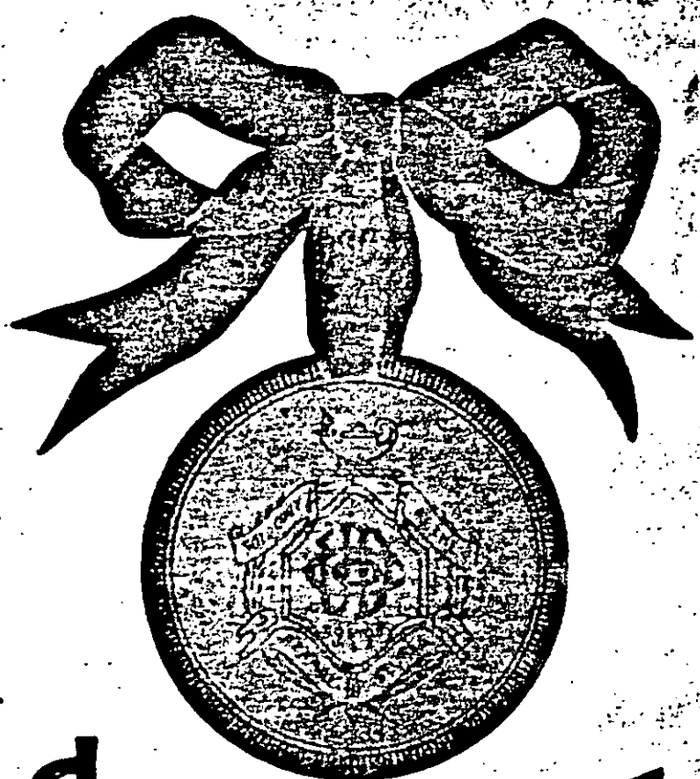
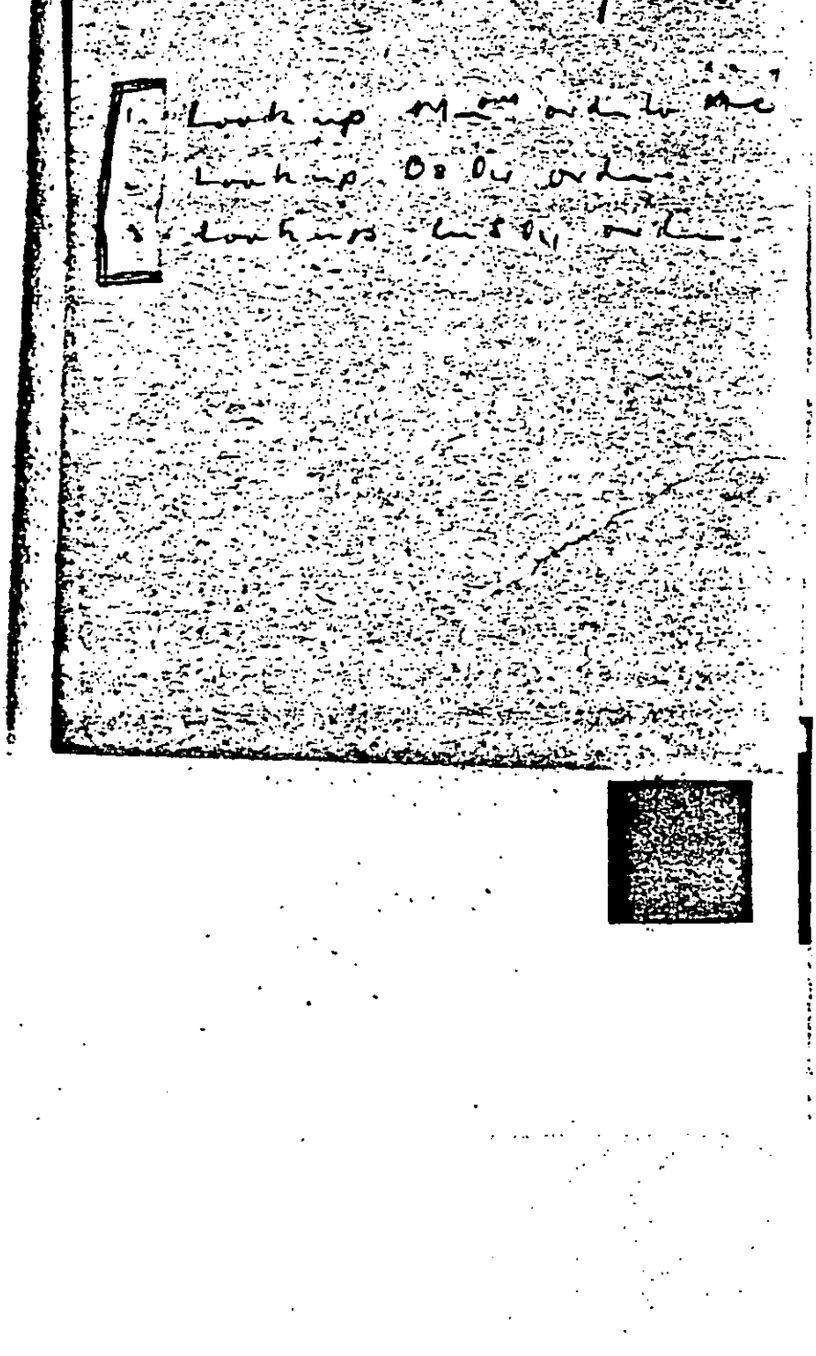


GOLD MEDAL

WRITING TABLET

S 905

Harry Gold



THE GIRDLER CORPORATION

INCORPORATED

VOTATOR DIVISION

GENERAL OFFICES

LOUISVILLE 1, KENTUCKY

December 3, 1947.

A. Brothman and Associates,
Chemical and Mechanical Engineers,
85-03 — 57 Avenue,
Elmhurst, L.I.

Attention: Mr. A. Brothman, Chief Engineer.

Gentlemen:

We have your request for literature on our Votator equipment and are pleased to enclose several circulars and pieces of literature describing the Votator principle of heat transfer and processing and illustrating several models of Votator units designed for different applications. At the present time our general catalog is in the process of revision but will not be issued for several months.

We are forwarding a copy of your letter to our Eastern Sales Manager, Mr. S. N. Welch, located at 150 Broadway, New York City. If, after reviewing the enclosed literature, you wish further particulars, please contact Mr. Welch at the above address.

Thanking you for your interest, we are

Very truly yours,

THE GIRDLER CORPORATION

J. E. Slaughter, Jr.,
Vice President.

JES/cla
encls.

Wherever liquid or viscous materials are processed, consider Votator!

The Votator and Processing Edible Oils

The Girdler Corporation, manufacturers of the VOTATOR, was the *first* to provide equipment for processing margarine *continuously*. Use of the VOTATOR *completely changed the entire method of manufacture* of margarine, with the result that Girdler is considered to have made the greatest single contribution to this industry's production efficiency. In the production of shortening and lard, the VOTATOR is used for chilling and plasticizing, and has also made these operations continuous and much more efficient. Today 75% of the nation's shortening and margarine, and a large and fast-growing percentage of its lard, are VOTATOR-made. In each application, the VOTATOR begins with the prepared hot oils (and other ingredients, if any) and completes the manufacture of the product, delivering it to fillers or molding apparatus.

In these edible oils applications, the VOTATOR has improved the quality, uniformity, texture and color of the product. Moisture condensation and contamination have been minimized. Keeping, creaming, mixing and cooking properties have all been improved, and a more efficient use has been made of everything needed in production — materials, refrigerant, manpower, floor space and power.

The Votator and Processing Petroleum Products

Use of the VOTATOR by the petroleum industry has led to various production short-cuts and new standards of quality, efficiency and safety. The following applications are typical and considerable information, including some pilot plant and plant data, is available:

Grease. A processing system for continuous production of lubricating greases.

Wax. The VOTATOR is an efficient instrument for continuous crystallization and filling of paraffin wax.

Hydrocarbons. Very effective for low temperature crystallization of various hydrocarbons.

Alkylation. A special adaptation, called the VOTATOR Reactor, gives higher yield, higher octane and greater 3-C values in the production of aviation gasoline alkylate.

The Votator and Processing Foods

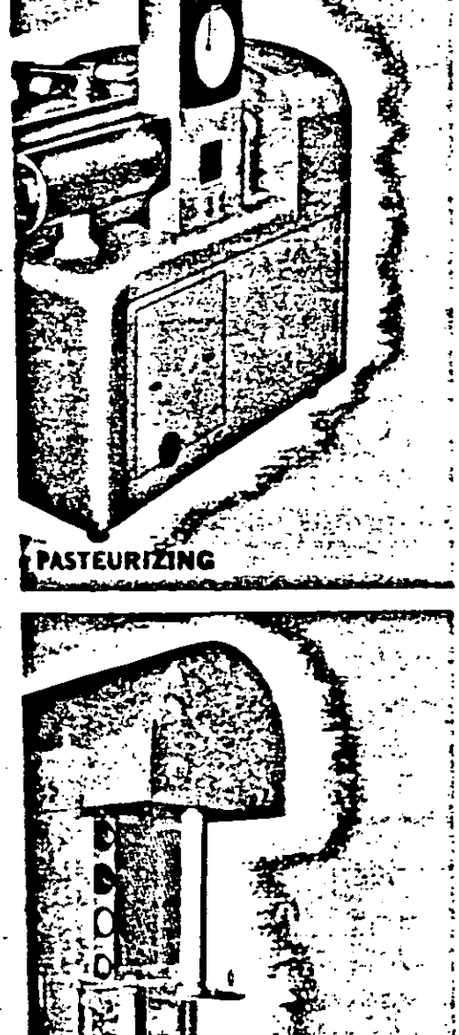
By means of the VOTATOR, *ice cream* production was put on a *continuous* basis. Chilling was accomplished in seconds, which made possible an improved texture of the ice cream and precisely controlled aeration. This application of the VOTATOR has led to numerous others in the chilling of food products, and in all of these uses the above three advantages are of primary importance and outstanding as compared to other methods. The VOTATOR can also be used to cook food products in liquid, viscous or suspended form. Rapid removal of film by surface scraping permits higher temperatures without danger of burning or scorching. In all food processing, The VOTATOR'S closed operation, sanitary construction and easy cleaning are significant.

Other food applications include: *Fruit juices and purees* — quick chilling and crystallization. *Liquid whole eggs* — quick chilling and pasteurization. *Starch base solutions*, such as used in making salad dressings — continuous cooking and cooling.

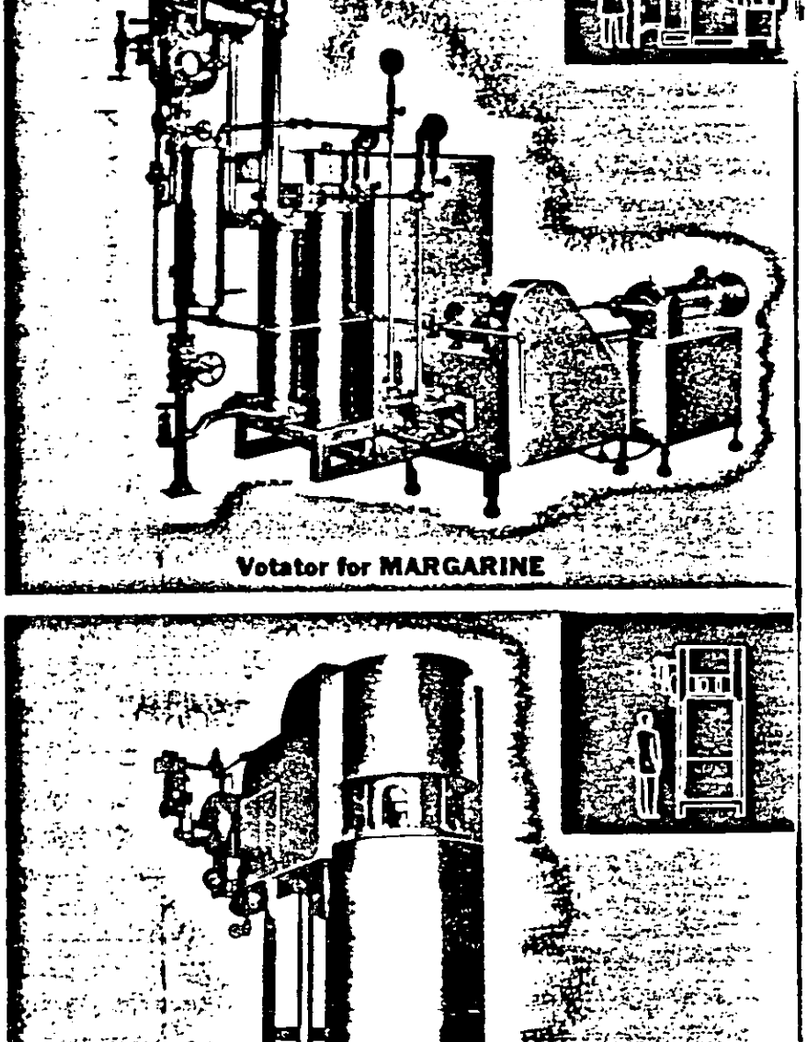
The Votator and Processing Chemicals

The VOTATOR is suitable for processing a wide variety of chemicals that are in liquid or viscous form, at least during one stage of manufacture. The distinguishing feature of each of these applications is *uniform, continuous operation under controlled temperature — continuous mixing, heating, cooling, emulsifying, plasticizing*, etc. Of this broad group, the following are only typical:

Photographic emulsions — cooling and processing.
Textile printing gums — heating or cooling.
Leather preparations — cooling.
Liquid resins — continuous processing of resins . . . heating and cooling in fluid stage.
Waterproofing compounds — heating or cooling.
Gelatin and glue — heating or cooling.
Paper and textile coatings — uniform mixing with temperature control.
Wax Products — continuous cooling and emulsifying.
Shaving Creams — Chilling and Plasticizing.

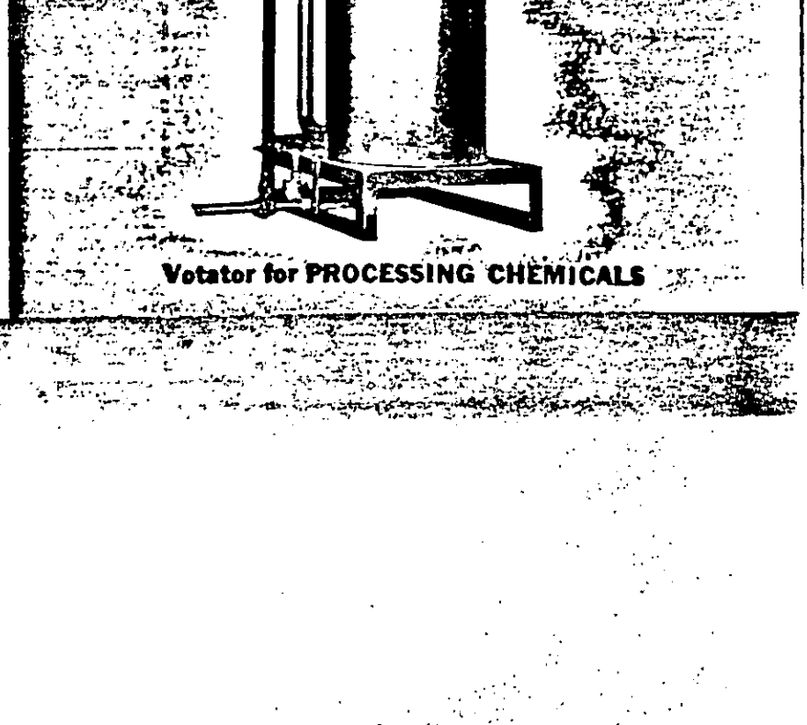


PASTEURIZING

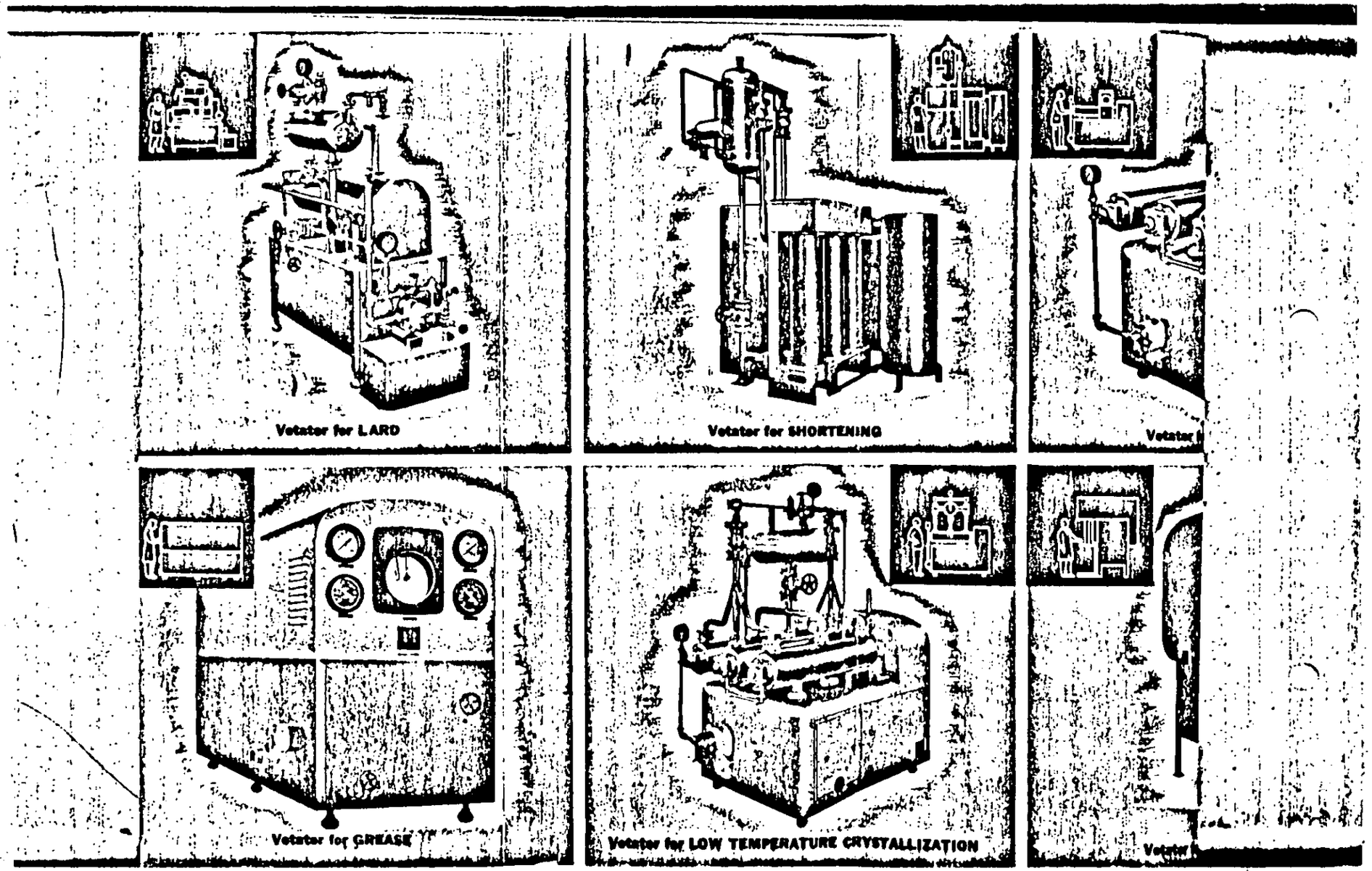


Votator for MARGARINE

PARAFFINE WAX

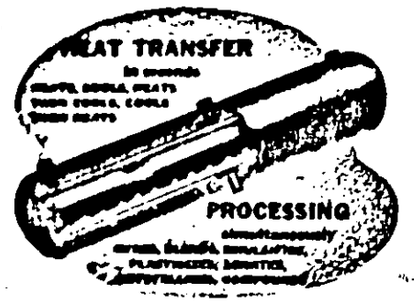


Votator for PROCESSING CHEMICALS


Votator for LARD
Votator for SHORTENING
Votator
Votator for GREASE
Votator for LOW TEMPERATURE CRYSTALLIZATION
Votator

Votator

CONTROLS UNIFORMITY AND PRODUCTION EFFICIENCY IN MANY INDUSTRIES!



THE VOTATOR processes virtually any liquid or viscous material, including the heavier viscous substances and those that tend to adhere to heat transfer surfaces or are otherwise difficult to handle with conventional equipment. For this reason and also because the continuous, closed, controlled operation improves the quality of the finished product, its application is being rapidly extended into many fields. The VOTATOR has had commercial applications in heating the product to more than 600°F and cooling the product to -70°F.

VOTATORS are built in a wide range of sizes to meet either large or small capacity requirements. VOTATOR equipment can be furnished in either carbon steel or special corrosion-resisting materials. Specific data on particular applications available on request.

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TYPICAL Votator UNITS

6/6-150

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HEAT TRANSFER in the VOTATOR

N. Q. Houlton
THE GIRDLER CORPORATION, LOUISVILLE, KY.

Over-all coefficients of 500 to 1150 B.t.u./(hour) (square foot) (° F.) are easily obtainable on water-to-water heat interchange using the Votator. High agitation combined with scraping of the heat transfer wall produces thin films and high turbulence. The result is high rates of heat transfer even though the linear velocity through the Votator is less than 0.1 foot per second. This internal design leads to small size equipment which, in turn, allows high jacket velocities with low pressure drops. The Dittus-Boelter equation is used to calculate film coefficients on the jacket side where the flow is helical. The coefficients thus obtained check the experimental results within 10%. Film coefficients on the Votator side are found to increase less rapidly above a blade peripheral velocity of 13 feet per second for waterlike materials in the particular Votator design used.

THE Votator has been used extensively for processing margarine, shortening, and lard, because crystallization, plastization, emulsification, and heat transfer may be brought about simultaneously. Its main accomplishment is processing, so that little stress has been put on the high heat transfer efficiency of the Votator. This paper deals with a water-to-water heat interchange test in which blade velocity, jacket-water velocity, and throughput rates were studied in relation to the over-all and film heat transfer coefficients.

A laboratory Votator, 8 inches in diameter and equipped with a 2.25-inch diameter shaft and two stainless steel blades, was designed for use with both water and ammonia. For water a sleeve insert cuts the height of the annular space to $^1/_8$ inch, and a baffle seal at one end prevents by-passing the water flow through the ammonia section. Copper tubing ($^1/_8$-inch diameter) inside the sleeve forms a helical water path around the nickel Votator tube. This method is apparently satisfactory since the heat balance—i.e., the quantity of heat flowing as measured from the jacket and Votator sides—checked to less than 2% for most cases. The assembly of this unit is shown in Figure 1.

The method consisted in pumping hot water (175° F.) at about 560 pounds per hour through the Votator and cooling it with a countercurrent flow of cold water (60° F.) on the jacket. Speeds of the mutator (a shaft with blades) were 200, 400, 500, 700, 1000, and 1900 r.p.m. Jacket-water velocities of 4.7, 5.1, 6.5, 7.5, 9.8, 12.9, 18.1, and 25.9 feet per second were tried. These corresponded to pressure drops through the jacket of 0.5, 1, 2, 3, 5, 10, 20, and 40 pounds per square inch. In two cases, 1900 and 400 r.p.m., the throughput rate was changed from 560 to 340 and 1800 pounds per hour, respectively. In all cases calibrated thermometers (0.2° F. subdivisions) were used, and the water rates were determined with a stop watch and scale tank. Thirty pounds of votated water and 86 pounds of jacket water were weighed. Check readings were made to ensure that the equipment had come to equilibrium. The mutator speed was less accurate since the speed indicator could not be reliably read better than ±10 r.p.m.

