN WANAMAKER
PHILADELPHIA

JOHN L. HARTMAN

MEN'S CLOTHING
BUDGET STORE GALLERY

ABA LABORATORIES
85-09 57TH AVE.
ELMHURST
LONG ISLAND, N.Y.

TFC
6-3-50 (5)

Charles Fleming
Del 6-5-50
Ft. 317
Feb 28

TFC
6-3-50 (6)

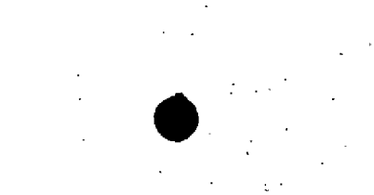
TFC
6-3-50 (4)

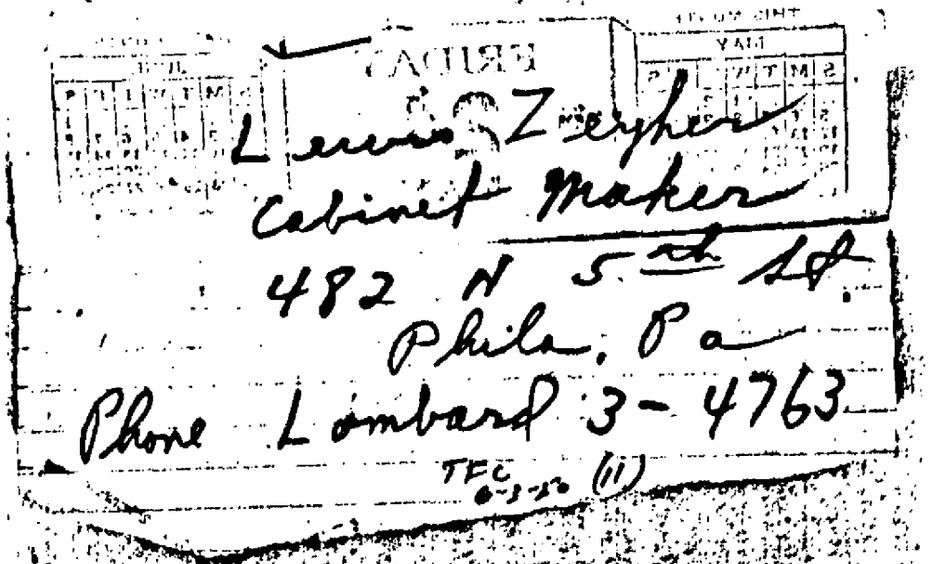
TFC
6-3-50 (3)

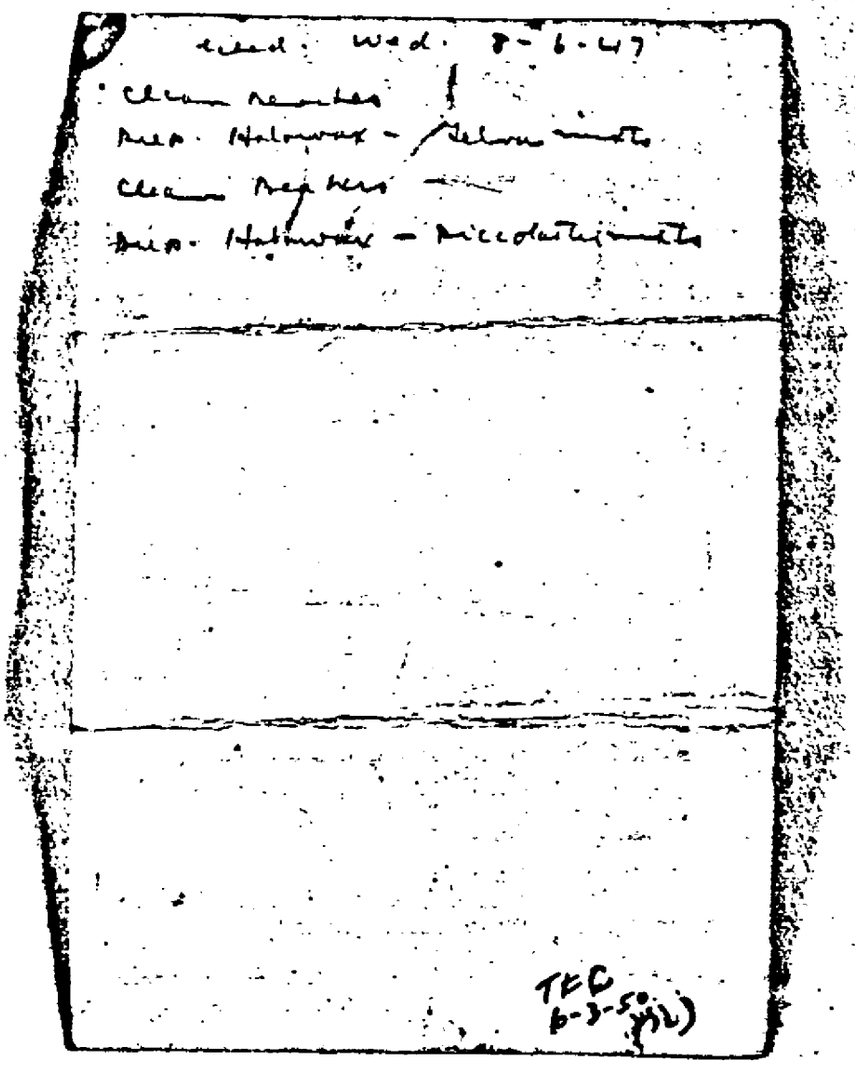
TFC
6-3-50 (2)

TFC
6-3-50 (1)

TFC
6-3-50 (7)




Louis Zeyher
Cabinet Maker
482 N 5th St
Phila. Pa
Phone Lombard 3-4763


Wed. 8-6-47
TEC
6-3-50