Three points should be considered for accurate analysis of the data—errors due to (a) movement in stagnant layer of water outside the sleeve insert, (b) any flow by-passing from one helical turn to the next, and (c) expansion and contraction losses at entrance and exit of jacket. This work neglects these errors since they are small and are apparently within the accuracy of the data—namely, 2%.

HEAT BALANCE

The quantity of heat flowing per hour was determined by multiplying the average specific heat by the weight rate of water flow and the temperature change of the water. This change in heat content of water flowing through the Votator and jacket were separately calculated; values checked in most cases to less than 2%. The correction for average specific heat was found unnecessary with the present accuracy.

Table I summarizes the data. Figure 2, constructed from the data of Table I, shows how the quantity of heat flowing, Q, varied with changes in mutator speed for several jacket-water (jw) velocities. It illustrates that the amount of heat flowing through the 0.7 square foot of cooling surface reached as high as 52,000 B.t.u. per hour, with 37,000 B.t.u. as about the average flow. Increased mutator speed increased the heat flow considerably, but the increase at the higher mutator speeds was much smaller, as shown by the following data taken at a jacket-water velocity of 9.3 feet per second (ΔP = 5 pounds per square inch, 2900 pounds per hour):

Mutator Speed, R.P.M.	B.T.U. Removed per Hour	Mutator Speed, R.P.M.	B.T.U. Removed per Hour
300	22,750	700	37,800
500	34,800	1000	38,800

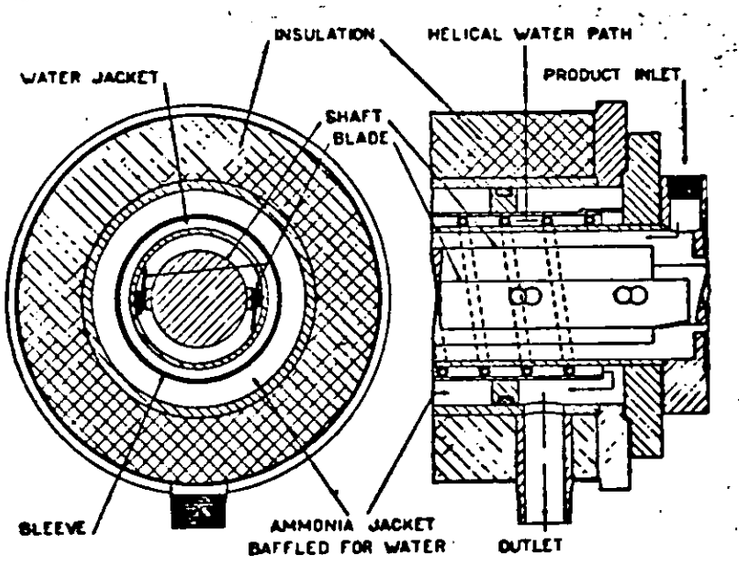

Figure 1. Longitudinal and Cross-Sectional View of Ammonia-Jacketed Laboratory Votator Baffled for Water

In going from 300 to 500 r.p.m., 2050 B.t.u. per hour more could be removed; in going from 700 to 1000 r.p.m., the increase was less than half as much, 1000 B.t.u. per hour. Obviously there should be a selection of the highest mutator speed which is consistent with power load, tube, blade, and bearing wear.

Black dots in Figure 2 indicate the few cases where the heat balance did not check closely. For this reason the values obtained from the votated water side were used where the data were more reliable, since low rates and large temperature differences existed. By this procedure the curves became consistent with one another throughout all this work. Other points on the graph are an average of the data obtained from the jacket and Votator sides.

The bottom curve at a jacket-water velocity of 5 feet per second is smooth, but all other curves show a sharp break at 500 r.p.m. Also, the greatest increase in heat transfer for jacket-water velocities, 9 feet per second and above, occurred in going from 500 to 700 r.p.m.; at 5 feet per second the sharpest increase occurred at 300 to 500 r.p.m. The facts are explained later where it is more clearly shown that full turbulence apparently does not occur until a jacket-water velocity of 7.5 feet per second is obtained.

Table I. Data for Water-to-Water Heat Transfer

Temperature, °F. Vot. outlet	Jacket out	Vot. inlet	Jacket in	LMTD	Rate, Lb./Hr. Vot.	Jacket	Heat, B.T.U./Hr. Vot.	Jacket	ΔP, Jacket	U
300 Revolutions per Minute										
177.2	67.2	113.1	62.8	76.31	884.6	8168	27,410*	33,880	60	700*
178.3	69.6	116.1	62.8	77.94	884.3	5612	28,200*	34,740	20	663*
179.0	71.5	119.2	62.8	79.21	881.7	3993	34,740	34,690	10	636
179.5	74.0	122.7	62.8	80.56	877.1	2890	32,750*	33,330	5	581*
179.8	76.3	124.6	63.0	80.62	882.5	2292	31,790	30,430	3	562
179.9	80.9	128.7	64.7	80.25	881.4	1602	29,340	28,630	1	515
400 Revolutions per Minute										
179.3	71.9	148.9	62.7	86.41	1780	8649	54,430	51,900	20	788
178.8	69.6	111.4	62.8	74.35	873.1	5804	38,580	37,990	20	736
179.3	81.9	136.0	63.0	78.92	881.5	1817	30,810	30,500	1	556
500 Revolutions per Minute										
176.4	66.8	103.1	63.8	67.83	855.3	8042	40,640	40,160	60	851
176.6	70.5	106.2	63.8	69.44	859.3	5721	39,320	38,280	20	798
176.4	72.8	110.0	63.8	71.09	853.3	4060	36,690	36,490	10	737
177.3	75.6	114.2	63.8	73.06	855.3	2192	34,990	34,760	5	682
177.4	77.4	116.4	64.0	73.66	852.3	2457	33,650	32,870	3	645
177.2	79.9	119.2	64.0	74.22	855.3	2039	33,170	33,360	2	631
177.7	82.2	121.9	64.2	75.01	859.3	1712	31,260	30,780	1	590
700 Revolutions per Minute										
179.4	68.1	100.5	63.0	67.83	866.5	8096	44,630*	41,940	60	940*
178.0	70.1	103.4	63.8	68.53	862.3	5780	41,580	42,070	20	871
176.8	72.5	106.9	63.8	69.92	865.3	4060	39,450	39,320	10	806
179.0	76.0	112.2	63.8	73.93	858.9	2274	37,760	37,870	5	741
178.2	78.3	114.8	63.0	73.21	856.2	2215	35,420	35,250	3	691
178.4	80.0	120.2	63.1	74.58	859.3	1624	32,520	32,250	1	630
177.6	84.6	121.6	63.3	74.37	856.3	1466	31,230	31,140	½	583
1000 Revolutions per Minute										
179.6	70.5	102.1	62.5	68.54	863.7	5646	44,410	45,110	20	933
179.4	73.0	105.6	62.5	70.02	865.3	4044	41,670	42,400	10	852
178.5	76.0	109.8	63.6	71.41	863.6	2968	38,840	39,710	5	786
178.6	78.6	113.6	62.6	73.74	869.4	2329	36,970	37,200	3	728
178.6	84.1	119.7	63.7	74.15	866.3	1569	33,330	33,300	1	643
1900 Revolutions per Minute										
178.3	63.7	90.5	66.8	66.08	880.3	7485	51,840	51,630	60	1116
177.5	65.6	93.2	66.6	67.43	871.7	5347	48,060	48,090	20	1018
176.5	69.1	100.0	66.7	70.34	863.4	3623	43,020	49,890	10	880
170.0	61.1	75.7	66.8	51.83	883.8	7506	31,400*	32,650	60	872*
170.8	63.1	79.4	66.8	54.40	887.1	5413	30,640*	34,080	20	806*
171.8	66.1	85.0	66.9	56.56	883.9	3662	30,560*	33,670	10	746*

* Over-all coefficient U based on heat

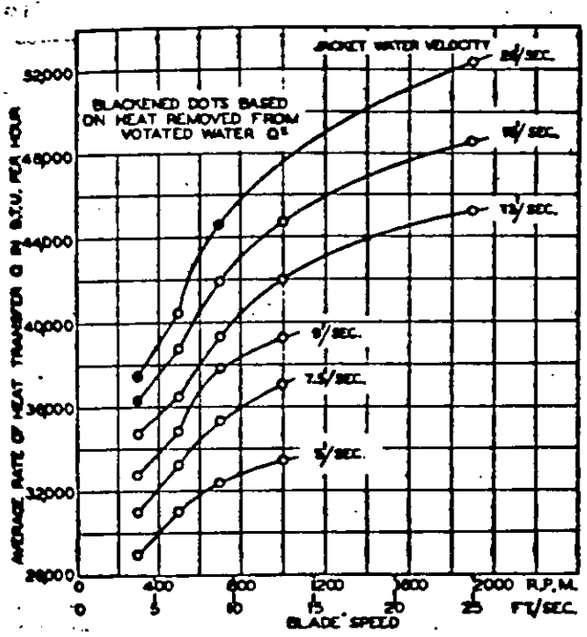

Figure 2. Effect of Blade Speed on Heat Transfer for Several Jacket Conditions

The data at 1900 r.p.m. do not fall on the 26, 18, and 13 foot per second lines. The correct velocities for these are 24, 17, and 11.6 feet per second; consequently, extrapolated values are included in Figure 2 to make the picture complete.

To simplify calculations on the jacket side, an over-all average was made of the average jacket temperatures obtained at various pressure drops. The inlet and outlet jacket-water temperatures were averaged for each Votator condition. Since these averages were quite close for different conditions on the Votator side, they were again averaged (Table II) in order to calculate the physical properties of the jacket water as given in Table III.

A plot of variation in transfer of heat with changes in *jw* velocities for the several mutator speeds showed that, up to 9 feet per second, the heat transfer increased linearly with increased velocity; above this value the increase tapered off. At a mutator speed of 700 r.p.m., 3700 more B.t.u. per hour were transferred in going from a *jw* velocity of 5 to 8 feet per second; in going from 20 to 23 feet per second, the increase was only 2100 B.t.u. per hour. Even the latter amount is considerable, so it is advisable to use the highest *jw* velocity possible and economical with the water pressure available.

Table III indicates that at 800–1000 r.p.m. a velocity of 25 feet per second required 8000 pounds of water flow per hour and a pressure drop of 40 pounds per square inch. Unless the water is to be used later at low pressure for further processing, these conditions are impractical without a booster pump. Values above 9 feet per second should be used in all possible installations since the amount of transferred heat increases at its maximum rate up to this point.

Table II. Inlet and Outlet Jacket-Water Averages

Jacket Pressure Drop, Lb./Sq. In.	Av. Jacket-Water Temp., ° F. 800 r.p.m.	900 r.p.m.	700 r.p.m.	1000 r.p.m.	Over-all Av. Jacket Temp., ° F.
40	65.0	66.3	65.6	..	65.6
20	65.9	67.2	66.5	66.5	66.6
10	67.2	68.3	67.7	67.8	67.8
5	68.4	69.7	69.4	69.3	69.2
2	69.7	70.7	70.7	70.6	70.4
2	..	71.8	..	..	71.6
1	73.0	73.2	73.1	73.6	73.5
0.5	..	..	74.0	..	74.0

OVER-ALL COEFFICIENTS

The over-all coefficients were calculated from the average quantity of heat flowing, Q, by the following equation:

$$Q = UA_s LMTD \qquad (1)$$

The amount of heat being transferred per hour, Q, is proportional to the cooling surface area, A_s, and the driving force, $LMTD$.

Cooling area A_s was 0.7 square foot of scraped surface for our unit. This figure was based on the assumption that the flanged heads of the jacket (Figure 1) were only half effective for cooling and that the cooling space occupied by the helical baffle was negligible. Certainly the cooling area will not be appreciably larger than this, and if the baffle does effectively occupy space, the calculated over-all coefficient, U, is on the conservative side. The over-all coefficients were calculated on the basis of effective scraped surface.

Effect of Mutator Speed. The effect of mutator speed in the range 300–1900 r.p.m. on over-all coefficient U is shown in Figure 3. In contrast to the heat quantity curves (Figure 2), these curves are smooth and do not show the pronounced break at 500 r.p.m. Here, as previously discussed, the points at 1900 r.p.m. are extrapolated values. The largest U obtained was about 1140 B.t.u./(hour)(square foot)(° F.), and the average was close to 800. The most rapid change in U occurred at the lower speeds.

The increase in U slowed down after 600 r.p.m. It would obviously be poor efficiency to operate below 600 r.p.m. for this liquids, and as discussed in the section on Heat Balance, it is advisable to use the highest mutator speed consistent with wear and power. The peripheral speed at 600 r.p.m. was 7.8 feet per second. As a result of the high over-all coefficient U obtained by scraping, the size of equipment is small, and high jacket-water velocities and film coefficients can be obtained with small pressure drops.

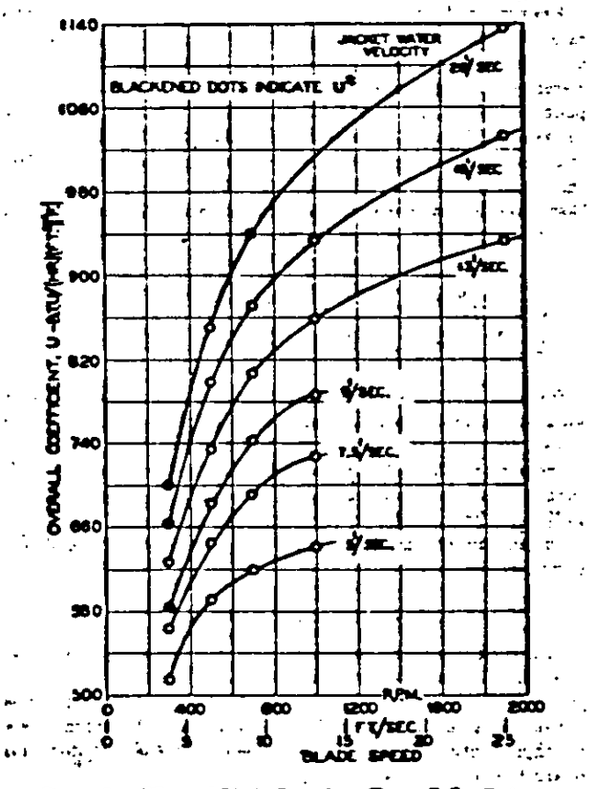

Figure 3. Effect of Blade Speed on Over-all Coefficient of Heat Transfer for Several Jacket Conditions

Table III. Jacket Average Data

(Annular space = 1.895 × 10^{-3} sq. ft., equivalent diameter D_e = 0.0234 ft.)

300–1000 R.P.M.							1900 R.P.M.				
Pressure drop, lb./sq. in.	Av. temp., °F.	Av. rate, lb./hr.	G, lb./sq. ft./sec.	Density, lb./cu. ft.	Viscosity, centipoises	V, ft./sec.	R_e	Vot. soln., lb./hr.	Pressure drop, lb./sq. in.	Av. temp., °F.	Av. rate, lb./hr.	V, ft./sec.
40	85.6	8096	1612	62.3	1.036	25.88	75,000	580	40	90.25	7485	23.9
20	96.6	5664	1128	62.39	1.024	18.10	53,400		20	81.1	5247	17.08
10	87.8	4038	804.3	62.28	1.012	12.91	38,800		10	83.9	3627	11.6
5	99.2	2921	581.6	62.27	0.987	9.33	28,900					
3	70.4	2347	467.3	62.36	0.972	7.51	23,900	340	40	89	7506	24.26
2	71.5	2039	405.9	62.25	0.955	6.52	21,100		20	80	5413	17.6
1	72.5	1591	316.8	62.24	0.943	5.09	17,000		10	82.9	3662	11.75
½	74.0	1465	291.7	62.22	0.929	4.69	15,000		5	83.6	2540	8.13

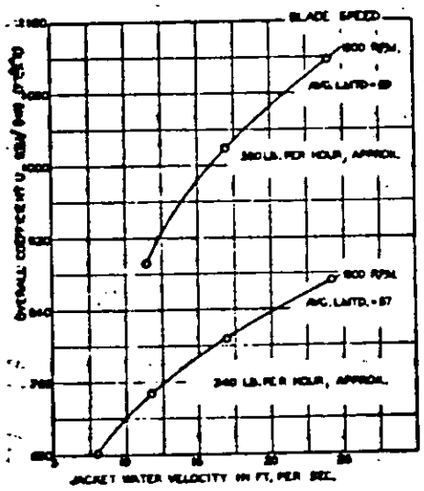

Figure 4. Effect of Changes in Rate and Temperature of Votated Water on Over-all Coefficient

Effect of Changes in Conditions on Votator Side. The rate of votated water was varied in two cases. At 1900 r.p.m. about 580 and 340 pounds per hour were tried at three jacket-water velocities (Figure 4). At 400 r.p.m., rates of 1800 and 560 pounds were used. The data are given in Table I. Figure 4 shows the difference in over-all coefficient obtained. In addition to a change in throughput rate, the log mean temperature difference varied. The following data for 340 pounds per hour were based on the heat change of the votated water, Q_v, since the heat change of the jacket water, Q_j, was inconsistent and erratic:

LMTD	Rate, Lb./Hr.	Mean t_w Temp., °F.	Mutator Speed, R.P.M.	Q	U
69	570	90	1900	48,000	1018
54	340	89	1900	30,600	806

Since the jacket-water temperature and velocity were about equal, the film coefficient would be about the same in the two cases. Consequently, the change had to do with a difference in phenomena on the Votator side. The log mean temperature difference decreased about 20%. The heat load dropped about 36%, and the over-all coefficient was lowered about 20%. The log mean temperature difference is the main contributing factor, as would be expected.

FILM COEFFICIENTS

Film coefficients on the Votator side and jacket side were calculated. It is well known that the heat transfer is mainly dependent on the rate at which the heat can be transferred across the stagnant films which lie close to the metal. Although only a few thousandths of an inch thick, these films act as insulators and retard the flow of heat.

The heat Q which is transferred per unit time from the Votator to the jacket must flow through each resistance (1) Votator water film, (2) metal, and (3) jacket-water film. The heat equation is then

$$Q = h_v A_e (t_v - t_{mv}) \quad (2A)$$

$$Q = h_m A_e (t_{mv} - t_{mj}) \quad (2B)$$

$$Q = h_j A_e (t_{mj} - t_j) \quad (2C)$$

Proportionality constants h_v, h_m, and h_j apply to Votator water, metal, and jacket-water film, respectively; t_v, t_{mv}, t_j, and t_{mj} apply to temperature of votated water, metal surface on Votator side, jacket-water, and metal surface on jacket side, respectively. The area stays constant. This is an arbitrary assumption because U is based on the Votator side; this means only that the h values, even though applying to different films, are based on the area of the inside scraped surface. To convert to the outside area—e.g., $Q = h_v A_e (t_{mv} - t_v) = h_v A_e (t_{mv} - t_v)$. Then

$$h_v A_e = h_v A_e \quad (3)$$

From Equation 2,

$$Q = \frac{\Delta t A_e}{\frac{1}{h_v} + \frac{1}{h_m} + \frac{1}{h_j}} \quad (4) \qquad \frac{1}{U} = \frac{1}{h_v} + \frac{1}{h_m} + \frac{1}{h_j} \quad (5)$$

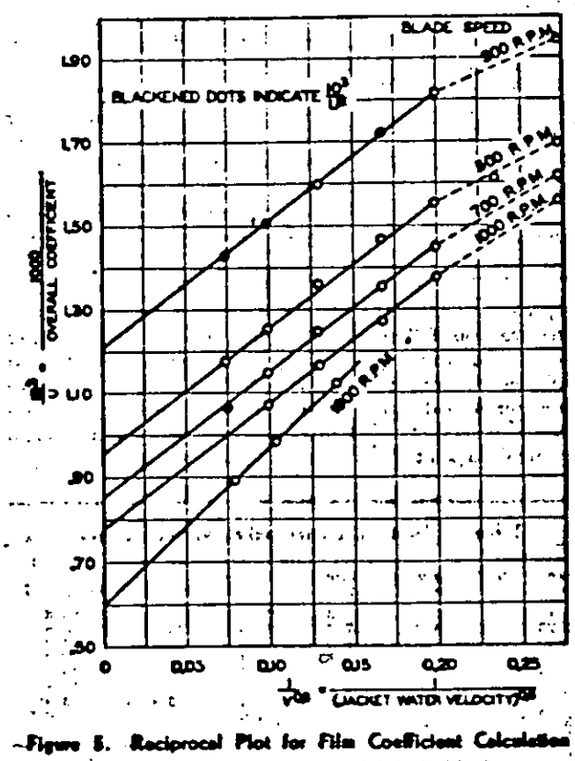

Figure 5. Reciprocal Plot for Film Coefficient Calculation

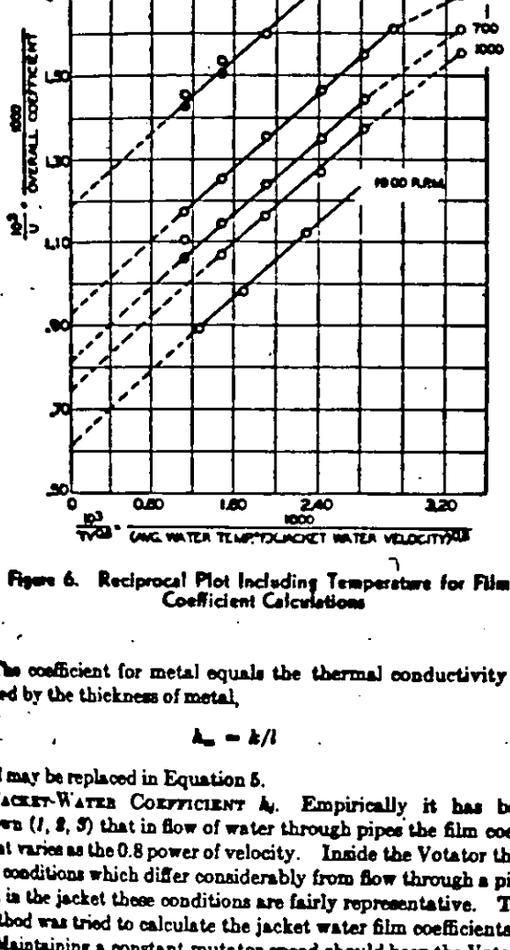

Figure 6. Reciprocal Plot Including Temperature for Film Coefficient Calculations

The coefficient for metal equals the thermal conductivity divided by the thickness of metal,

$$h_m = k/l \qquad (6)$$

and may be replaced in Equation 5.

JACKET-WATER COEFFICIENT h_j. Empirically it has been shown (*1, 2, 3*) that in flow of water through pipes the film coefficient varies as the 0.8 power of velocity. Inside the Votator there are conditions which differ considerably from flow through a pipe, but in the jacket these conditions are fairly representative. This method was tried to calculate the jacket water film coefficients.

Maintaining a constant mutator speed should keep the Votator film coefficient, h_s, approximately constant, and $1/h_j$ should vary with $1/U$ (Equation 5); since it was shown that h_j varies with $V^{0.8}$, a plot of $1/U$ against $1/V^{0.8}$ should give a straight line for any given mutator speed. Substituting in Equation 5,

$$\frac{1}{U} = \frac{m}{V^{0.8}} + \left(\frac{1}{h_s} + \frac{1}{k/l}\right) \qquad (7)$$

A plot of $1/U$ against $1/V^{0.8}$ is given in Figure 5. A straight line does result so that the assumption of constant h_s is justified. With the exception of 1900 r.p.m. the lines are parallel. The slope is 0.00303 and the jacket-water film coefficients h_j is, therefore, easily calculated.

There is about 5° F. difference in the jacket water used at 1900 r.p.m. and that for the data at 300–1000 r.p.m. This accounts in part for a difference in slope in these two sets of data. If no difference in slope had been obtained, it would have been concluded that temperature did not affect the jacket-water film coefficient, which is known to be false. The slope in this case is 0.00377. The intercepts of these lines from Figure 5 are:

R.P.M.	Intercept	R.P.M.	Intercept
[illegible]	1.208×10^{-3}	1000	0.778×10^{-3}
[illegible]	0.855×10^{-3}	1900	0.867×10^{-3}
[illegible]	0.853×10^{-3}		

The jacket-water film coefficient is calculated from

$$h_j = m/V^{0.8} \qquad (8)$$

Applying this method of calculation, the following results are obtained:

300–1000 R.P.M.				1900 R.P.M.		
Velocity of f_w, ft./sec.	Av. f_w temp., °F.	h_{fo}	h_{fi}	Velocity of f_w, ft./sec.	Av. f_w temp., °F.	h_{fi}
25.9	65.6	4110	4450	23.9	60.2	3350
18.1	66.6	3100	3360	17.1	61.6	2570
12.9	67.8	2350	2550	11.6	62.9	1830
9.3	69.2	1820	1972			
7.5	70.4	1530	1660			

Below a velocity of 7.5 feet per second the curve is no longer straight, and this method no longer applies. The black dots of Figure 5 do fall on the straight line so that the previous use of these values was justified. Since Equation 8 holds only in the turbulent region, it must be concluded that complete turbulence starts around 7.5 feet per second in the jacket of this Votator. From this work there appears to be a transition range in turbulence since Reynolds numbers were high (16,000) even when the jacket water velocity was 4.7 feet per second.

Since the temperature of the jacket water was different for the values at 1900 r.p.m. as compared to those at 300–1000, $1/U$ was plotted against $1/TV^{0.8}$ in order to find out if the values at 1900 r.p.m. would fall into line (Figure 6). The 1900 r.p.m. points fall on a straight line parallel to the others. Therefore we are justified in correcting the value of h_j for temperature differences. The slope is 0.221. The film coefficients thus calculated were used in all later work:

300–1000 R.P.M.			1900 R.P.M.	
Velocity of f_w, ft./sec.	h_{fo}	h_{fi}	Velocity of f_w, ft./sec.	h_{fi}
25.9	3760	4075	23.9	3580
18.1	2840	3080	17.1	2680
12.9	2190	2370	11.6	1980
9.3	1730	1872		
7.5	1480	1600		

Comparison of this table with the one above shows that h_j (300–1000 r.p.m.) decreased about 10% when the temperature correction was applied.

VOTATED WATER COEFFICIENT h_s. The film coefficient on the scraped surface may be calculated by substituting in Equation 5 or 7. Equation 7 gives the following results:

Mutator Speed R.P.M.	Peripheral Speed, Ft./Sec.	h_s for Scraped Surface Fig. 5	Fig. 6	Temp. of f_w °C.
300	3.93	1080	1110	Approx. same
500	6.54	1490	1550	
700	9.16	1760	1870	
1000	13.1	2030	2160	
1900	24.8	3200	3030	Approx. 5° lower

Figure 7. Relation between Blade Speed and Film Coefficient

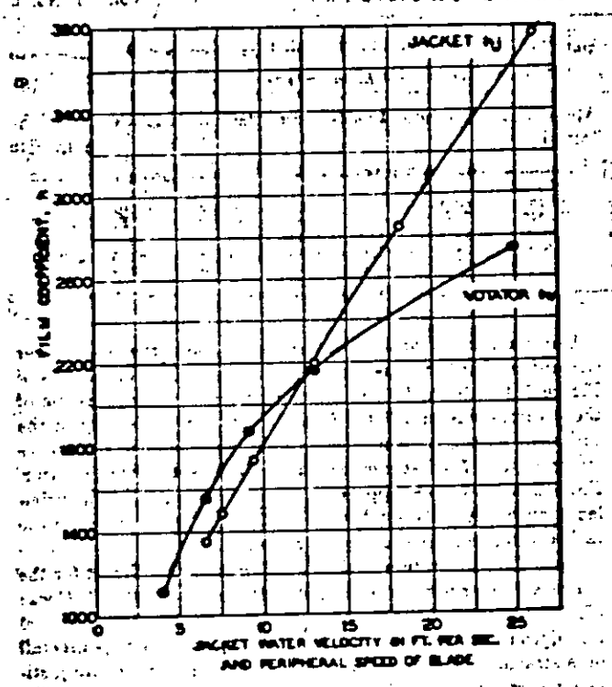

Figure 8. Effect of Velocity on Film Coefficients of Jacket and Scraped Side

The results from Figure 6 are plotted in Figure 7. The latter shows that the relation between film coefficient and mutator speed may be expressed by a straight line on semilog paper when jacket conditions are approximately the same. The equation is:

$$\log (\text{r.p.m.}) = mh_v + \log (\text{intercept}) \qquad (9)$$

$$= \frac{(0.475)h_v}{1000} + \log 87.5$$

The 1900 r.p.m. point falls to the right of the line; this may be due to the fact that the mean temperature of the votated water (137° F.) was lower than that for the 300–1000 r.p.m. points (145° F.). Apparently, when thin liquids are used, a lower mean temperature inside the Votator leads to a higher film coefficient. This is unexpected, since, in general, with other heat transfer equipment the film coefficient increases with higher temperatures. The reason may be that the scraping force of the blade is more effective as the viscosity increases. The most effective equation for h_v is to express it as a function of the properties of the material processed; future work will attempt to set up such an equation.

Comparison of h_v and h_j. It is interesting to see how h_v and h_j vary for a given linear velocity. In the case of h_v the velocity is assumed to be that of the tip of the blade. Figure 8 is a plot of h_v and h_j against velocity. The points on the h_v curve above 1000 r.p.m. are obtained from the extrapolated curve of Figure 7.

Figure 9 was constructed from Figure 8 by reading h_v and h_j at the same abscissa. The equation of this line is:

$$\log h_j = mh_v + \log b \qquad (10)$$

$$m = 0.886/1000; \; b = 324$$

Thus when h_j is known, h_v can be calculated from Equation 10 and vice versa. The effect of changes in operating conditions on this curve is not known. Equation 10 at first appears to have no immediate application, since to determine h_j would, in general, give the experimental means for obtaining h_v. However, the following section shows that the Dittus-Boelter equation can be used to obtain h_j and thus obtain h_v on the basis that Equation 10 holds for other operating conditions.

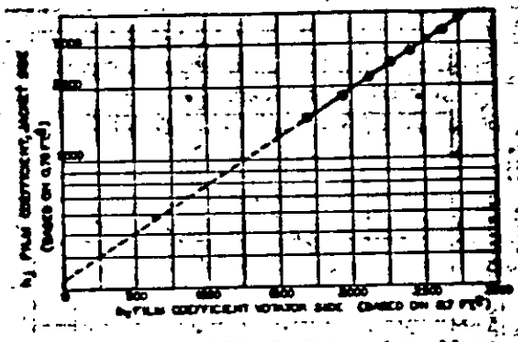

Figure 9. Relation of Film Coefficients during Votation

h_j by Dittus-Boelter Equation. Dittus and Boelter (*U*) were able to show that, for a wide variety of materials (e.g., air and water) flowing in turbulent motion, the film coefficient of heat transfer could be represented by the empirical equation,

$$hD/k = 0.0225(Re)^{0.8}(Pr)^{0.4}$$

where D is the diameter of the pipe; in the case of the Votator jacket it is D_e, the equivalent diameter of the rectangular helix.

The following table summarizes the different water velocities used in the Votator jacket and compares them to the values of h_j obtained from Figures 5 and 6:

Velocity, Ft./Sec.	ΔP	h_j from: U (Fig. 5)	U (Fig. 6)	D. & B. equation
25.9	60	6410	6780	6360
18.1	30	5180	5540	5130
12.9	10	3250	3160	3430
9.2	4	1820	1730	1880
7.5	3	1530	1480	1630

The results are in good agreement. A fairly accurate estimation is therefore available of h_j and of h_v from Equation 10; or if the over-all coefficient has been determined, h_v can be more accurately obtained from Equation 5. Also the calculated h_j falls closer to h_v obtained from Figure 5 than from Figure 6. This is, however, no criterion of selection since A_j is not known with sufficient accuracy, and h_v could easily vary by 10%.

Different Votating Conditions. The data graphed in Figure 4 for two throughput rates (340 and 580 pounds per hour) at 1900 r.p.m. can be treated similarly by the methods outlined. These data are plotted in Figure 10 for $1/U$ against $1/TV^{0.8}$. Here, as previously, the lines are not parallel when $1/U$ is plotted against $1/V^{0.8}$ since the jacket water temperatures were different. The method of dividing by temperature again shows its merit since the slope for the two rates, even though of different jacket-water temperatures, became the same. From Figure 10, the corrected film coefficients are as follows:

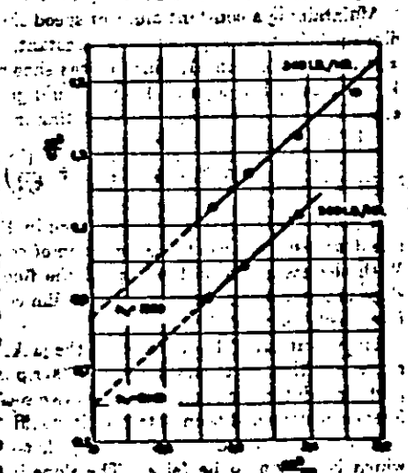

Figure 10. Reciprocal Relation Comparison, Including Temperature, of Different Votating Conditions for Film Coefficient Calculation

340 Lb./Hr., h_o = 1800			880 Lb./Hr., h_o = 3140		
Av. *jw* temp., ° F.	*V* of *jw*, ft./sec.	h_{jl}, Fig. 10	Av. *jw* temp., ° F.	*V* of *jw*, ft./sec.	h_{jl}, Fig. 10
59	24.35	3410	60.3	23.9	3580
60	17.0	2620	61.6	17.08	2680
61.5	11.75	1990	62.9	11.6	1980
63.6	8.13	1540			

Even though the average temperature inside the Votator is considerably different, this alone does not seem to explain the marked change in h_o with change in rate. Further work is necessary to clarify this point.

SUMMARY

1. A good average over-all coefficient is about 800 B.t.u./(hour) (square foot) (° F.). The coefficient varies as follows:

Mutator Speed, R.P.M.	Velocity of *jw*, Ft./Sec.	Over-all Coefficient *U*
300	5	590
1800	24	1120

2. A minimum jacket-water velocity of 7–10 feet per second and a minimum mutator speed of 600 r.p.m. (7.8 feet per second) should be used for efficient operations on waterlike materials. Values greater than these are beneficial and should be used if other factors such as power load, jacket-water pressure drop, blade and tube wear, do not make the operation uneconomical.

3. The film coefficient on the jacket side varies about as follows:

Velocity of *jw*, Ft./Sec.	h_j, B.T.U./(Hr.)(Sq. Ft.)(° F.)
7.5	1800
26	4100

4. The film coefficient in the votated water side varied about as follows:

Mutator Speed, R.P.M.	Peripheral Speed, Ft./Sec.	h_o, B.T.U./(Hr.)(Sq. Ft.)(° F.)
300	3.9	1100
1000	13.1	2200

5. The Dittus-Boelter equation can be used to calculate the film coefficient on the Votator jacket, even though the path is helical. The results check experimental values within 10%.

ACKNOWLEDGMENT

The author wishes to thank Bruce E. Adams for his help with the calculations and figures presented here.

NOMENCLATURE

A_o = cooling surface area, sq. ft.
D_e = equivalent diameter of jacket based on rectangular section
G = mass velocity, lb./sq. ft./sec.
h = film coefficient of heat transfer, B.t.u./(hr.)(sq.-ft.)(° F.)
h_{jl} = jacket-water film coefficient based on inside area as heat transfer wall
h_{jo} = jacket-water film coefficient based on outside area of heat transfer wall
h_m = metal wall expressed as film coefficient
jw = jacket water
LMTD = log mean temperature difference, ° F.
l = thickness of metal
Mutator = shaft with scraper blades
ΔP = pressure drop through water jacket, lb./sq. in.
P_r = Prandtl number = $c_p\mu/k$
Q° = heat transferred, based on heat removed from votated water, B.t.u./hr.
Re = Reynolds number = DG/μ
T = temperature, ° F.
U° = over-all coefficient based on Q°, B.t.u./(hr.)(sq.-ft.)(° F.)
V = velocity, ft./sec.

° See footnote Table I.

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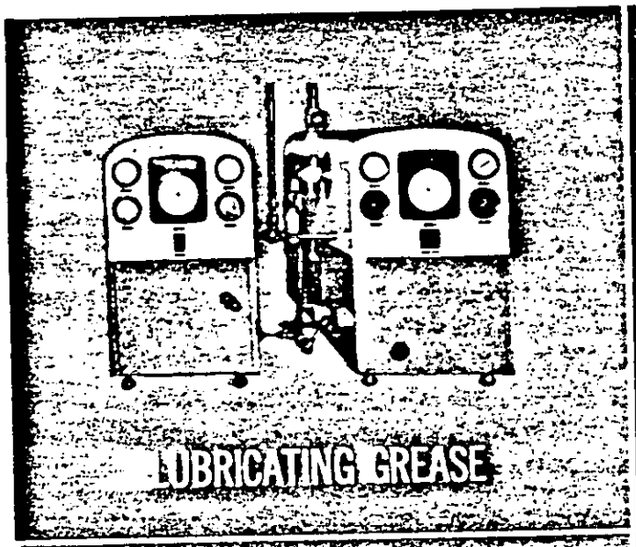
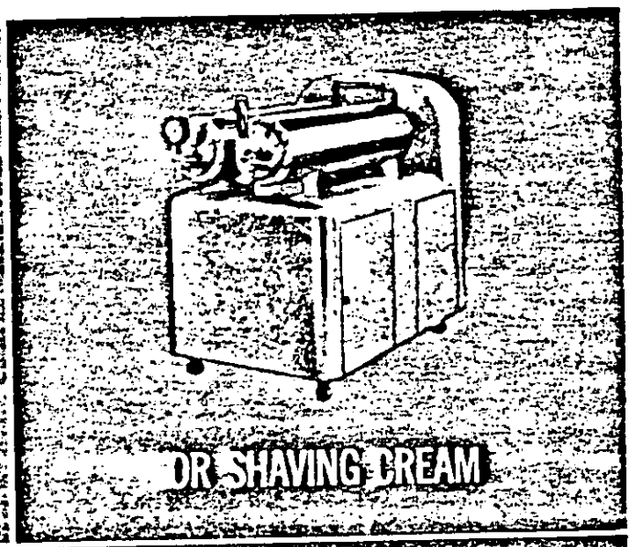
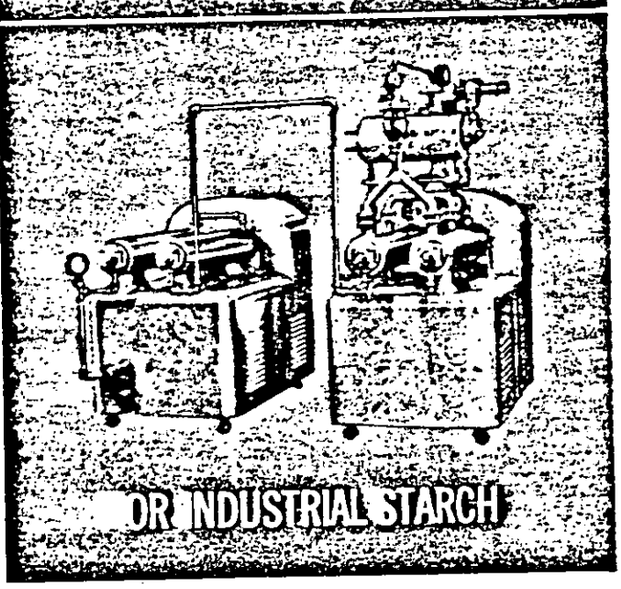
(1) Dittus, F. W., Boelter, L. M. K., *Univ. Calif. Pub. Eng.*, 2, 443 (1930).
(2) McAdams, W. H., Sherwood, T. K., and Turner, R. L., *Trans. Am. Soc. Mech. Engrs.*, 48, 1233 (1926).
(3) Wilson, L. E., *Ibid.*, 37, 47 (1915).

PRINTED IN U. S. A.







OR What viscous material can you process more profitably?

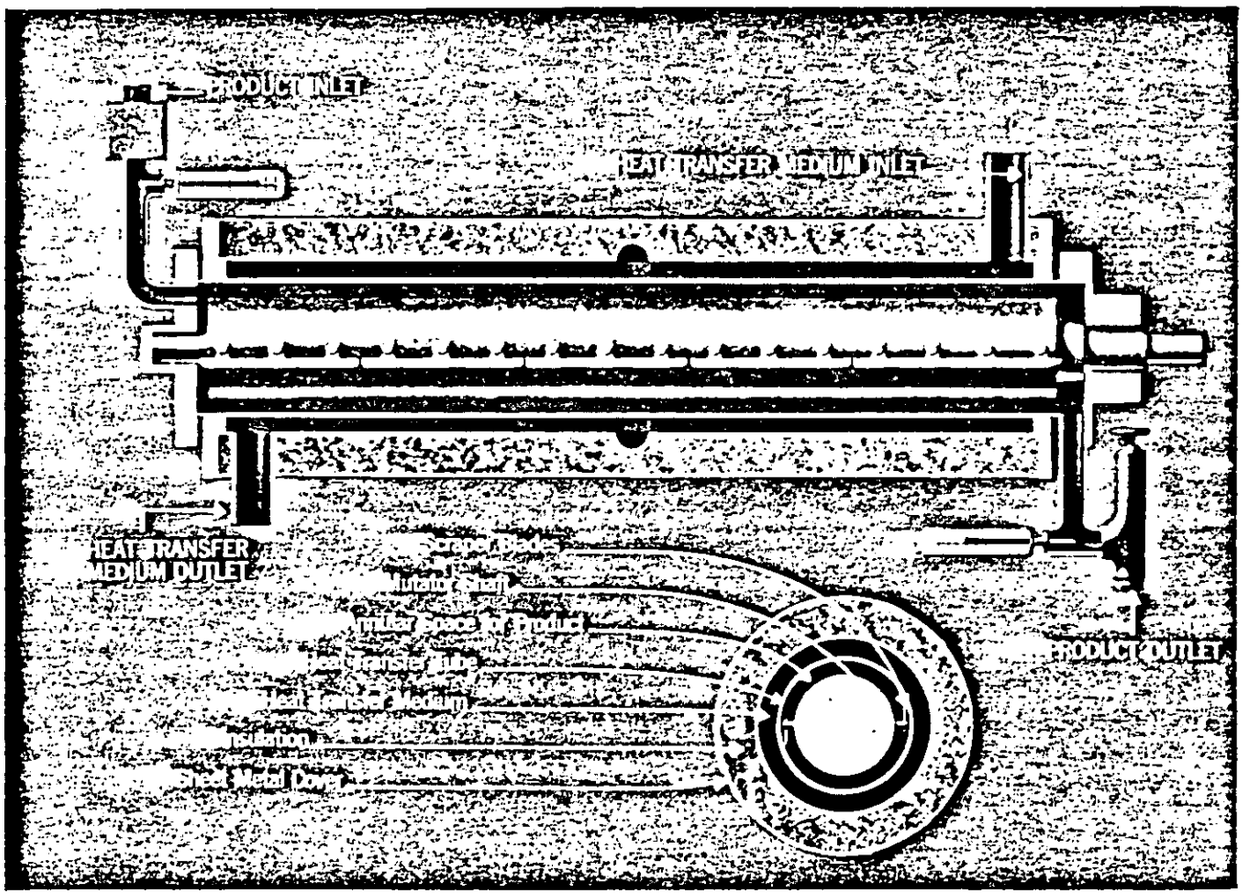
ALMOST invariably the processing of viscous materials involves heating or cooling. Votator equipment provides a continuous, closed system embodying the cleanest, safest, most efficient heat transfer operation for this purpose. Does a dependable, more uniform job in generally less than half the floor space required by batch methods. Makes possible corresponding savings in labor, heat or refrigeration, and overall operating expense for a great cross-section of industry.

The above were picked at random from more than a dozen tried and proved Votator applications. There is also a long list of potential Votator applications which may include your products — the processing of viscous materials covers such a wide range of industrial territory.

If you process anything in viscous form which requires heating, cooling or both heating and cooling, chances are Votator equipment can cut your costs, increase your profits.

Votator
A GIRDLER PRODUCT

6/6/15



VOTATOR Systems have this heat transfer mechanism

VOTATOR equipment is setting new records for efficiency in the processing of liquid and viscous products which require heating, cooling or both heating and cooling.

This exclusive, patented heat transfer mechanism is one of the reasons why.

It is the most effective application known of the basic theory that a clean heat transfer surface together with a high ratio of heat transfer surface to volume of material being treated, does the best heat transfer job.

The material is forced into a narrow, annular passage, there contacts the heat transfer surface as a thin film. Revolving scraper blades constantly expose a clean surface to the material.

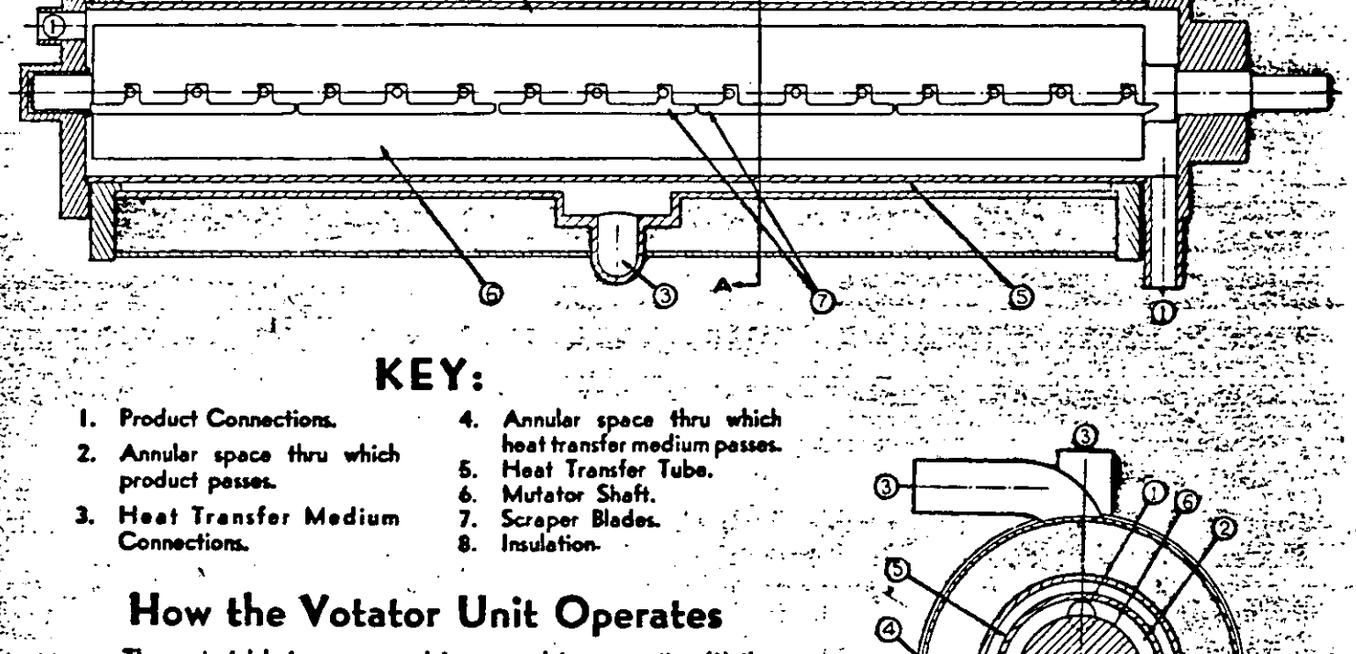
The material is heated or cooled, as the case may be, almost instantly. This takes place under pressure, non-stop, and a remarkable volume is handled in relation to the size of the equipment.

VOTATOR—T. M. Reg. U. S. Pat. Off.

THE GIRDLER CORPORATION, VOTATOR DIVISION, LOUISVILLE 1, KENTUCKY

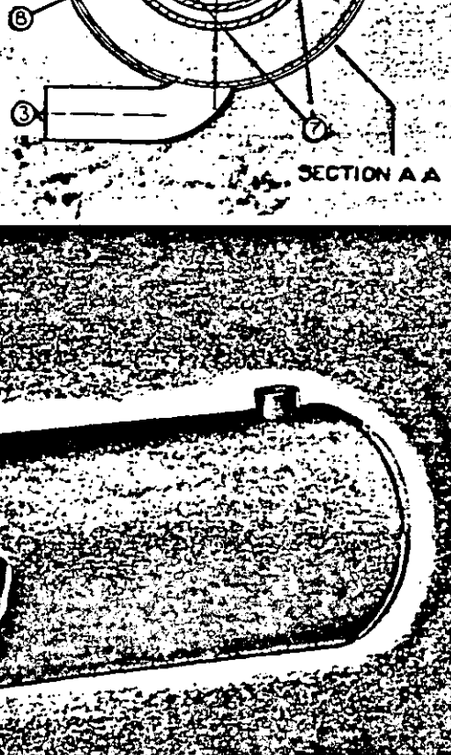
DISTRICT OFFICES: 150 Broadway, New York City 7 • 2612 Russ Bldg., San Francisco 4 • 617 Johnston Bldg., Charlotte 2, N. C.

DIAGRAMS OF VOTATOR MECHANISM



KEY:

1. Product Connections.
2. Annular space thru which product passes.
3. Heat Transfer Medium Connections.
4. Annular space thru which heat transfer medium passes.
5. Heat Transfer Tube.
6. Mutator Shaft.
7. Scraper Blades.
8. Insulation.



How the Votator Unit Operates

The material being processed is pumped in connection (1) thru annular space (2) and out connection (1) at opposite end, depending upon direction of flow desired. The heating or cooling medium enters at connection (3), passes thru annular space (4) and out connection (3), the actual piping arrangement to be determined by the type of heating or cooling medium used and the direction of flow required. The mutator shaft (6) carrying scraper blades (7) is motor driven, causing blades to scrape film from surface of heat transfer tube (5) several hundred times per minute.

(7) 1-15-47

Hydroxylation of acetylenic Hydrocarbons

C.A. 39, 844 (1945)

U.S. Patent 2,347,358 April 25, 1944

Nicholas A. Milas (to Research Corp.).

Unsaturated org. cpds. containing the acetylenic linkage $-C\equiv C-$ such as C_2H_2, monosubstituted acetylenes of the type $R-C\equiv C-H$ and disubstituted acetylenes of type $R-C\equiv C-R_1$ where R and R_1 are univalent organic radicals, are treated with H_2O_2 in an anhyd. inert organic solvent in the presence of a small amount of OsO_4, ReO_4, V_2O_5, MoO_2, or CrO_3 in the absence of an organic base. The resulting products are hydroxy aldehydes and (or) hydroxy acids.

Note - C.A. 31 (1937) to C.A. 39 (1945)

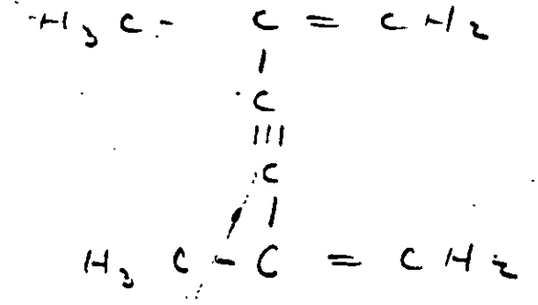
covered as to oxidation (by air or peroxides) of $-C\equiv C-$ with a mild reagent.

Synthesis and Degradation of acetylenic ... Alcohols

C.A. 40, 3394⁸ (1946).

A. Babayan - Bull. Armenian Branch Acad. Sci. U.S.S.R. 1941 no 5/6 (10/11), 121-45 (in Russian)

B. dehydrated 2,5-Dimethyl-2,5-Dihydroxy-Hexyne-3 with Me-⬡-SO₃H to yield (80%)



b.p. 123-124° C
d₄²⁰ 0.7863

... was accomplished by slowly distilling the Hexene from the sulfonic acid under vacuum.

A. BRO..HMAN & ASSOCIATES

JOB: Mettur

SUBJECT: $Ca(OCl)_2$ Process

	German (also Pennsalt)	Mathieson	Columbia
Raw materials	1. Thick lime slurry 2. Cl_2	Lime NaOH Cl_2	Na_2CO_3 Cl_2 Cl_2 Lime
Temp.	30-40°C	< 16°C - 10°C	0°C Carried low
Steps	1. Chlorinate thick lime slurry under pressure 2. $Ca(OH)_2 + 2Cl_2 \rightarrow Ca(OCl)_2 + CaCl_2 + H_2O$ (a good part crystallizes out as dihydrate; remains soluble) 2. Filter 3. Conduct final filtration in a hydraulic press 4. Dry to 1.4% H_2O	1. $Ca(OH)_2 + 2NaOH + 2Cl_2$ (equimolar) $\xrightarrow{below\ 16°C} Ca(OCl)_2 + 2NaCl + 2H_2O$ 2. Below 16°C the triple salt [illegible] $Ca(OCl)_2 \cdot NaOCl \cdot NaCl \cdot 12H_2O$ exists, so after chlorination, the mass is cooled to -10°C 3. Centrifuge triple salt 4. Decompose the triple salt with a chlorinated lime slurry, $CaCl_2 + Ca(OCl)_2$ 5. Dewater the slurry to remove NaCl 6. Dry in vacuo (vacuum drum)	1. $2Cl_2 + 2N$[illegible] $\rightarrow Cl_2O + 2N$[illegible] [illegible] 2. Pass dilute [illegible] into water to dissolve & → HOCl 3. neutralize $Ca(OH)_2$ a[illegible] temp. 4. [illegible]
Principal Equipment	1. Pressure chlorinator 2. Centrifuge 3. Hydraulic press 4. Drier	1. Atmospheric chlorinator 2. Refrig. system 3. Centrifuge (2 sets) 4. Drier	1. Reactor [illegible] $Na_2CO_3 \rightarrow$ [illegible] 2. Chlorin[illegible] (Temp. T-[illegible]) 3. Cl_2O [illegible] 4. Filter [illegible] 5. Spray dri[illegible]
Final Form	Containing [illegible]	1. Powder or coarse granule	

Action of H_2O_2 on unsaturated HC

Berichte 33, p. 2015-18 (1900)

C.F. Cross, C.J. Bevan and Th. Heiberg
(Co-workers with Fenton)

action on C_2H_2

1. add 0.125 gms. $FeSO_4 \cdot 7H_2O$ per 50 cc of diluted (3%) H_2O_2.
2. To this solution add the C_2H_2 (air-free gas) till the reaction is complete. Keep the temp. at 50°-70°C.
3. Data - per 50 cc H_2O_2.

Reaction products

Run No.	H_2O_2 %	$H_3C-COOH$	EtOH	$H_3C-C(=O)-H$
1	0.50	0.24	0.0009	0.0025
2	1.57	0.60	0.0014	0.0011
3	2.81	1.10	0.0015	0.0045
4	4.58	1.26	0.0019	0.0093
5	6.59	1.71	0.0016	0.0118
6	8.72	2.11	0.0010	0.0109
7	11.54	2.28	0.0004	0.0125

Note. - Fenton, J. chem. Soc. 75, 1-11 (1899),
used for acetylene glycol 1. 6.2 g. glycol dissolved in 70 cc H_2O

(2) 11-18-46

4. at temp rise and then let stand for 1½ hrs.
5. separate reaction product by forming a gel:

11-18-46

oxidation of -C≡C- to acid

org. Syntheses 21, p. 38-40.

N. Rabjohn, R. B. Whitlatch, & A. V. McIntosh

oxidize complex aromatic cpd. containing -C≡C- side chain to the corresponding acid.

Data

1. Dissd. 0.1 mole of cpd in 300 cc AcOH
2. add a soln. of dropwise { 37 gm. CrO_3 in 30 cc H_2O plus 400 cc. of AcOH
3. Keep temp at 30°C
4. addition should take 10 min.
5. Keep temp at 30°C for addnl. 10 min.
6. Cool soln. (?°?)
7. Destroy excess chromic acid by adding 30 cc of MeOH - Keep t° below 30°C.
8. Conc. reaction mass by distillation under reduced pressure
9. Distill rapidly at first; then carry out below 30°C; at 10 mm. the conc. requires about 2 hrs.

Oxalic acid from acetylene

J. A. C. S. 45, 795-9 (1923)

M. L. Kearns; L. Heider & J. A. Nieuwland

Data

1. Three flasks are connected in series to a gasometer
2. In each flask is placed a mixture of
   - 900 cc conc. HNO_3 (sp. gr. 1.42)
   - 500 cc H_2O
   - 25 gms. $Hg(NO_3)_2$
3. acetylene and air (or O a gain) are passed into the first flask and then the other two flasks. The first flask is agitated.
4. When the reaction in the first flask has moderated, the first and second flasks are transposed and the process repeated till all three flasks have been exchanged
5. The three mixtures are then combined and C_2H_2 passed in till all evidence of reaction has ceased.
6. The oxalic acid separates in crystalline form. (It is washed with distilled H_2O & dried.) The yield is approx. 1000 gms.

In a 1 l. ... add T...

11-18-46

Oxidation of diethylene glycols

C.A. 31, 5798⁶ [I. Ya. Chem. (U.S.S.R.)]

Tetraphenylene ketone diol is oxidized to

2, 2, 5, 5 - Tetraphenyl - 3, 4 - dioxotetrahydrofuran

5 g. tetraphenyl cpd. dissolved in 25 cc AcOH (glacial)

add 2.56 g. Cr_2O_3 dissolved in 25 cc of 95% AcOH dropwise + stirring.

Ext. furan cpd. with petroleum ether. — yield 51%

Reaction between O_2 and acetylene in the presence of Nitrogen oxides

J. a. c. s. 53, 2962-7 (1931)

S. Lichter

C_2H_2 is oxidized by O_2 thus:

1. Nitric acid vapor is introduced into a gas mixture of 1:1 C_2H_2 and O_2 by first passing the O_2 thru a wash bottle containing 90% HNO_3 and only 0.046% nitrogen peroxide.

2. Data (partial) { 190 cc of 1:1 C_2H_2 - O_2 mixt. contact time = 3 min.

Temp., °C	HNO_3 in mixt., %	Reaction Products: CO_2, cc	CO, cc	H_2 cc	Glycol, gms.
210	1.7	0.3	5.2	0.1	0.0132
230	1.7	1.1	4.2	0.2	0.0130
210	4.1	3.4	19.1	0.8	0.0362
230	4.1	6.2	20.1	0.8	0.0418

3. Principal reaction product is formic glycol, corresponding to 50-60% of the acetylene oxidized.

4-20-47

Bull. de la Société Chimique 25, 346-369 (1911)
Marcel Delépine

Formation & Decomp. of Acetals

1. D. reacted methylal in sealed tubes under the following conditions: Time 3-6 hrs. HCl N/2

lim.*

1 H_2O	0.78	16 H_2O	0.245
2 H_2O	0.69	32 H_2O	0.195
4 H_2O	0.57	64 H_2O	0.061
8 H_2O	0.42	128 H_2O	0.044

* lim = fraction of methylal remaining

2. Soap Hydrolysis takes place best with HCl < H_2SO_4 < AcOH.

3. Other results - cold ✓

1 methylal + 16 H_2O @ r.t. → < 1 part/1000 of methylal reacted in one month

methylal + 16 H_2O @ 14-16°C $M_1 = \frac{M-L}{1-L}$

HCl N		HCl N/2		H_2SO_4 N/2	
Time	M	T	M	T	M
				17	0.92
5	0.77	18	0.78		
28	0.45	47	0.60	69	0.75
216	0.30	168	0.38	191	0.53

4-20-47

methylal + 128 H_2O @ 14-16°C

1 HCl Al		1 HCl Al_6		H_2SO_4 Al	
T	M	T	M	T	M
21	1.64	16	0.97	8	0.96
70	0.24	——		21	0.77
120	0.096	140	0.89	289	0.14

16 H_2O 1 HCl Al l = 0.303

T	M
18	0.72
69	0.26
113	0.09

1[illegible] H_2O 1 HCl Al l = 0.03

T	M
21	0.63
46	0.36
70	0.21

4.2.0-47

J. Phys. Chem. 36, 2325-2337

Decomposition of methylal in hot flask
& among other gases.

E.T. Herrig

methylal decomposed in the gas phase at 410°C
in a quartz vessel, doubling its pressure in
about 81 minutes & then changing slowly
without reaching equil. even after 7 hrs.

actual → pressure nearly 3 times original
at 370°C indicating that the actual
molecule breaks up into three molecules.

4-20-47

Berichte 70, 1713 - 1719 (1937)

Hydrolysis of acetals

J. Loberring & A. Fleischmann

1. $K' = \frac{1}{(t_2 - t_1)\, 0.4343} \log \frac{a - x_0}{a - x_1}$

$\frac{K'}{\text{conc of acid catalyst}} = K_s$ (hydrolysis constant)

{30°C, K = 5.3 x 10^-3, K_s = 3.01 x 10^-4}	$t_2 - t_1$	cc HCl	% CH2O	K
	40	1.28	25.41	5.2 x 10^-3
	245	4.06	74.5	5.45 x 10^-3
	436	4.97	91.0	5.40 x 10^-3
	710	5.46	100.0	—

2.

°C	K_s
10	0.56 x 10^-3
14.17	0.74 "
20	1.22 "
25	1.83 "
30	3.01 "
35	8.58 "

4-21-47

Acta 67, 424 - 429 (1934)

Velocity of acetal hydrolysis

M. H. Palomaa & Aimi Salonen

C_A = acetal normality

C_{H+} = H+ normality

$k = \frac{1}{t_2 - t_1} \ln \frac{(V_1 - V_\infty)}{(V_2 - V_\infty)}$ unimolecular constant

$t_{min} = 1$ minute

FM methylal

$C_A = 0.3065$

$C_{H+} = 0.3307$

$k_2 s = 0.00197$

$k_3 s = 0.00860$

$\frac{k_3}{k_2} = 4.56$

also,

$C_A = 0.3$

$C_{H+} = 0.15$

$k_2 s = 0.00153$

C 57-4307
Ex 21

SAC, Philadelphia

7/10/50

SA T. SCOTT MILLER, JR.

HARRY GOLD, was.
ESPIONAGE - R

EXHIBIT 65-4307-1B-13 (10) (Exhibit 21)

On 6/22/50, GOLD was shown the above material, at which time he stated that the letter on the stationery of the ACHESON COLLOIDS CORPORATION was from his friend, MORRELL E. DOUGHERTY.

PRESTO SALES, the name which appears on the envelope, made acetylene, and the BROTHMAN firm purchased same from PRESTO.

The remainder of the material is concerned with work at the BROTHMAN firm.

TSM:HKF
65-4307

1. Vapor phase esterification

2. Hydration of chlorsulfonic acid

3. Hydrating action of H_2SO_4 @ various temperatures

4. Decomposition temperature of chlorsulfonic acid

5. Rent. agt. work — Dehydration of α-OH-Urbound

ACHESON COLLOIDS CORPORATION
PORT HURON, MICHIGAN

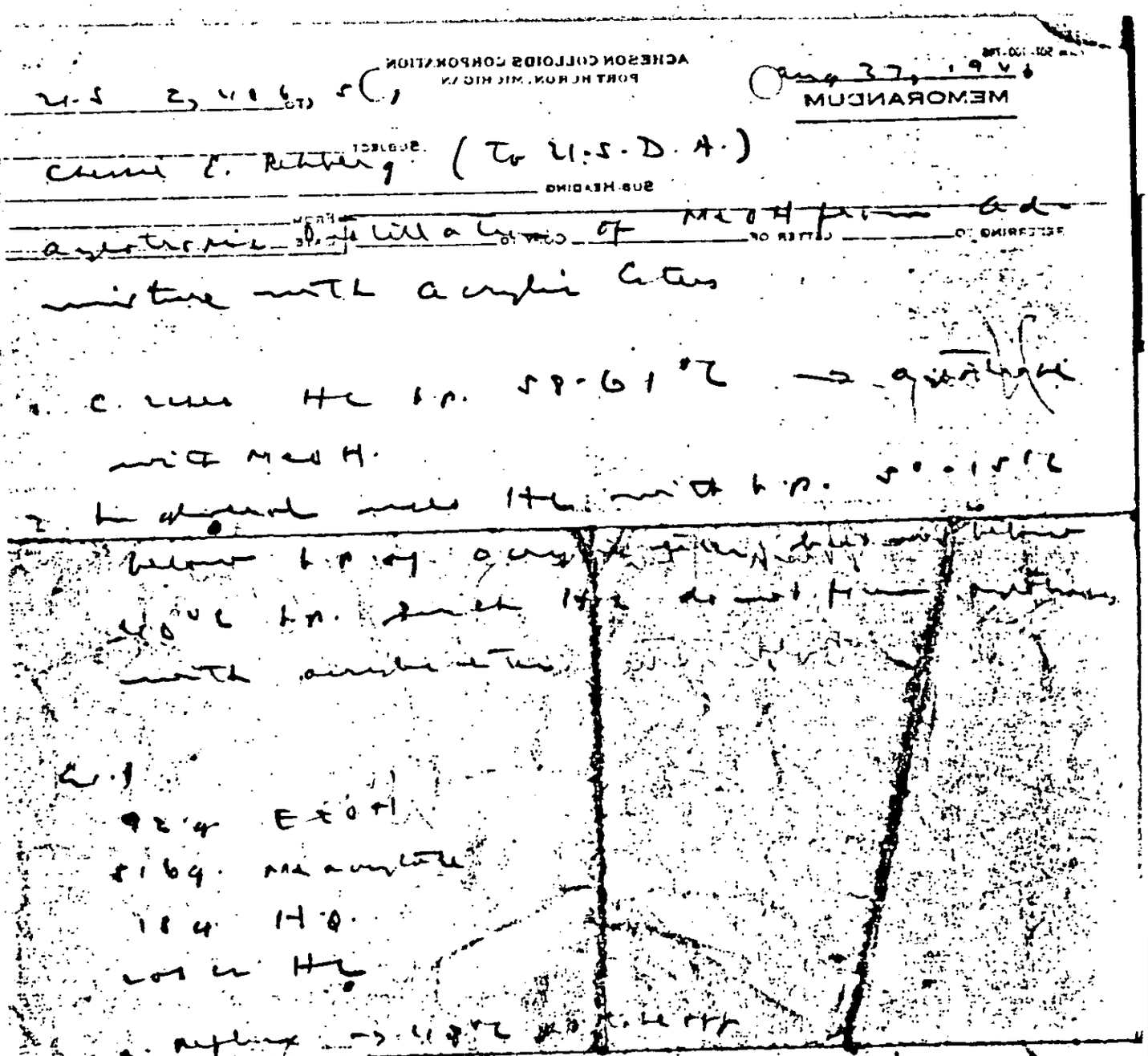
MEMORANDUM

SUBJECT: Chemical Reactions (To U.S.D.A.)

SUB-HEADING

FROM

SUBJECT TO LETTER OF



Form 501-100-765

MEMORANDUM

ACHESON COLLOIDS CORPORATION
PORT HURON, MICHIGAN

To

Subject

Sub-Heading

Referring to Letter of Copy to

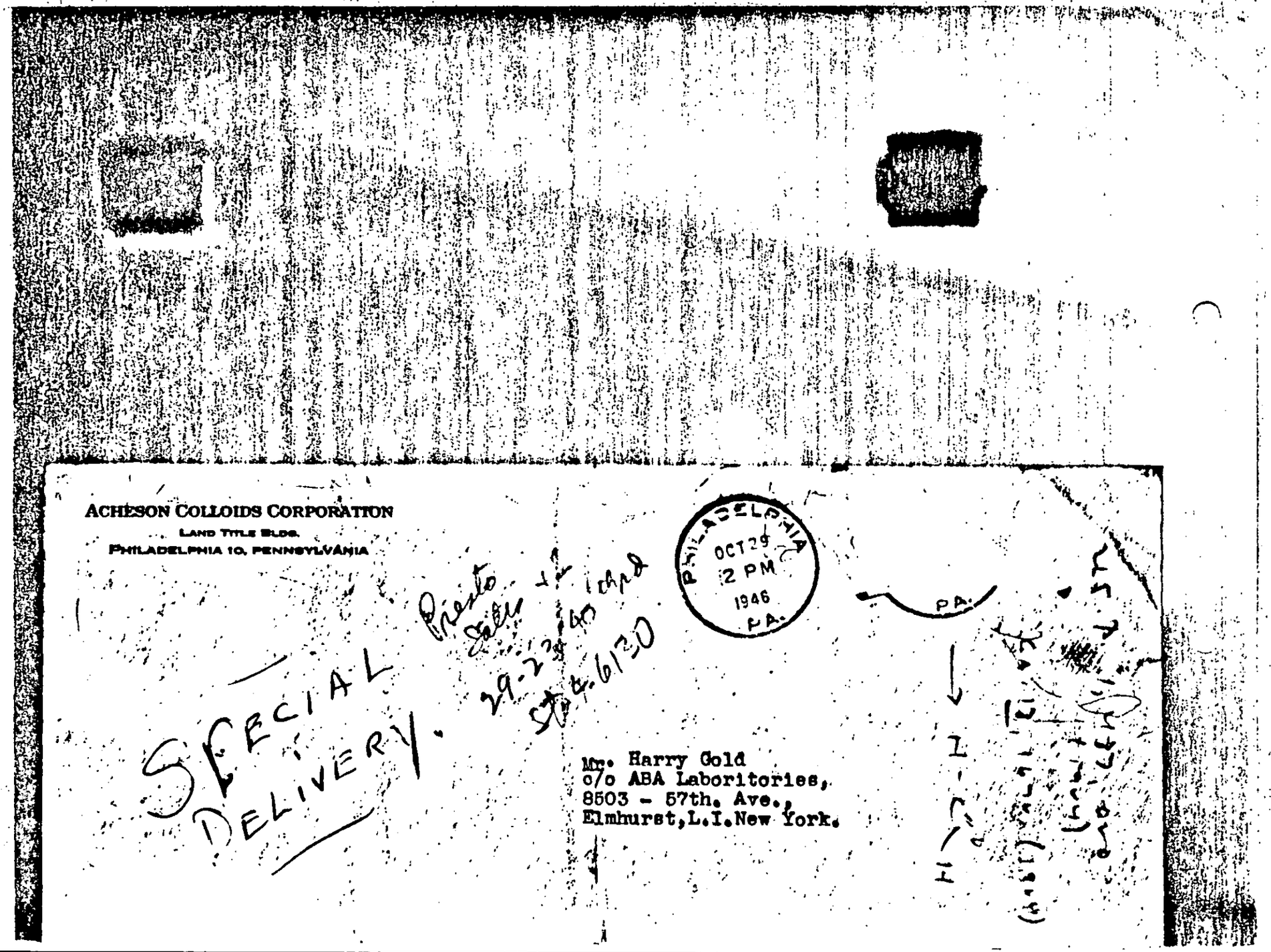
From

Date

Harry -

Wish you luck - see you over the week-end.

Doc



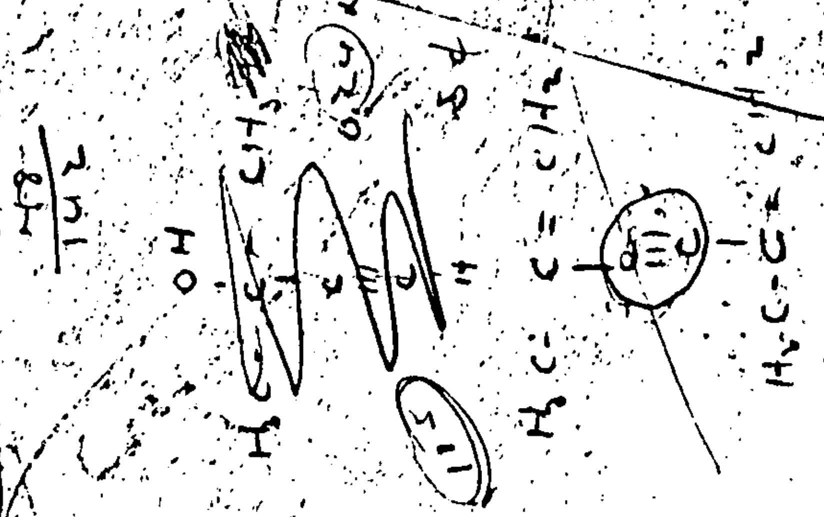
ACHESON COLLOIDS CORPORATION
LAND TITLE BLDG.
PHILADELPHIA 10, PENNSYLVANIA

PHILADELPHIA PA. OCT 29 2 PM 1946

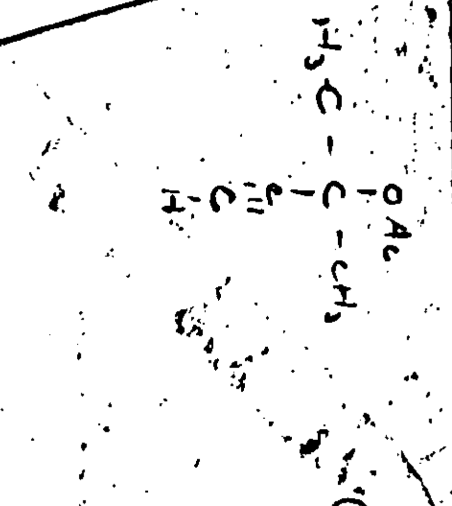
SPECIAL DELIVERY.

Mr. Harry Gold
c/o ABA Laboritories,
8503 - 57th. Ave.,
Elmhurst, L.I. New York.

File
6-6-50



NEW YORK, N.Y. REG. O.P.O.
OCT 29
8:30 PM
1948



①

1 Vacuum take-off Still Head

---

1 Lab. Ozonizer "Hammer Type" capable of delivering ~~—~~ a 5-8% Ozone Stream

1 ~~Drop~~ Jar 8½ x 11 with Desiccator Type Flange & equipped with a Head providing for

a- agitation
b- a gas inlet tube
c- a Take-off tube.

joint
24/40
24/40

U-F Powder

1.9 mol CH_2O : 1 mol. urea
Take up in resin kettle to ms. stock → 50% by wt. resin in H_2O sol.

Knead with α cellulose to impregnate the α cellulose.
use a Σ blade mixer — 50:50 resin

Dry on trays. (→ stirring)

Ball mill (→ 200 mesh)

Catalysts are added - amine salts NH_4Cl

Granulate (convert to granules)
(10 mesh)

3. also add lubricants - glycerol

R.C.

1. [illegible] to [illegible] process
2. α cell.
3. Ball mill
4. Granulates

Solubilities of p-Dichlorobenzene &

o-Dichlorobenzene in C_6H_6

5° C

75 gms. C_6H_6

100.0
− 32.7
67.3 gms. p-Dichlorobenzene
11.8

100.0
− 26.8
73.2 gms. o-Dichlorobenzene

20° C


65-43307-1B413 CLD
65-43307
4-22

SAC, Philadelphia

7/10/50

SA T. SCOTT MILLER, JR.

HARRY GOLD, was.
ESPIONAGE - R

EXHIBIT 65-4307-1B-13 (11) (Exhibit 22)

On 6/25/50, GOLD identified the notebook pages comprising this exhibit as being his handwritten notes in connection with a chemistry course at the University of Pennsylvania, as well as a German course at the same institution.

It is noted that these notes are dated 1932.

TSM:HKF
65-4307

7/3/3 ✓

Localization of Industries

1. H_2SO_4 & Fertilizer
large no. of small plants

2(a) Petroleum Refining
Company leaders in capital invested. Product of low bulk value ∴ refineries are near markets

(b) Rubber
Raw material must be imported. British control market. Has high bulk value ∴ transport costs cut out in controlling factor.
Rubber is a laboratory product throughout. produced in small batches. Do not have to ship tires any great distance to consumer.

3. (a) Salt Industry
where raw material exists

(b) Coal Tar & Chemicals
Located near greatest raw material & greatest demand for them exists.

4. Paper & Pulp. - Produces own products & does not depend on other products.
Factors
1. Raw material
2. Power

3. tremendous quantity of high grade water.

1. ~~[illegible]~~ practically no production of pulp in Phila. ~~[illegible]~~ used to bring in wood, but now bring in as paste in a drum or dry in sheets.

2. Use grain stalks for fairly high grade paper

5. Clay Products - little bulk value, economy of transport. In addition need fire places which require considerable fuel also skilled labor.

Glass industry - even cheap glass needs good sand

Fuel in Ph. C.
See page 3 of text bk.

7. Cotton goods

Capital ratio -

1. If for every $ invested get $ sales capital ratio is one. If capital ratio is high
   - see p. 37 top
   1. accounts receivable not due
   2. stock of finished products is high
   3. equipment obsolete
   4. inefficient utilization of floor space

$6.50
300

next 1. Specific industries
Be able to tell what economic
factors control each industry

labor ?
raw material ?
market ?

concludes 1st. Chap

Chap II

1 statistical analysis of industries

1 capital Gas have large no. small plants. not economical to send gas long distances

large invest for pumping to within 50 mi. radius

natural Gas. only competition

1 petroleum refining

stages Pond

rubber industry the largest skill & labor
clay Products

v. Growth of Industry

3. Localization of Industries
see text p. 19

a market det. by density of population

b. must consider all variables in location of industry. market is greatest factor.

rubber industry near automobile industry

Wed 7/17/3 ✓
Dr. Lukens
Text p. 551-593

Iodometric Processes
Iodimetry

Reaction of iodine with starch is very much influenced by temp. Color vanishes on heating & reappears on cooling. Must be certain that solution is at room temp. or lower.

I_2 may be produced by reaction or may be prepared as a std. solution

$I_2 + H_2SO_3 + H_2O \longrightarrow$

$2HI + H_2SO_4$

Production of blue more easily recognized than vanishing of blue.

Free chlorine can be determined by I_2 method

$Cl_2 + KI \rightarrow KCl + I_2$

I_2 can be determined as above.

Bunsen found that the upper limit of strength of H_2SO_3 was .04% that could be used. Bunsen extended method to Br_2, BrO_3^- ClO_3^- Chromates, chlorates, iodates, vanadates, manganates, ferrates etc.

substitute for H_2SO_3 proposed by Schwartz

$I_2 + 2Na_2S_2O_3 \rightarrow Na_2S_4O_6 + 2NaI$

not a reducing agent sulfite

$Na_2SO_3 \cdot O_2$

displaced by S_2

$Na_2S_2O_3$

reaction is applicable to neutral or faintly acid not. but is not applicable to an alkaline solution even a bicarbonate.

$I_2 + H_3AsO_3 + H_2O \rightleftarrows$

$H_3AsO_4 + 2HI$

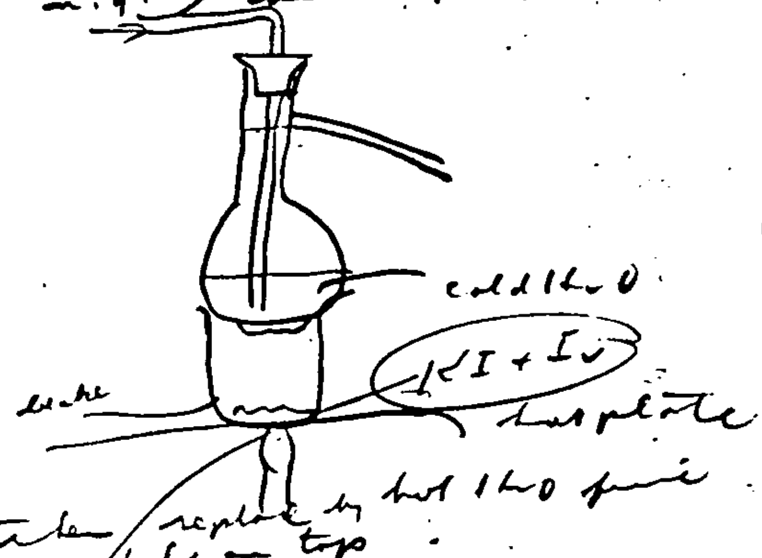
reversible because $[H^+]$ determ which way reaction goes

completing; if have difficulty in getting stopped point best make certain that sol. contains all solvent in sol in which titr. then in sample

2 grams standard / liter.

prep. of std I_2 sol.

commercial I_2 contains Cl, Br, CN, etc. Can be purified (elaborate methods in Ref. 1) Can be prepared



Taken / replace by hot H_2O from crystals on top

to get rid of CN

one sublimation is quite sufficient.

I_2 can be sol by dissol. in H_2O & KI & using a weighing bottle

$I_2 + KI$

6.6.50

If want reaction to go from left to right must take something to remove I_2

If want reaction to go from left to right must increase $[H^+]$ & heat sol. to volatilize I_2

$$I_2 + NaHAsO_3 + H_2O \rightarrow NaH_2AsO_4 + 2NaI + 2H^+$$

Prepare fresh starch solution as we need it, mix starch in cold water & pour suspension into boiling H_2O until we have a clear-fluid starch solution.

Can keep starch sol. in small bottles practically filled to tops & tightly stoppered or else use HgI_2.

may get violet or maroon color as one approaches end point. Can be avoided by completing most of the titration before the end point is reached & then adding starch &

First weigh KI sol. & then add I_2 crystals.

Use a N/10 I sol.

See text for prep.

Can also use As_2O_3 as std. Can be obtained pure & must be sublimed as a little S_e gives it a pronounced yellow color. > S_e red color.

$$As_2O_3 + 2I_2 + 5H_2O \rightarrow 2H_3AsO_4 + 4HI.$$

Weigh out As_2O_3 & dissolve it in $NaHCO_3$ sol.

End point on blue color with starch paste.

about KI in sol. of I_2. about twice weight of KI as we have I_2 in sol.

Wed. Feb. 04 Lec.

Dr. Lukens.

Prep of $Na_2S_2O_3$ sol.

① Sharp end point

② Precautions

(a) $Na_2S_2O_3$ sol not stable

as CO_2 dissolved in H_2O reacts with $Na_2S_2O_3$:

$$Na_2S_2O_3 + 2H_2CO_3 \rightarrow 2NaHCO_3 + H_2S_2O_3$$

$$H_2S_2O_3 \rightarrow H_2SO_3 + \underline{S}$$

H_2SO_3 reacts with Iodine :

$$H_2SO_3 + I_2 + H_2O \rightarrow 2HI + H_2SO_4$$

The sol of $Na_2S_2O_3$ now appears to be stronger than before used

$$2Na_2S_2O_3 + I_2 \rightarrow 2NaI + Na_2S_4O_6$$

∴ sol is stronger than originally made for H_2SO_3 also reacts with I.

CO_2 may be removed by boiling & will kill bacteria & if kept stoppered sol. will not change.

Light has no appreciable effect.

I_2 solutions also are not stable: method must have convenient ~~a~~ for std. of I_2 sol.

An I_2 sol is best made by direct weighing out as described in last lecture & should be used only for standardizing & not for analytical purposes

Pure Cu wire a best test. method for det of $Na_2S_2O_3$

weigh out carefully .2 g sample of pure Cu wire & dis. in HNO_3 ⇒ $Cu(NO_3)_2$. $Cu(NO_3)_2$

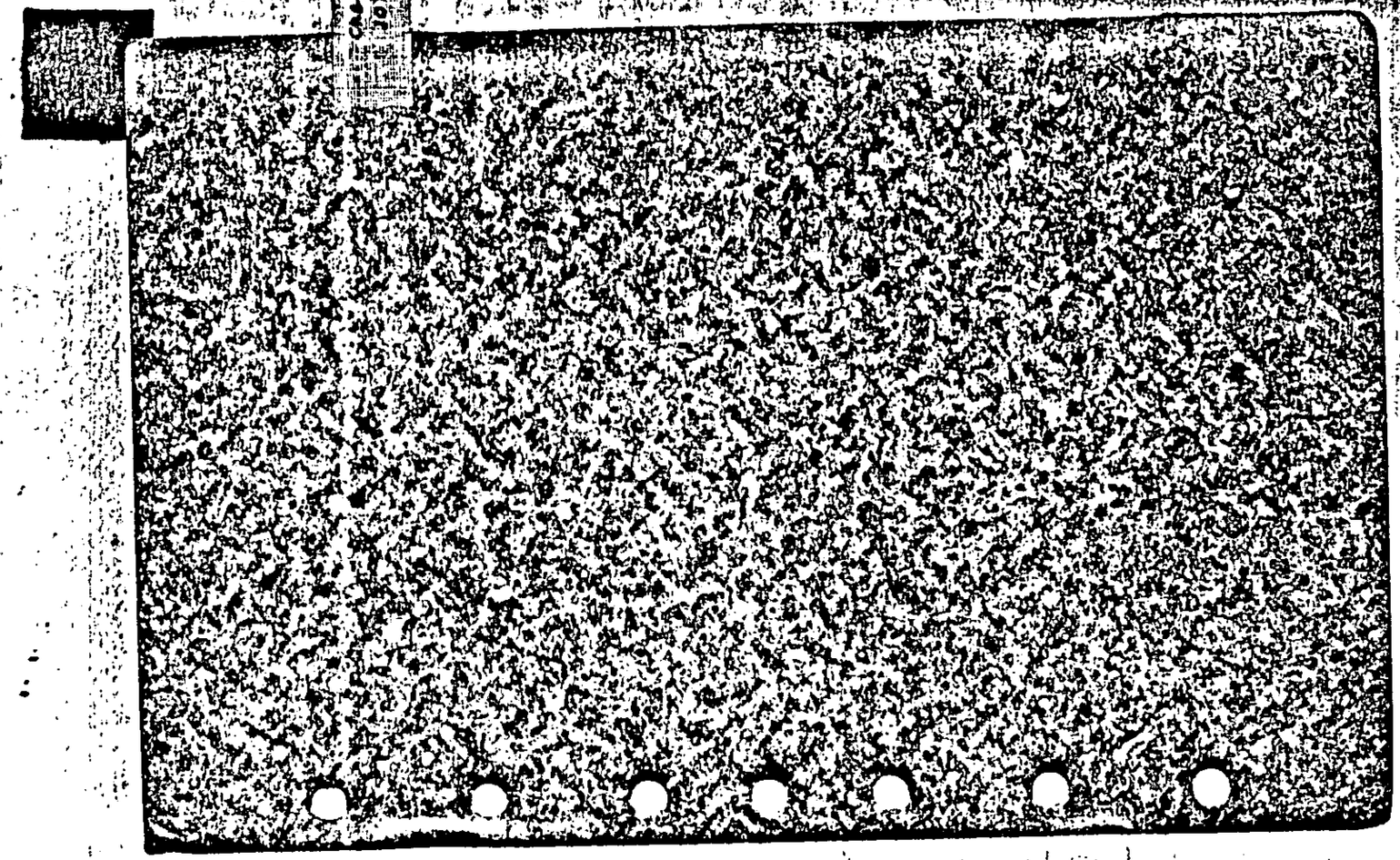
~~[illegible]~~

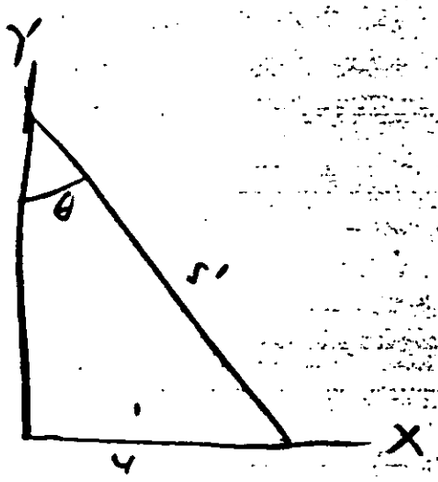
~~[illegible]~~

~~[illegible] NH_3~~

is then heated with ~~[illegible]~~ slight excess forming $[Cu(NH_3)_4](NO_3)_2$. to remove oxides of N as [illegible]

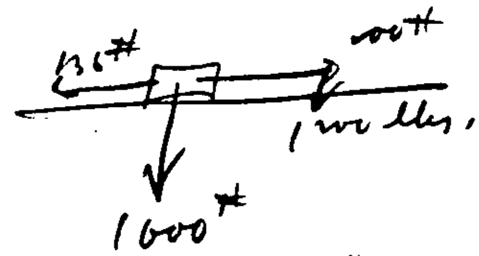
6-6-50





$\bar{X} = r\cos\theta =$

$\bar{Y} = r\sin\theta - 1 = 0$



$f_R = 136^{\#}$

$a = ?$

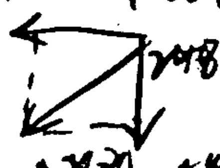
$500 - 136 = \frac{1000}{32} a$

$a = 11.8 \text{ ft/sec}^2$

$F = \frac{1000}{32} \times \frac{32}{28} + 500$ (118 written above 1000)

$= 2118$ lbs. force exerted on roadbed

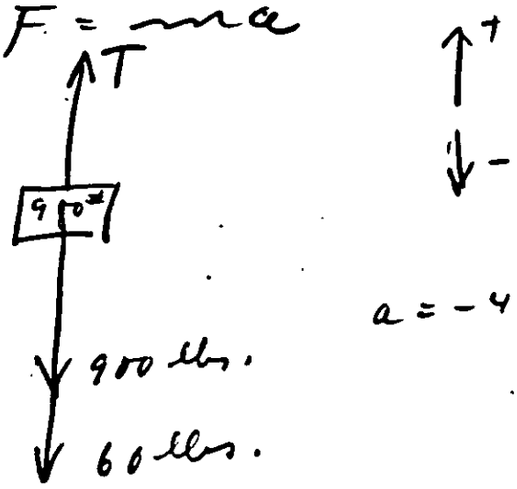
net [illegible] on roadbed = 1000#



square & get resultant

3/4/3 ✓

(~) $F = ma$



$a = -4 \text{ ft/sec}^2$

$(T - 900 - 60) = \frac{900}{3\checkmark}(-4)$

$T = -115.5 + 960$

$T = 844.5$ lbs.

---

uniform velocity upward

$T - 900 - 60 = \frac{900}{3\checkmark} \times 0$

$T = 960$ lbs.

---

uniform velocity downward

$T - 900 + 60 = 840$

$W = 1600$

$m = 100$

$v_0 = 44$ ft/sec

$t = 4$ sec

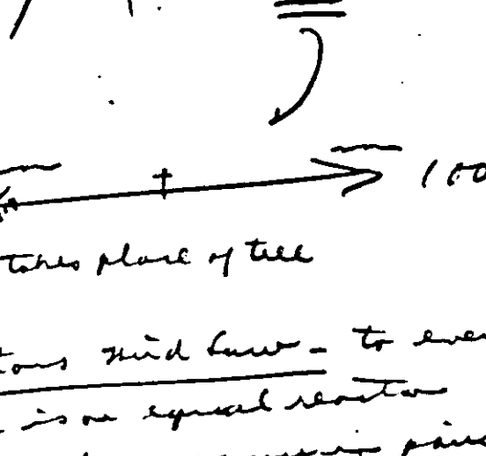
$v_t = 0$

T

$a = +\frac{4}{}$ = 4 ft/sec²

$f = ma$

$T - 1760 = \frac{1760}{32} 4$



100 ← ↑ → 100

on tree's place of tree

Newtons third law - to every action there is an equal reaction in opposite direction forces occur in pairs -

get $\begin{cases} F = ma \\ VV = mg \end{cases}$

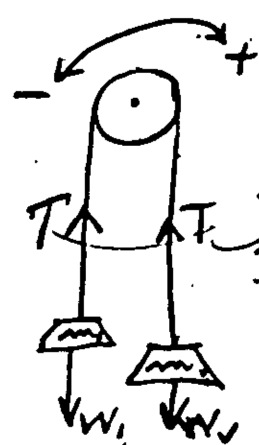
If mass is in lbs. weight will be in pounds

If mass is in slugs. weight will be in

05.9.9

~~[illegible]~~ rev. 1.   3/1/13 ✓

Cg. Grav. unit unit of force is the pull of the earth on a 1 gm. mass. (Moves the 1 gm mass → acc. of to 980 cm/sec²



$m_2 > m_1$, same as pulley in g. relation

accelerations are equal

Cover up 1/2 of diagram & deal with 1 part

accelerat. of gravity & pull must not be

$f_R = m a_R$ change

cause change of s. motion

$T - W_1 = m_1 a$

$W_2 - T = m_2 a$

3/4/3 ✓

① Na_2CO_3 Run 1 B

$R_1 = 0.00$

$R_v = 34.39$

$R_2 = 34.40$

H_2SO_4 Run 1 A

$R_1 = 0.07$

$R_v = 34.45$

$R_2 = 34.30$

② Na_2CO_3 Run 1 B

$R_1 = 0.00$

$R_v = 33.14$

$R_2 = 33.15$

H_2SO_4 Run 1 A

$R_1 = 3.96$

$R_v = 41.90$

$R_2 = 37.86$

3/11/3 J

(1) Na_2CO_3

$R_1 = 0.00$

$R_v = 32.83$

$R_L = 33.84$

H_2SO_4

$R_1 = 0.00$

$R_v = 33.28$

$R_L = 33.65$

(2)

$R_1 = 0.00$

$R_v = 31.40$

$R_L = 31.47$

$R_1 = 0.00$

$R_v = 31.31$

$R_L = 31.73$

2/25/82 w.g #1

R_1

~~4.78~~
~~5.1~~
~~8.2~~

~~1.7~~
~~1.54~~
− 8.000

R_2

3.5488
2.650
6.1988

R_3

pupel
clean + H_2O = 251.99 g
clean − H_2O = 152.00
99.99 g
.32
100.31 ml
22.09C

erlen dry = 92.56 g
erlen + H_2O = 192.39 g
19.8°C = 2.29 ml

3/1/34

19.38
99.83
+ .78
100.61

#1
R_2 = 33.07 cc. Na_2CO_3
R_1 = 0.00
R_c = ~~33.05~~ 33.08

#4 SOV
R_1 = 1.6
R_2 = 33.15
R_c = 31.55

#3
R_1 = 0.06
R_2 = 34.06
R_c = 34.01

#4 SOV
R_1 = 1.0
R_2 = 33.54
R_c = 32.44

~~34-4~~

33.05
- 1.0
31.63
- .09
31.55

33.54
1.0
32.54
.08
32.44

6.6.50

[redacted]

[redacted]

Silica will be examined for
contaminating constituents.
SiO_2 should be perfectly white
in color.

6.6.50

avoid hydrolysis.

H_2ZrO_3 might have some Fe & ... will be colored. Then have to resort to second fusion.

Filter out H_2TiO_3 ~~out~~ from boiling hot sol, wash with Δ H_2O, ~~ignite~~ ignite to ZrO_2 & weigh

ZrO_2 paint pigment which is ~~fine~~ pure white resistant.

/ reoxidize ferrous salt by HNO_3, & precip Fe by NH_3. Ignite Fe to Fe_2O_3

& in filtrate precip Mg as $MgNH_4PO_4$ & ignite to $Mg_2P_2O_7$

H_2TiO_3 might cling to vessel ~~and~~ walls. Need to diss in Δ conc. H_2SO_4 & dilute & rehydrolyze again.

rid of Pt. Saturate sol. with H_2S → brown Pt S_2 (still in cold).

H_2S + { $FeSO_4$ (H₂ sulfide SO_4^{--} ← $SO_4^{=}$), $Ti(SO_4)_2$, $MgSO_4$ }

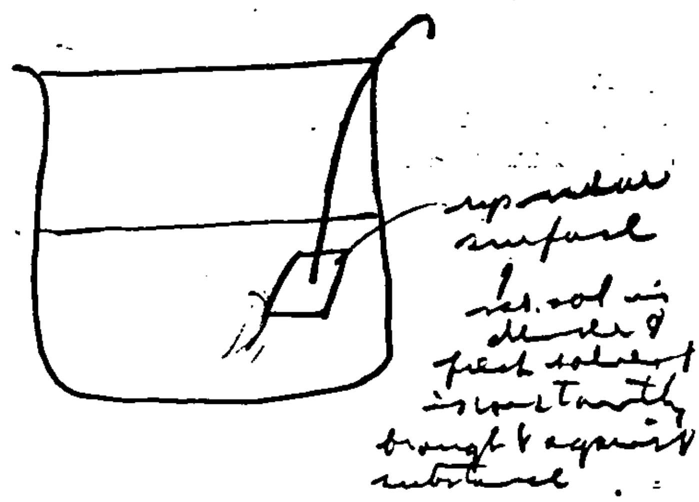
Dilute still further & heat to boiling (dil = 500-700 cc.) to dil. H_2SO_4

Prepare a strong sol. of Na_2CO_3 & add it carefully dropwise to above, by drop kits sol. get FeS i as the FeS dissolves & continue until a drop or two more would produce a permanent precip of FeS. In other words have reduced $[H^+]$ to just enough to keep Fe in sol.

Heat sol to boiling while still passing H_2S thru sol. in erlen flask. i.e. H_2TiO_3 will separate as white ppt. Fe remains as $FeSO_4$ & Mg as $MgSO_4$.

purpose of keeping Fe in ferrous condition is to

quantity to use, & are able to lift it almost all out.



fuse
Cover melt with conc H_2SO_4 & then bring in Pt wire etc. Allow to dissolve in cold (large amt)

$FeO \rightarrow Fe_2(SO_4)_3 + FeSO_4$

$TiO_2 \rightarrow Ti(SO_4)_2$

$SiO_2 \rightarrow \underline{\underline{SiO_2}}$

$MgO \rightarrow MgSO_4$

~~only~~ Filter out SiO_2 wash (with H_2O) & dry.

$KHSO_4$ acts on Pt; ∴ to get

TiO_2 = Rutile

Procedure - .5 g sample or
$KHSO_4$ (comes highly hydrated)

$KHSO_4$ + water of crys. $\xrightarrow{\Delta}$ fluid
+ bubbling & spattering $\xrightarrow{\Delta}$ quiet
drive off H_2O → $K_2S_2O_7$

spattering + (H_2O) $\xrightarrow[\text{quite a little}]{\Delta}$ K_2SO_4 + SO_3

occurs fairly regularly

does the work & converts constituents into sulfates.

First get to, cool, then introduce weighed sample & heat just a little gentle & decomposition will be readily & efficiently accomplished. Keep crucible covered & watch it carefully

Silica will float around in white flocks & any mineral of undecomposed will be dark. Allow to cool.

Pt wire will let solidify to a melt

then apply burner flame

6.6.50 [illegible]

3/2/32 Wed.
Dr. [illegible]

Estimation of Titanium

p. 108, 115, 116, 124, 150, 156, 160, 549A, 597 J+H

where Ti would appear in a qualitative examination.

Ti not in first group - chlorides sol.

Ti in third group. NH_3 lowers $[H^+]$ of solution & get hydrolysis or precip H_2TiO_3. ∴ get white gelatinous precip [illegible] sol. acid which might be mistaken for Ti.

H_2TiO_3 might be mistaken for silica (in ores & minerals)

∴ to get Ti bearing ores into sol.

~~procedure [illegible] bisulphate fusion~~

use for example ~~Menaccanite~~ Menaccanite ($FeTiO_3$)

$FeO + TiO_2$ Ilmenite

$KBr + KIO_3 \rightarrow KBrO_3 + I_2$

(1) Balance

$KIO_3 + 5KI + 6HCl \Rightarrow 6KCl + 3H_2O + 3I_2$

titrate with $Na_2S_2O_3$. This

3 moles I_2 for 1 mole KIO_3.

number of acids present may be [illegible]

$$2CuSO_4 + 4KI \rightarrow 2K_2SO_4 + \underline{Cu_2I_2} + I_2$$

Distill & liberate I_2 into KI or Cu_2I_2 also gives color to starch.

6. Det of Sb.
   by HI.

Sb often alloyed with Pb & sometimes Sn. Sb hardens Pb.

Sb in higher state of oxidation reduced by HI & I_2 is liberated & det. as usual

$$H_3SbO_4 + 2HI \rightleftharpoons H_3SbO_3 + H_2O + I_2$$

In presence of soluble tartrates preventing formation of basic salts similar reaction can be carried out without distillation of I_2.

Have Sb action in salt in presence of tartrate & excess $NaHCO_3$.

Details see text.

7. H_3AsO_4 may also be reduced by HI.

8. MnO_2 (pyrolusite) decomp. liberating Cl_2 (from HCl) & conduct in KI sol & Cl_2 will liberate its equivalent of Cl_2.

$MnO_2 + 4HCl \rightarrow MnCl_4 + 2H_2O$

$MnCl_4 + \Delta \rightarrow MnCl_2 + Cl_2$

$Cl_2 + 2KI \rightarrow 2KCl + I_2$

PbO_2 also.

9. Br_2 est. as Cl_2 in (8)

10. Evaluation of chlorates

$KClO_3 + 6HCl \rightarrow KCl + 3H_2O + 3Cl_2$

$3Cl_2 + 6KI \rightarrow 6KCl + 3I_2$

(11) vanadium oxide $V_2O_5 + 2HBr \rightarrow V_2O_4 + H_2O + Br_2$

6.6.50

[redacted]

cc. titrate with $Na_2S_2O_3$ adding starch toward end.

3 KI does not have to be accurately weighed out as long as we have excess.

Put in dark because light oxidizes HI

(which stood for a while)

Best std. I_2 by As_2O_3 weighed out.

Applications of Std. I_2 Solutions used in oxidation reactions

(1) As alk with $NaHCO_3$

(2) $Na_2S_2O_3$

(3) Sb - sol. alk with $NaHCO_3$ should have tartarate to form complex with the Sb & prevent precipitation of Sb.

(4) SO_2 may be determined only when $[H^+]$ is low otherwise dithionic acid may be the product instead of H_2SO_4.

$$2H_2SO_3 + I_2 \rightarrow H_2S_2O_6 + 2HI$$

∴ SO_2 sol. would appear to be weaker.

$2K_2CrO_4 + 6KI + 16HCl \rightarrow$
$10KCl + 2CrCl_3 + 8H_2O + 3I_2$

$K_2Cr_2O_7 + 6KI + 14HCl \rightarrow$
$8KCl + 2CrCl_3 + 7H_2O + 3I_2$

get chromic salt green or violet & E. quite difficult to recognize end point. Best to have both solutions extremely dilute. pot slightly. MnO_2 ... or Amyl in sol. of $K_2Cr_2O_7$ makes colorless (investigate?). changes from deep green to colorless.

4. Det of Fe

$2FeCl_3 + 2HI \rightleftharpoons$
$2HCl + 2FeCl_2 + I_2$

easily reversible ∴ it is advisable to distill Iodine from sol. into KI & then titrate I_2 with $Na_2S_2O_3$.

3. Cupric salts with iodides:
(see application)
conducted in presence of free HAc, HCl, + HNO_3, H_2SO_4
if I_2 distilled & det in distillate — otherwise

6-6-50
[illegible]

Rec. 1/19/38 - mar

Applications of Iodometric processes

Two Types

① I (element) dis in KI acts as an oxidizing agent & I is liberated

~~(2) I~~

1. Process for estimation of free Bromine

Cause Br_2 to come in contact with excess KI

$Br_2 + 2KI \rightarrow 2KBr + I_2$

& det I_2 by (titr) $Na_2S_2O_3$.

many times other things with Br_2 [illegible] Br_2 water and [illegible] Br_2 is distilled off into KI bulb & titration is made directly in receiving vessel

2. Cl_2 (same as Br_2)

Carry out both of above reactions in acid solution.

3. Est of [illegible] in presence of free acid while in higher state of oxidation.

would dis. Cu which would a
use $Na_2S_2O_3$ ∴ boil sol.
to remove NO_2^- &
add Br₂ water also &
boil off Br₂ to make sure all
NO has been driven off.

Boil of excess of NH_3 &
add HAc to diss any
$Cu(OH)_2$ which may ppt.
& ~~then~~ the sol. ~~now~~
contains $Cu(NH_3)_4(NO_3)_2$
& bring to contact with
about 3 g. KI. I_2 will
be liberated. Run in $Na_2S_2O_3$
sol. until I_2 is almost but
not entirely consumed, then
add starch paste & complete
titration to colorless.

Since CuI remains in
sol. a faint blue color due to
adhesion of starch may remain
after end point.

$$2Cu^{++} + 4I^- \rightarrow Cu_2I_2 + I_2$$

$$I_2 + 2S_2O_3^= \rightarrow 2I^- + S_4O_6^=$$

A std. sol. of $KMnO_4$ sol.
may be used instead of Cu_2I_2

The $KMnO_4$ is added to an acid sol. of KI

~~$KMnO_4$ + KI +~~

$$2MnO_4^- + 10I^- + 16H^+ \rightarrow$$

$$2Mn^{++} + 8H_2O + 5I_2$$ accurately

std. sol. of $KMnO_4$: a vol. of 25–40 cc. 0.1 N, 50 cc. H_2O in it, is run into a vol. of 50 cc. of H_2O containing 3 g KI & 5 cc. of conc. HCl. The mixture should then be placed in the dark for 2–5 min & dil to 300 cc. & titrate with $Na_2S_2O_3$ to be standardized.

also (thio is std.)

$$Cr_2O_7^{--} + 6I + 14H^+ \rightarrow$$

$$2Cr^{+++} + 3I_2 + 7H_2O$$

a std. $K_2Cr_2O_7$ by direct weighing (accurately) out.

25–40 cc of $K_2Cr_2O_7$ run into beaker & add 3 KI + 50 cc. H_2O + 10 cc. free conc. HCl & allow to react in dark, dil to 200–400 cc.

Dilute to 100 cc. & titrate with standard $K_2Cr_2O_7$ to the appearance of the violet blue color that remains unchanged on further addition of oxidizing agent, 10 cc. of $K_2Cr_2O_7$ solution = .05 Gm. which = the amount of 1 N $K_2Cr_2O_7$ necessary to oxidize the indicator, calc. 3. F. from curve.

9.

p. 95 see {
c - Bureau of mines
d - Dept of interior
e - Treasury Dept.
f - Geological Survey
g - Reports of

6-6-50

Estimation of production costs
& Profits
1. Reichert p. 61
a - people lost money when
a scientific study would
have shown how hopeless
proposition was
[illegible] method
2. [illegible]
a - book on research from
economic side [illegible] book.
[illegible] points out
b - It is imp to sales dep to det.
demand
or [illegible] can be expected
as basis for cost estimates.
1. Have careful analysis of
costs of [illegible]
plant before starting
2. make budget.
3. Diff. bet. [illegible] & pilot plant
1. Costs higher in pilot plant

p. 66 & 67
[illegible] budget
Det. costs for all capacities besides
normal.

p 67 Example of process development

Market Surveys
1. Know demand
a. a - Dept of Commerce bulletin
b. Bureau of [illegible]

3/10/37

Market Survey & Reproduction Drawing

Financing new Enterprises methods

1. Sale of additional capital stock

In order to do it must have an organization already set up

2. Long term loans or bonds.
also needs long established company.

3. Short term loans - not so good as they may be called.

4. Financing from employees will be well to have already well organized organization

Profits & Losses

Problems in Research

Research ordinarily classified as overhead usually first to go in depression.

Laboratory is ordinarily a service bureau

Can estimate costs by keeping account of how many

depts & how much you have helped.
not always possible to do this as a little testing of ten do a great service.
∴ record every analysis & show how much each analysis would cost outside

Development Dept.
and get last years costs & estimate this years & what they can hope for in way of a return. If have finished anything estimate its value & state.

summary: you may know value of your dept but management does not unless you put it down in black & white.

Problems of Development problems.
1. personnel (planning for completion
2. [illegible] of problem
3. no of [illegible]

4. App't [illegible] & [illegible]
5. Value of Product

Items for overall Budget
1. Direct salaries & Direct labor
2. Lab. Equip
3. materials & supplies
4. Salaries for direction & supervision
5. Indirect salaries & labor
6. Light, Heat & Power
7. Telephone, Printing, Postage

6.6.50
JPP

8. Travel expenses
9. Memberships dues
10. Bonus & special compensation
11. Insurance
12. Rent for building & tools
13. Gen'l administration overhead.
14. Sold plant expense
15. Miscellaneous expense

fixed expenses

Evaluate all elements

1. Any improvements of existing process
   a. Reduce cost of operation
   b. Improve quality of product.
2. Developed new uses for existing products.
3. Developed entire new process
   a. old product
   b. Brand new product
4. Paid out patents
   a. Sell out to organization
   b. Sell patent outright
5. Supplies ideas for sales organization
   1. "years of Research idea"

Intangible things hard to analyze
1. Help customers & breeds good will.

[redacted]

[redacted]

[redacted]

[redacted]

6.6.50

not known or used by others in this country before his invention thereof, or not patented or described in any printed publication in this country or any foreign country, before his invention or discovery thereof, or more than two years prior to his application, unless the same is proved to have been abandoned, may upon payment of the fees required by law, & other due proceedings had, obtain a patent therefor.

A patent is a contract between two parties
1. Inventor - gets monopoly
2. Public (Gov.) - gives idea to public.

At the end of several years. right ceases & only by special act of Congress can it be renewed

Obtain Patents on
1. arts
2. machines
3. Compounds or composition of matter
4. Designs

3/11/37

Wright - Investigating & Patents (Library)

Rossman - Clerical Patents

1992 - Patents 600000
1911 - " 1,000,000
1944 - " 1,200,000

50 Patents in U.S. give 1,000,000 a year

85% of industrial wealth is protected by patents

Why Want a Patent

1. Can keep it secret
   a. no labor turnover
   b. Integrity of workers
   c. Could stop (keep people out)
   d. Somebody else might get same idea
2. Can get Patent
   1. Have to publish whole idea
   2. Have monopoly for years that patent runs

Sec 8, Art 1. Patents & Copyrights

1. Learn it to Public
2. To protect inventor

Any who has invented or discovered any new & useful art, machine, manufacture or composition of matter, (chemicals)

or any new & useful improvement thereof

7/14/34

Chap II

Development of Ch. C. Products

1. Research & laboratory

Want to know if
1. Basic ideas are sound
2. Is it attractive economically

1. Economics (a) must be available after we have developed idea/process
should search all patent literature & patent literature
(b) If potential market exists

(c) peculiar characteristics with respect to distribution.
a - Rayon
1. Conduct "consumer test"

(d) Financial Risk
1. ∴ must develop step by step.
2. must have ample capital available before starting
(a) concerns have died when
(b) concerns taken over by other concerns who developed fully
3. Have a budget before each step.
4. ∴ have accounting department & estimate expense.

(e) 5. Test Have experimental dept entirely separate from

use of plant

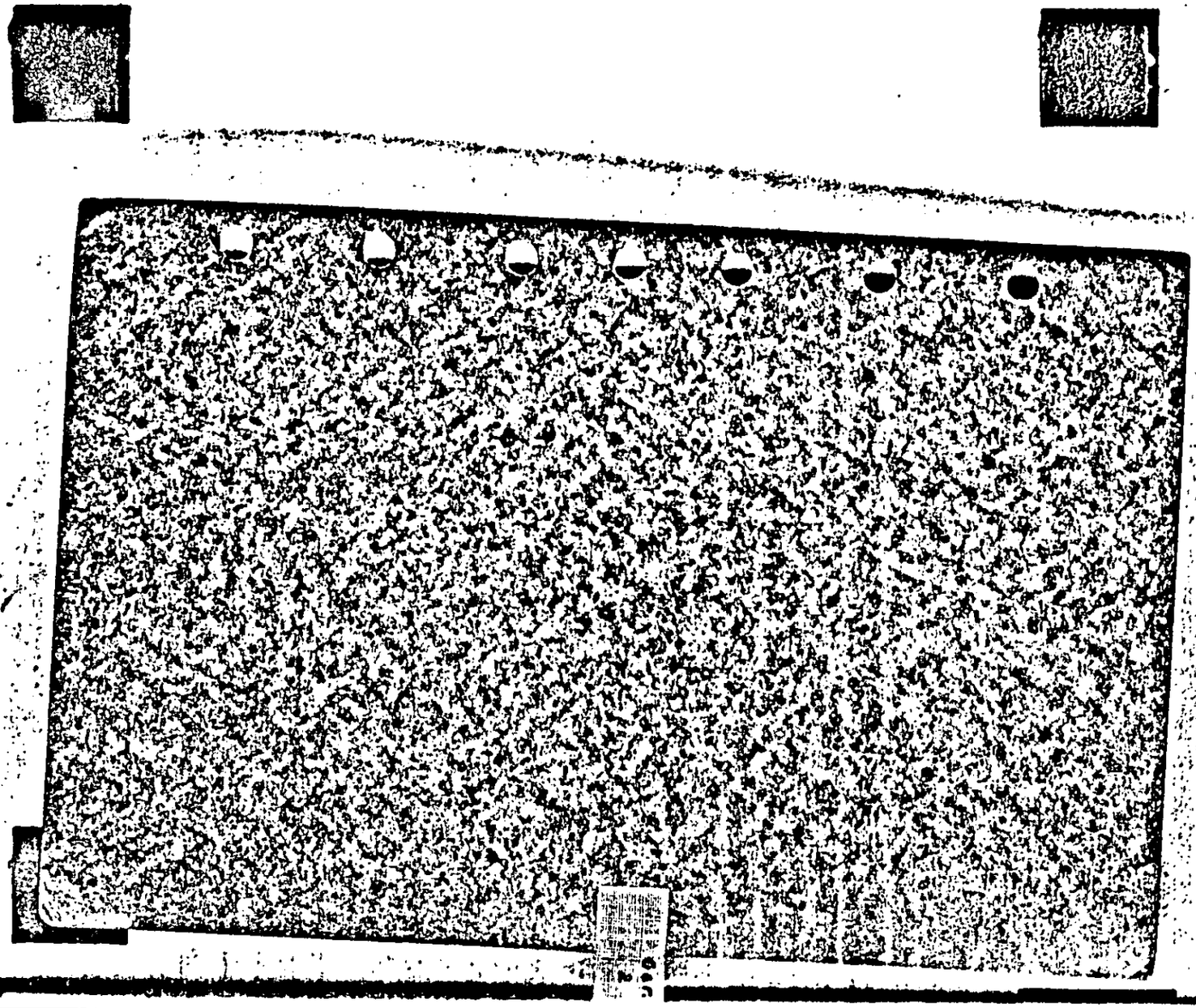
~~Principles of Tech~~
Principles of Tech Development

1. Research usually carried out first in routine laboratory but then it is carried out into plant by chem. engineers

2. Development
3. Full scale [illegible] stage.

method for Ch. E. Process development ([illegible])
1. Beaker on laboratory scale
2. Larger lab operation
3. Large single unit
a - Design of apparatus
(1) [illegible] to [illegible]
b. Knowledge of Designer
(1) Soap. stirring device [illegible] studies first
[illegible] to designer
(2) Requires large organization for specialists in a - & b.
1. Draw conclusions as to materials of construction & design
2. Semi commercial plant
(all efficiency - works)
1. ought not to seriously change important details
5. Pilot Plant (commercial plant)

6.6.50 [illegible]



p. 30
anstreichen, i, i, to paint
die Wachtstube - n, guard-room
das Gildehaus - es ¨-er, guild hall
ungefähr, approximately
das Standbild - es - er, statue
vergoldet, gilded
das Zepter - s - scepter
die Weltkugel - n, globe
erraten, ie, a
der Dom - es - e, cathedral
der Kaiserstuhl - s ¨-e, imperial throne
niederreißen, i, i, to tear down
bedeutungsschwer, portentous
abbrechen, a, o, to tear down
die Rumpelkammer - n, lumber-room
die Merkwürdigkeit - en, curiosity
aufstellen, to place on view, exhibit
die Glasmalerei - en, stained glass
p. 31 das Gemälde - n, painting
ferner, furthermore
heidnisch, heathen
der Opferaltar - s - e, sacrificial altar
viereckig, four cornered
die Sockel - n, dais, base
die Karyatide - n, caryatid
gedrückt, crushing, bending down
stützen, to support
unerfreulich, unpleasant
häßlich, ugly
das Gesicht - s - er, face
ein Gesicht schneiden, to grimace
indessen, however
der Christuskopf - es ¨-e, head of Christ
der Dorn - s - en, thorn
freilich, to be sure, indeed

p. 31
weinerhaft, mournful
das Hinsterben – s, death
gottgeboren, born of God.
der Heiland – s – e, Saviour.
das Leiden – s –, suffering
hineinschmutzeln, to come into
eher, rather
der Lehrsaal – s – säle, lecture-room
der Gasthof – es ¨e, inn, hotel
der Wirt – s – e, host
überflüssig, superfluous
langweilig, tedious
erlösen, to save, rescue
wo? was? where? by what means? why?
how? when?
abgetragen, worn out
hervorgehen, to appear.
erwerben, a, o, to acquire
p. 32
die Vaterstadt ¨e, native town
das Erbbegräbnis – ses – se, family vault
aufgeklärt, 'enlightened', rationalistic
gleichgültig, immaterial
schriftlich, in writing, in 'black and white'.

unheimlich, uncanny
schlau, sly, cunning
kümmerlich, thin
das Äuglein – s –, little eye
verblichen, dim
ängstlich, fearfully, timidly
ich will – – gesagt haben, I didn't mean to say
der Kirchhof – es ¨e, churchyard
ordentlich, regular
streichen, i, i, to stroke

6.6.30
[illegible]

p. 36 ernsthaft, solemn, serious
der Bart - es "e, beard
bei den Chinesen gar, as for the Chinese
die Lust, joy, pleasure
die Ruhestätte - n, resting place
manierlich, refined
die Geige - n, violin
verzieren, to decorate
das Lattenwerk - s, lattice-work
das Porzellanfigürchen - s -, little porcelain figure
der Zetzen - s -, bit
bunt, varicolored
das Seidenzeug - es - e, silk stuff
künstlich, artificial
ansprechen, a, o, to appeal to
desto, the (with comparatives)
das Locken köpfchen - s -, little head of curls
p. 37 herausschauen, to look out
das Parterrefenster - s - ground-floor window
das Glockenblümchen - s - little flower
artig, pretty
die Mütze - n, cap
kümmern (sich) to care, bother
aufgesperrt, gaping
das Maul - s "er, mouth (of animal)
versteinert, petrified
das Glotzauge - s - n, goggle eyes
qualifiziert, petty
der Diebstahl - s "e, larceny
hold, fair, lovely

p. 33 zurückstürzen, to rush back
das Antlitz -es -e, countenance
genau, detailed
durchsichtig, clear
die Verkörperung -en, embodiment
der Sommerabendhauch -es -e, summer evening breath
der Nachtigallenlaut -es -e, song of nightingales
der Rosenduft -es ¨e, scent of roses
der Hausflur -es -e, corridor
rasch, quick
entfliehen, o, o, to escape
beschwichtigend, conciliatory
geheim, secret
der Widerdruck -es -e, answering pressure
unbewusst, unconscious
die Zauberformel -n, magic formula
p. 34 schnurrbärtige Liebenswürdigkeit, familiarity of their moustaches

bezwingen, a, u, to compel
das Logis -, -, room, lodgings
gewähren, to give, afford
jagen, to sweep along
das Ross -es -e, steed, charger
die Mähne -n, mane
das Wasseraufgiessen -s, watering
die übrigen, the rest of
der Schrank -es ¨e, chest, cupboard
mit Brettern zugenagelt, nailed up with boards
durchbrechen, to break through
riesig, gigantic
der Petersschlüssel -s -, St. Peter's key
die Unsterblichkeit, immortality
aufschliessen, to open
6.6.50

p. 34
der Spießbürger - s -, Philistine
die Nachtmütze - n, night cap
die Tonpfeife - n, clay pipe
das Maul - s ¨ er, mouth (of animals)
lau, mild
behaglich, comfortable
das Lebensflämmchen - s -, spark of life
hineinvegetieren, to vegetate into
p. 35 der Geograph - en - en, geographer
verlegen, to change the position of
schmachtend, yearning, longing
duften, to be fragrant
das Menschenherz - ens - en, human heart
unbelauscht, unobserved
stärker fühlt, feels more intensely
sinnig-anmutig, with charming shyness
umhüllen, to envelop
aushauchen, to breathe forth
erzeigen, to show
die Seligkeit - en, bliss
beben, to tremble, quiver
die Augenwimper - n, eyelashes
aufschlagen, to open
schimmern, to gleam, glitter
smaragden, emerald
schnüren, to pack
p. 36 der Ranzen - s -, knapsack
zubringen, zubrachte, zugebracht, to spend
seltsam, strange
begegnen, to happen to
die Angst ¨ e, fear, terror
der Geist - es - er, ghost
der Österreichische Beobachter, the Austrian observer
der Verstand - es, reason
das Gemüt - s - er, soul
zufällig, accidental
behaupten, to maintain, assert
der Vernunftschluss - es ¨ e, process of reasoning

p. 2 die Vernunft, reason
fortwährend, continually
der Vorzug -es, ¨e, excellence, advantage
pflegen, to be accustomed
abstrakt, abstract
transzendentalgrau, gray beyond belief
der Leibrock -s, ¨e, coat
schroff, harsh, angular
grade (gerade), straight
streben, to strive
positiv, positive
herrlich, fine, splendid
p3 das Christentum -s, Christianity
die Broschüre -n, pamphlet
die Unvernünftigkeit, irrationality
die Unhaltbarkeit, untenability
überhaupt, in fact
die Menge -n, quantity
die Vortrefflichkeit -en, excellence
renommieren, to boast
ernsthaft, serious, solemn
die Hinsicht -en, regard, respect
die Achtung, esteem
verdienen, to deserve
bestehen, to consist
der Hauptspass -es, ¨e, best part of the joke

eben, just
einst, once upon a time
der Bediente -n -n, servant
anziehen, to move
beschwichtigend, conciliatory
indessen, however
entsetzlich, horrible
die Darstellung -en, portrayal
das Grauen, horror
durchfrösteln, to send a cold shiver through
6.6.5 [illegible]

p.3] auch, besides
erregen, to cause, produce
schauerlich, gruesome
p.39 zumal, especially
gräslich, terrible
zutragen (sich), to happen
der Fleck - s - e, spot
unwillkürlich, involuntarily
überdies, besides, moreover
zweideutig, dim
unberufen, unbidden
aufrichten (sich), to sit up
erblicken, to perceive
unheimlich, uncanny
schwerfällig, ponderous
gähnen, to yawn
und zwar, and that too
völlig, fully
unterdessen, meanwhile
verfliessen, to elapse
von vorn, from the beginning
keifend, scoldingly
gell, gellend, shrill
ärgerlich, vexed
die Gevatterin - nen, gossip
schlottern, to shuffle
schlappen, to drag, hobble
rieseln, to run
das Mark - s, marrow
das Espenlaub - es, aspen leaf
wagen, to dare
das Gespenst - es - er, ghost
p.37 zusammenkneifen, to pucker together
der Augenkreis - es - e, orbit (of the eye)
spanisches Röhrchen, bamboo cane
stützen, to support

p.39 mundfaul, slow, drawling
die Täuschung -en, illusion
die Phantasie -en, imagination
die Bedingung -en, condition
der Abschnitt -s -e, section
das Hauptstück -es -e, chapter
alsdann, then, thereupon
der Gespensterglaube -ns, belief in ghosts
problematisch, hypothetical
der Syllogismus —, -en, syllogism
der Beweis -es -e, proof
durchaus keine, no ... at all
klappern, to chatter
die Kastagnette -n, castanet
die Seelenangst ¨e, mortal terror
unbedingt, unconditional
der Satz -es ¨e, proposition
spukend, ghostly
die Absurdität -en, absurdity
das Geratewohl, random
die Absicht -en, purpose
p.40 der Hügel -s -, hill
der Nebel -s -, fog, mist
verscheuchen, to dispel
schwirren, to rustle
der Nachtmantel -s ¨, night robe
die Tanne -n, fir
rütteln, to shake
der Schlaf -es, sleep
das Glied -es -er (pl.) figure
frisieren, to dress (the hair), curl
die [illegible] -n, matin
das Wiesental -es ¨er, meadow-va
glitzern, to sparkle

p. 13 trotz, in spite of
ungeheuer, enormous
Kante, f., edge
vermuten, to suppose
( ) Anzahl, f., number
verhindern, to prevent
Verfinsterung, f., eclipse
(7) Bedeckungen, occultations
bedeutend, considerable
( ) XI
Kreisel, m., top
(7) als bewiesen annehmen, accept as demonstrated
p. 14 (4) lässt – sich auffinden, can there not be discovered
regungslos, motionless
Gegenstand, m., object
verursachen, to cause
vorüberfliegen, to fly past
genau, exactly
entgegengesetzten, opposite
(8) als die ist, from that
indes, however
Schluss, m., conclusion
anwendbar, applicable
p. 15 XII
Schwere, f., gravity
Gewicht, n., weight
Anziehungskraft, f., force of attraction
Folge, f., result
Schwerkraft, f., force of gravity
beschreiben, to describe
[illegible], n., the other hand
verwirren, to confuse

p.15 Bezeichnung, f., designation
(1) eng --- verbunden, closely connected
Vorstellung, f., conception
Seil, n., rope
bewirken, to produce
ziehen, to attract
(2) der --- Körpern, with the mutually attracting bodies

unsichtbar, invisible
vorhanden, present
(3) Ferner --- gesprochen, moreover, just as a force is spoken of

fortwährend, continuous
p.16 fortstossen, to push
Ringkämpfer, m., boxer
(4) dadurch - dass - wirft, by his knocking down
(5) sich --- handelt, refers to
stützen, to support
(6) nach - zu, towards
(7) wird - angeschaut, is conceived
(8) welche --- von, which existed independently of

Naturgegenstand, m., natural object
zugänglich, accessible
tatsächlich, actually
Naturwissenschaft, f., natural science
Hauptpunkt, m., chief point
verschaffen, to secure
Naturgesetz, n., natural law
wonach, according to which
(10) irgendwelche zwei, any two whatever
gegenseitig, mutually
allmählich, gradual
66.50 [illegible]

~~[illegible] 1/13/38~~
~~Gore - German Initial Reader~~
~~Edition 1931~~

Ger. 3

p. 23 & 24
6th exercise
1st 23 sentences

p. 25
Idioms & phrases for review
write

Porterfield - German
Short Stories

~~Ger. p. 30 l. 6~~
~~p. 33 l. 12~~

~~[illegible]~~
~~1/29/38 [illegible]~~

~~[illegible]~~
~~[illegible]~~
~~[illegible]~~

$I = \int \sin^{-2}\theta \cos^{m+1}\theta \, d\theta$

(4) $\int (\sin ax)^m (\cos bx)^n \, dx$

$u =$ $\quad dv =$

$du =$ $\quad v =$

$= \int \frac{(\sin ax)^m (\cos bx)^{n-1}}{u} \underbrace{\cos bx \, dx}_{dv}$

(5) $\int \sqrt{ax - x^2} \, dx$

ans. for #4 ed.

Chapter III

art 137
139
140

p. 81 ✓ (b), (c), (d), (h)

✓ (a), (c), (f), (i)

תרגיל 5, (10), (16),

תרגיל 5, (3), a ו b

---

(5) $\int \sqrt{a^2 - x^2}\, dx$

$$\begin{cases} u = \sqrt{a^2-x^2} & dv = dx \\ du = \frac{-x\,dx}{\sqrt{a^2-x^2}} & v = x \end{cases}$$

$$= x\sqrt{a^2-x^2} - \int \frac{-x^2 + a^2 - a^2}{\sqrt{a^2-x^2}}\, dx$$

$$I = -x\sqrt{a^2-x^2} - \underbrace{\int \sqrt{a^2-x^2}\, dx}_{I} + a^2 \int \frac{dx}{\sqrt{a^2-x^2}}$$

$$2I = -x\sqrt{a^2-x^2} + a^2 \arcsin\frac{x}{a}$$

$$I = \frac{x}{2}\sqrt{a^2-x^2} + \frac{a^2}{2}\arcsin\frac{x}{a}$$

6.6.90 סוף

mon. 2/15/32
art 126   review 10-71.
" 127
" 128
memorize formulas
on p. 191, 192 to 13 inc.

art 129
practice diff on p. 195
(10) ?
(12) ✓
(15) ✓
p. 196
(18) ?
(20) ✓
(27) ✓
(28) ✓
(29) ✓
(33) ✓

By integration we mean to find a primitive fct. when the derivative is given

then

$$\frac{dy}{dx} = f(x) \quad (1)$$

Find y

$$\frac{dy}{dx} = \frac{e^x}{x}$$

cannot find y by elementary fcts.

$$y = \int f(x)\,dx \quad (2)$$

$$dy = f(x)\,dx \quad (3)$$

(1), (2), & (3) are all identical

$$y = \int 2x\,dx$$

$$\frac{dy}{dx} = 2x$$

$$dy = 2x\,dx$$

$$y = x^2$$

$$y = x^2 + C$$

6.6.50

suppose $F_1(x) = \int f(x)\,dx$

$F_2(x) = \int f(x)\,dx$

show $F_1(x) - F_2(x) = C$

$\frac{dF_1}{dx} = f(x)$ | $\frac{dF_1(x)}{dx} - \frac{dF_2(x)}{dx} = 0$

$\frac{dF_2}{dx} = f(x)$ | $\frac{d(F_1 - F_2)}{dx} = 0$

* this is only possible when.

$F_1 - F_2 \equiv 0$ Q.E.D.

$\int$ - indefinite integral to show that there are many models of solution

$\frac{d}{dx}\left(\int f(x)\,dx\right) = f(x)$

the derivative of an integral is $f(x)$ itself.

$d\left(\int f(x)\,dx\right) = f(x)\,dx$

$\int\left(\frac{dF(x)}{dx}\right)dx = F(x) + C$

Table of Elem. Integrals
(memorize)

$$\int x^n dx = \frac{x^{n+1}}{n+1} + C$$

(for $n = -1$)

$$\int x^{-1} dx = \int \frac{dx}{x} = \log x + C$$

$$= \log x + \log C = \log Cx$$

$$\int \sin x \, dx = -\cos x + C$$

$$\int \cos x \, dx = \sin x + C$$

$$\int \sec^2 x \, dx = \tan x + C$$

$$\int \csc^2 x \, dx = -\cot x + C$$

$$\int \sec x \tan x \, dx = \sec x + C$$

$$\int \csc x \cot x \, dx = -\csc x + C$$

$$\int dx = x + C$$

6.6.50

$$\int \frac{dx}{x^2} = -\frac{1}{x} + C$$

- $\int \cos ax\,dx = \frac{\sin ax}{a} + C$

$$\int \frac{dx}{\sqrt{x}} = 2\sqrt{x} + C$$

- $\int a^x dx = \frac{a^x}{\log a} + C$

- $\int \frac{dx}{\sqrt{1-x^2}} = \arcsin x + C$
- $= -\arccos x + C$

- $\int \frac{dx}{1+x^2} = \arctan x + C$
- $= -\operatorname{arccot} x + C$

- Rules for elementary integration

(1) $\int A f(x)\,dx = A \int f(x)\,dx$

(2) $\int (f_1(x) \pm f_2(x))\,dx =$

$$\int f_1(x)\,dx \pm \int f_2(x)\,dx + C$$

Illustrative example

$$\int \left(5x^3 - \frac{x}{3}\frac{y_2}{(x'')} + \frac{1}{5}\sqrt[7]{x^2} - \frac{1}{x} + 3\sin 5x + 7e^{-\frac{x}{3}x} + \frac{1}{\sqrt{x}}\right) dx$$

$$= 5\,\frac{x^8}{8} - \frac{x}{3}\,\frac{x^{-10}}{-10} + \frac{1}{5}\,\frac{x^{\frac{9}{7}}}{\frac{9}{7}}$$

$$- \frac{1}{\sqrt{x}}x - \frac{3\cos 5x}{5} + \frac{7e^{-\frac{x}{3}x}}{-\frac{1}{3}}$$

$$+ \frac{1}{x}\log x + c$$

Date 05.7.9

Wed 2/12/82
14–23 [illegible]
p. 192–193.

~~$\int a^x dx$~~

$$\int \sin ax\, dx = \frac{-\cos ax}{a} + C$$

Table of Integrals

$$\int \frac{dx}{a^2+x^2}$$

if a were 1 we would have

$$\int \frac{dx}{a^2+x^2} = \arctan x$$

∴

$$= \frac{1}{a^2}\int \frac{dx}{1+\left(\frac{x}{a}\right)^2} = \frac{a}{a^2}\int \frac{\frac{dx}{a}}{1+\left(\frac{x}{a}\right)^2}$$

$$= \frac{1}{a}\int \frac{d\left(\frac{x}{a}\right)}{1+\left(\frac{x}{a}\right)^2}$$

∴

$$\therefore \int \frac{dx}{a^2+x^2} = \frac{1}{a}\arctan\frac{x}{a} + C$$

$$\int \frac{dx}{\sqrt{a^2-x^2}} = \frac{1}{a}\int \frac{dx}{\sqrt{1-\frac{x^2}{a^2}}}$$

$$\left(\text{Now } \sqrt{a^2-x^2} = \sqrt{a^2\left(1-\frac{x^2}{a^2}\right)}\right)$$

$$= \frac{a}{a}\int \frac{\frac{dx}{a}}{\sqrt{1-\left(\frac{x}{a}\right)^2}} = \int$$

$$\int \frac{d\left(\frac{x}{a}\right)}{\sqrt{1-\left(\frac{x}{a}\right)^2}} = \arcsin\frac{x}{a} + c$$

Derivation
1st formula 19 p. 19v

$$\int \frac{dx}{x^2-a^2}$$

suppose

$$\int \frac{dx}{x+a} = \int \frac{d(x+a)}{x+a}$$

assume constant

$$= \log(x+a) + C$$

6.6.50 BRD

$$\therefore \int \frac{dx}{x^2-a^2} = \frac{1}{2a}\int \frac{2a}{(x-a)(x+a)}$$

$$= \frac{1}{2a}\int \frac{(x+a)-(x-a)}{(x-a)(x+a)}\,dx$$

$$= \frac{1}{2a}\left[\int \frac{x+a}{(x-a)(x+a)}\,dx - \right.$$

$$\left. - \int \frac{x-a}{(x-a)(x+a)}\,dx\right]$$

$$\int \frac{dx}{x^2-a^2} = \frac{1}{2a}\log\frac{x-a}{x+a} + c$$

Illustrative Example

$$\int \frac{dx}{3-x^2} = -\int \frac{dx}{x^2-3}$$

$$= -\frac{1}{2\sqrt{3}}\log\frac{x-\sqrt{3}}{x+\sqrt{3}}$$

$-\log a = \log \frac{1}{a}$

$\therefore \frac{1}{2\sqrt{3}} \log \frac{x+\sqrt{3}}{x-\sqrt{3}}$

ans for this
method formulas
p 196 - 197 practice all
your own

$\int (5x^3 - 7x)^{100} x^2 \, dx$

$u = 5x^3 - 7$

$du = 15x^2 \, dx$

$= \frac{1}{15} \int (5x^3 - 7)^{100} (15x^2 \, dx)$

$= \frac{1}{15} \int u^{100} \, du$

$= \frac{1}{15} \cdot \frac{u^{101}}{101} + C$

$$= \frac{1}{15}\frac{(5x^3-7)^{0.13}}{0.3} + C$$

$$\int \frac{\cos\theta\, d\theta}{\sqrt[3]{\sin^2\theta}}$$

$$u = \sin\theta \qquad = \cos\theta\, d\theta$$

$$= \int (\sin\theta)^{\frac{-2}{3}}\, d(\sin\theta)$$

$$= \frac{\sin^{\frac{1}{3}}\theta}{\frac{1}{3}} + C$$

p. 198 all problems

(74) $u = \log x$

$$\int \frac{u^2\, du}{x} = \frac{1}{6}u^3$$

$$= \frac{(\log x)^3}{6}$$

(7.) $u = e^x + v$

$\int \frac{(e^x + v)^3}{3}$

Ans wrd

art 131

" 13 ✓

practice all integration you can

195, 196, 197

all 199

p. v. 01, v 0 v

table of simple integrals

$\int \tan x \, dx = -\log \cos x + C$

$= \log \sec x + C$

6.6.50

$\int \tan x \, dx = \int \frac{\tan x \sec x \, dx}{\sec x}$

$= \log \sec x + C$

double cut by mult. by $-\sec x$

$\int \sec x \, dx = \int \frac{\sec x (\sec x + \tan x) dx}{\sec x + \tan x}$

$\sec x + \tan x$ in differential of $\sec x + \tan x$

$\log (\sec x + \tan x$

(11) p. 503

$\int \frac{dx}{1 - \cos x} = \int \frac{(1 + \cos x) dx}{(1 - \cos x)(1 + \cos x)}$

$\sin^2 x$

$= \int \frac{1}{\sin^2 x} - \int \frac{\cos x}{\sin^2 x} dx$

$\sin x = u$

$\cos x \, dx = du$

$$= \frac{1}{v}\int \cos^2 v\,v\,dv + \frac{1}{v}\int \frac{v\cos v\,v\,dv}{\sin^2 v v}$$

$$u =$$

$$= -\frac{1}{v}\cot v v - \frac{1}{v\sin v v}$$

$$= -\frac{1}{v}\cot v v - \frac{1}{v}\csc v v$$

$$u = \arctan\frac{u}{a}$$

$$du = \frac{a}{a^2+u^2}\,du$$

$$\int \frac{du}{a^2+u^2} = \frac{1}{a}\arctan\frac{u}{a}$$

$$\int \frac{du}{\sqrt{a^2-u^2}} = \arcsin\frac{u}{a}$$

$$\int \frac{du}{u^2-a^2} = \int \frac{du}{u^2-a^2}$$

$$\frac{1}{u^2-a^2} = \frac{A}{u+a} + \frac{B}{u-a}$$

a word to find numerator

$1 = A(x-a) + B(x+a)$

If $x = a$

$1 = 2aB \qquad B = \frac{1}{2a}$

If $x = -a$

$1 = -2aA$

$A = -\frac{1}{2a}$

$\therefore$

$-\frac{1}{2a}\int\frac{dx}{x+a} + \frac{1}{2a}\int\frac{dx}{x-a}$

$= -\frac{1}{2a}\log(x+a) + \frac{1}{2a}\log(x-a)$

$= \frac{1}{2a}\left[\log(x-a) - \log(x+a)\right]$

$= \frac{1}{2a}\log\left(\frac{x-a}{x+a}\right)$

$\int x^n dx = \frac{x^{n+1}}{n+1}$

$$\int \frac{dx}{\sqrt{x^2+a^2}}$$

$x = a\tan\theta$
$dx = a\sec^2\theta\, d\theta$

Can integrate $\int \frac{\sin x}{y}\, dx$

$$\int \frac{a\sec^2\theta\, d\theta}{\sqrt{a^2\tan^2\theta + a^2}}$$

$a^2\sec^2$

$$= \int \frac{a\sec^2\theta\, d\theta}{+\sec} =$$

$\log(\sec\theta + \tan\theta)$

$x = a\tan\theta$
$dx = a\sec^2\theta$

6.6.50

$$\int \frac{dx}{\sqrt{x^2+a^2}} = \log\left(\frac{\sqrt{x^2+a^2}+x}{a}\right)$$

Known Proof

Do not change sign under radical

In case $= -1$

$$\int \frac{dx}{x^2-a^2}$$

$x = a \sec\theta$

$dx = a \sec\theta \tan\theta \, d\theta$

$$= \int \frac{a \sec\theta \tan\theta \, d\theta}{a \tan\theta}$$

$$= \int \sec\theta \, d\theta = \log(\sec\theta + \tan\theta)$$

$\sqrt{a^2 \sec^2\theta}$

$\sqrt{a^2 \tan^2\theta}$

$$= \log\left(\frac{x}{a} + \frac{\sqrt{x^2-a^2}}{a}\right)$$

$= \log\left(x + \sqrt{x^2 - a^2}\right)$

(1) $p = 0.5$

$$\int \frac{dx}{x^2+1}$$

$x = \tan y$

$$= \frac{1}{\tan y} \int \frac{\sec^2 y \, dy}{\tan^2 y + 1}$$

$p = 0.5$

even probs $= 1/2$

$p = 0.7$

odd probs to 17

6.6.50

2/26/32

$$\int \frac{2x\,dx}{\sqrt{x^2-1}}$$

let $x^2 - 1 = u$

$du = 2x\,dx$

$$= \int u^{-1/2}\,du$$

$$\frac{(x^2-1)^{1/2}}{1/2} = 2(x^2-1)^{1/2}$$

~~[illegible]~~ next I part

~~$2(x^2 - 1)^{1/2}$~~ $+ \log\left(x + \sqrt{x^2-1}\right)$

~~more~~

work to 18 p. 209 & 210

Study ~~[illegible]~~ [illegible] 153

& work a little

p. 211

Integration by Parts
all even Powers

3/11/20

$$\int \arctan x\,dx = x\arctan x - \frac{1}{2}\int \frac{2x\,dx}{1+x^2}$$

$u = \arctan x$

$dv = dx$

$du = \frac{dx}{1+x^2}$

$$= x\arctan x - \frac{1}{2}\log(1+x^2) + C$$

$$\int x^3 \arctan x\,dx = \int \arctan x\,(x^3\,dx)$$

$u = \arctan x$

$du = \frac{dx}{1+x^2}$

$dv = x^3\,dx$

$v = \frac{x^4}{4}$

$$= \frac{x^4}{4}\arctan x - \frac{1}{4}\int \frac{x^4\,dx}{1+x^2}$$

$$x^4 - 1 + 1 \quad \frac{(x^2+1)(x^2-1)}{x^2+1} + \frac{1}{1+x^2}$$

$$= \frac{x^4}{4}\arctan x - \frac{1}{4}\left(\int (x^2-1)\,dx + \int \frac{dx}{1+x^2}\right)$$

$$\therefore \frac{x^4}{4}\arctan x - \frac{x^3}{12} + \frac{x}{4} - \frac{\arctan x}{4}$$

Integration by Parts

(1) $\int x^{-} \{\arctan x,\ \text{arc cot},\ \text{arc sin},\ \text{arc cos}\}\,dx$ ...

$(x^- dx = dv)$

(2) $\int e^{ax} x^{-}\,dx = \int k^x x^{-}\,dx$

$[(k = e^{\log k})$ by def of logarithms$]$

$k^x = e^{x \log k}$

$= \int e^{x \log k} x^{-}\,dx$

$$\int \underbrace{(\log x)^n}_{u} \underbrace{x^m}_{dv}\, dx$$

$u = \log x^n$

$du = n(\log x)^{n-1}\left(\frac{dx}{x}\right)$ (derivative of $\log x$)

$dv = x^m\, dx$

$v = \frac{x^{m+1}}{m+1}$

$$x^{m+1}(\log x)^n - \frac{n}{m+1}\int \frac{x^{m+1}(\log x)^{n-1}\, dx}{x}$$

3(a)

$$I = \int (\log x)^n x^m\, dx$$

$\log x = y$

$x = e^y$

$dx = e^y\, dy$

$$I = \int y^n e^{my} e^y\, dy$$

$$\int e^{ax} x^n \, dx$$

$$\begin{cases} u = x^n ; \; du = n x^{n-1} dx \\ dv = e^{ax} dx ; \; v = \dfrac{e^{ax}}{a} \end{cases}$$

$$= x^n \cdot \frac{e^{ax}}{a} - \frac{n}{a} \int e^{ax} x^{n-1} dx$$

---

(3) $\int (\log x)^n \cdot x^m$ — positive integers if negative $\neq -1$

$\int \frac{e^x}{x} dx$ (integration by parts won't help)

$$e^x = 1 + \frac{x}{1!} + \frac{x^2}{2!} + \frac{x^3}{3!} + \cdots$$

substitute

$$\int \frac{1 + x + \frac{x^2}{2} + \frac{x^3}{6} + \cdots}{x} dx$$

p. 39 & 40 table see
Improved technology
Coke
Cement – also due to larger & more efficient units

Compared with other industries capital
Ch. E. has higher ratio
.71 for 1919 for all industries

// Wages salary & raw material

19% for wage ratio in Ch.E.
& 5% for salaries.

Wage ratio 1/3 for wages to 1/2 for [illegible]
products

Material ratio – almost as important as capital ratio.
Markets fluctuate & is purp[illegible] to buy on a favorable market
means carrying excess of raw material but not too great an excess.
More material ratio of industry in [illegible] is a [illegible] importance
in [illegible] buying

65-4311-1B-13 (12)

65-4307

Ex 23

SAC, Philadelphia

7/10/50

SA T. SCOTT MILLER, JR.

HARRY GOLD, was.
ESPIONAGE - R

EXHIBIT 65-4307-1B-13 (12) (Exhibit 23)

On 6/22/50, GOLD advised that these cards are laboratory notes of BILL ROHOLL, an employee of ABRAHAM BROTHMAN, in connection with work on the methyl methacrylate molding powder process on which BROTHMAN was working.

TSM:HKF
65-4307

Methyl Methacrylate / Molding Powder

U.S. 2,171,765 Sept. 5, 1940 (Röhm & Haas)

Aq. suspension of a finely divided polymeric methacrylic ester and an anti Me at least 10 times as great as that of polymer is polymerized. Granular product.

(CA. 34:199)

Methyl Methacrylate

~~Fr. 847,879~~ June 20, 1939 duPont
~~U.S. 2,161,461 June 6,~~ ✓

MeMe or styrene, with catalyst, is emulsified in H_2O and passed in a continuous manner and in a turbulent flow through a curved tube which is heated at a temp. high enough to effect the polymerization when it passes the heated zone. Examples of emulsifying agents and

plasticizers (eg diamyl phthalate) given

6-7-50

(CA. 34 : 7878)

Methyl Methacrylate

Fr. 841,819 June 20, 1939
U.S. 2,161,461 June 6, 1939 Bm Works (duPont)

Apparatus and process for preparing a dispersion of MeMe. and Emulsion flows in a state of turbulent agitation through a heated tube for a time sufficient to effect polymerization.

Equipt might be adapted for powder formation

CA. 33: 7317

Example 1:

	Parts
MeMe	1200
water	600.
Sodium Lauryl Sulfate BP	1% dissolved in MeMe
H_2O_2 (30%)	1% dissolved in water

The mixture is passed through Colloid mill, and then ~~through~~ heated tubes.

Stable emulsion

Methyl Methacrylate — Molding Powder

US. 2,244,707 June 10, 1941 L.P. Hobbach (duPont)

A product suitable for molding is prepared by subjecting to polymerizing conditions a mixture comly methacrylic acid together with 2-10 times its quantity of Me Me.

(CA. 35: 6075[9])

Methyl Methacrylate

U.S. 2,123,757 Oct. 11, 1939 D.E. Strain (duPont)

MeMe polymerized in granular form by dispersing MeMe (5 parts) in water (25 parts) containing about 0.3 part of a gel-like resin obtained by polymerizing the product of the reaction bet. MeMe and aqua NH_3, and subsequently polymerizing the dispersion while ~~stirring~~ ~~mixing~~.

Methyl Methacrylate

U.S. 2117.371 May 17, 1938 R. Hill (ImpChem. Ind.)

Products suitable for molding or for uniting sheets of glass are formed by polymerization of MeMe and at least 2 other unsatd polymerizable esters (e.g. vinyl acetate). (No emulsion — product pale yellow)

C.A. 32: 5111

Methyl Methacrylate

U.S. 2,121,839 June 28, 1938 D.F. Strain (duPont)

A fluffy powder prepared by dissolving mon. in H_2O-MeOH (not over 72% mon.) and polymg. Note polymer is precipitated in fibrous form. Polymer is separated and monomer adhering to polymer is removed. Powder suitable for molding and for lacquers.

C.A. 33: 6366

Methyl Methacrylate — Molding Powder

Fr. 844.091 July 18, 1939 - Imperial Chem. Ind.

Granular dispersions prepared by heating at 80°C under agitation by using MeMe 30 parts, water 100 pts and 0.3 part of the persulfates of Ca, Mg, Ba. Persulfates of Li, Na, K, and NH_4 produce stable emulsions.

Example 2:

Me Me monomer	30 parts
dibutyl phthalate	20 "
Water	100 "
Li persulfate	1 "

Stirred vigorously at 80°C. After ½ hr. temp. rises to 90-95°

Stable emulsion

Dec. 5-6-9

Example 3.

Me Me	33 parts
Water	66 "
Ba persulfate	0.7 "

Spherical granules

Methyl Methacrylate

Brit 471,755 Sept. 9, 1937. du Pont

Granular polymer prepd from MM by subjecting it to kneading operation at a sufficiently high to induce polymerization. Polymerization catalysts, fillers, plasticizers, modifying agents (e.g. Lexsaa, H_2O, EtOH MeOH). Example: MeMe polymerized with or without (1) Bz_2O_2, (2) stearic acid, (3) Bz_2O_2 and

diethoxyethyl phthalate; and (3) α-chlo
(2) and (1)

Due 5-7-9

C.A. 32: 1362

Methyl Methacrylate Molding Powder

Br. 437,784 Oct. 28, 1935 duPont

MeMe is polymerized in polar inert org. solvent the amount of H_2O being substantially such that further addn. would ppt. monomer at the temp of polymerization.

[CA 30 : P7794]

Example: MeMe is introduced through one inlet and mix. of MeOH and H_2O through another inlet into a steam-jacketed kettle provided with a stirrer. The mixture is heated to 65°C. and samples taken to determine when appr. ℓ polymer begins, when fresh MeMe is introduced to preserve the correct compos. of reaction mixture. Polymer is separated and dried.

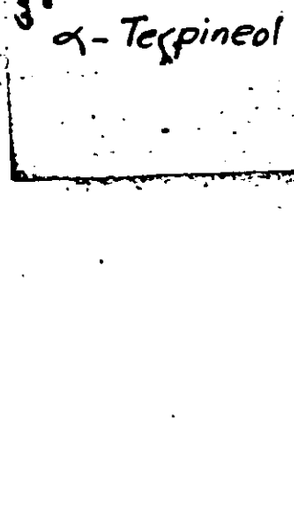
Ex. 9-9

Methyl Methacrylate — Molding Powder

U.S. 2,201,395 May 21, 1940. D.A. Fletcher & Post

Meme molding material is prepared by mixing monomer with 3-14% its quantity of α-terpineol and subjecting the mixt. to polymerization conditions.

(CA. 34: 6365)



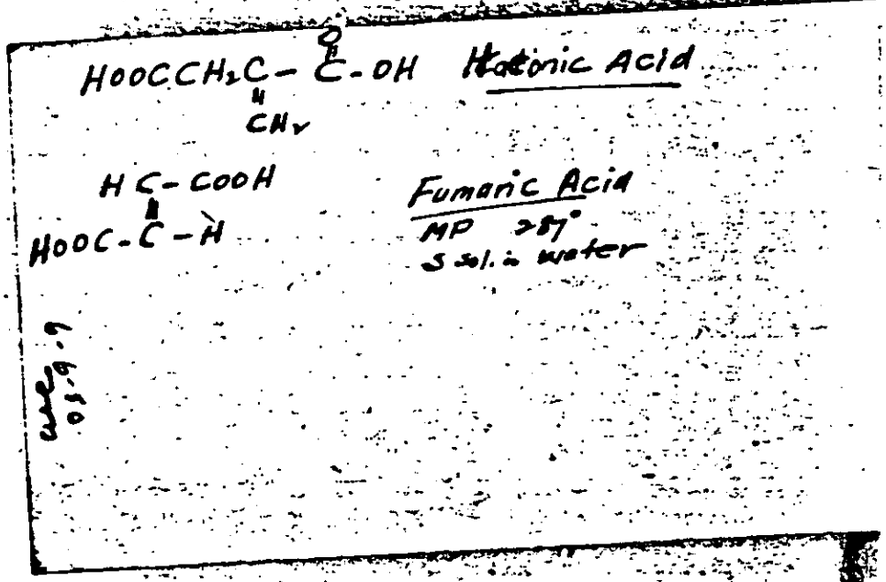
α-Terpineol

Colorless solid
m.p. ~~121°~~ 38-40°C
Odor of lilacs

Methyl Methacrylate

Br. 548,782 Oct. 7, 1941 The British Thompson-Houston Co,

A water-sol. salt for use as a granulating agent in prep'g synthetic resins fr. MeMe is prepared by subjecting to alk. hydrolysis, polymerized alkyl ester of itaconic, fumaric, mesaconic, citraconic or aconitic acids. (A. 37: 6374)


HOOCCH2C- C-OH Itaconic Acid
CH2
HC-COOH
HOOC-C-H
Fumaric Acid
MP >287°
S sol. in water
WEG-9-7
01-9-10

√ Methyl Methacrylate — Molding Powder

U.S. 2,265,474 Dec. 9, 1941 B. M. Marks (duPont)

A granular polymer of MeMe having adsorbed thereon a polymeric acrylic or alkyl acrylic acid is treated with an aq. soln of an alk phosphate, then washed with H_2O until free from salt.

(C.A. 36 : 2046)

Methyl Methacrylate.

U.S. 2,296,403 Sept. 22, 1942 Renfrew & Gates (Imp. Chem. Ind.)

MeMe dispersed in an aq. vehicle in the presence of metal or alk. earth metal persulfate as a dispersing agent with more of the compound than that which is soluble in the vehicle under prevailing conditions.

(CA 37: 1211)

Methyl Methacrylate Molding Powder

U.S. 2,326,326 Aug. 10, 1943 J. Breedis (R+H)

Moldable methacrylic resin prepared by injecting directly into water maintained at about 90-175°C, MeMe through an orifice (0.5 mm D) so as to cause the injected material to form as particles of such small cross section that they are heated

to the temp. of the water and
thus polymerized in a few sec.

wl
6-9-50

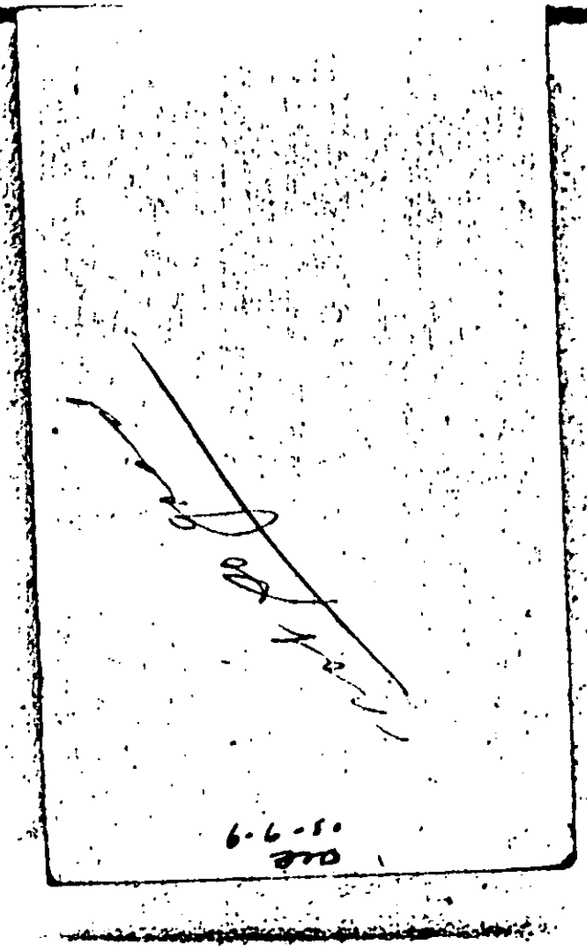
(CA.38: √99)

Methyl Methacrylate Powder

Br. 395,687 July 17, 1933 R. Holl

Articles are manufactured by thermoplastic molding of product obtainable by polymerization in presence of diluent. Plasticizers: Camphor, tricresyl phosphate. Polymerization: (1) BP → 100°C (2) Ac_2O & $NaBO_3$ → 60°C. (3) Mixing with titanium white & china clay

[C.A. 28: 5917]



Methyl Methacrylate

Ger. 735,784 Apr. 8, 1943 · Röhm & Haas

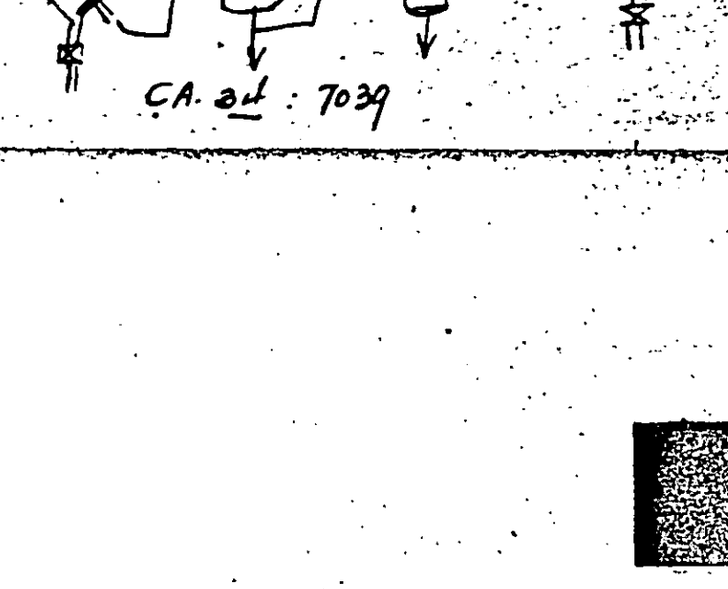
Mon. acrylates, methacrylates, and vinylates are mechanically emulsified without using emulsifiers, in an aq. suspension of powder substances insol. in the monomer or in H_2O. The emulsion is then polymerized.

(C.A. 38: 3770)

Fr. 844,073 July 18, 1939 I.G. Farben

Continuous polymerization of org. compds in aq. emulsions lighter than water consists in using high liquid columns, introducing the org compd and emulsion liquid at the top, and evacuating the dispersion of the polymerized products through the bottom; the liquid being

agitated only at the top.
Vinyl chloride
Emulsifying agent:
Sod. L- Oxy. octadecane sulfonate
Sod. persulfate



CA. 31 : 7039

✓

U.S. 2,163,305 June 20, 1939 Harry R. DitMar du Pont

A starch is used as a dispersing agent in the polymerization of acrylic acid or methacrylic acid or esters of these, and is then removed as by use of pancreatin and HCl also and washing. Procedure given

CA. 33: 7931

modified starch
O.R. Kreimeier & R.W. Maxwell
Patent U.S.

CMC
6-5-9

50, with styrene produces a tougher article than with B/50.

Example 3 A mix of 25 part styrene, 1 part 50, and 100 parts of water were heated with stirring at 90-100°C under reflux for 24 hrs. Product washed with ethyl alc. and dried.

Example 4: A mix of 15 part styrene, 6 part methyl meth., 1 part 50 and 400 part water in a flask with reflux condenser & stirrer, was heated with vigorous stirring under gentle reflux for 9 hrs. Some of the ~~product~~ remained in suspension ~~some acid was added to settle the suspen~~

Styrene

Br. 511,417 Aug 18, 1939 duPont

Styrene, or a mix. of styrene and MeMe is dispersed or dissolved in a liquid medium is polymerized in the presence of SO_2 as a catalyst.

C.A. 34: 1860

65-1984-1-G-12(?)

65-4307

Ex 24

SAC, Philadelphia 7/10/50

SA T. SCOTT MILLER, JR.

HARRY GOLD, was.
ESPIONAGE - R

EXHIBIT 65-4307-1B-13 (13) (Exhibit 24)

On 6/22/50, GOLD stated that the name JAMES A. DEVLIN was that of an assistant in the laboratory at St. Joseph's College. GOLD stated that he was a day school student and was Father MALLOY's assistant and worked in the laboratory at night. GOLD stated that he met DEVLIN at the Franklin Institute and apparently DEVLIN had written his name and address on the back of a Franklin Institute call slip.

TSM:HKF
65-4307

James A. Devlin
6238 N. 4th St.,
Phila. 20,
Penna.
HA4-1078.

65-43052-1-B-13 (14)

Date Received 6/6/58

From _____
(Name of Contributor)

_____
(Address of Contributor)

By James F. Bunyan
(Name of Special Agent)

To be returned [illegible]

[illegible]

File No. 65-43077-1-JB-13 (11)

6/6/50 Started 4:25 pm 65-4307

articles and items located and removed from premises of Jos Gold 6823 Kindred St, Phila, Pa

1 - One manila folder 12A

One fourth shelf of wooden cabinet in front of basement

One hundred 8 3/8" X 10 5/16" sheets of paper pertaining to answers to advertisements for positions of employment giving Harry Gold's background, education and experience in the field of chemistry

Eight applications for Federal employment U.S. Civil Service Commission announcement for examination in field of chemistry

found by SSD

1 - One manila folder 12B

One fourth shelf of wooden cabinet

Eighty two 9 1/2" X 11" sheets of paper containing chemical formulas and notes on experimentation concerning lactide, butyl acetate etc.

found by SSD

6/6/50 65-4307

On fourth shelf of wooden cabinet
Twenty two 8 3/8" X 10 15/16" sheets of paper containing chemical formulas and notations on experimentation with also a white sheet of paper 7 7/8" X 4 15/16" attached to one of them yellow sheets. On one of them yellow sheets the words are contained On Kazariari's method:
Zakharova - Sci Reports Leningrad State Univ.
Seven 4 15/16" X 7 7/8" red sheets relating to "Lab. organization, Lab Work, monomer portions and proven monomer
Photostatic copy of U.S Patent Office document # 2,317,138 concerning granular polymerization of ethanoid monomer
Photostatic copy of document bearing number 444,257 relating to Plastic Materials and Methods of Production
Photostatic copy of document bearing number 504,734 concerning Improvements in or relating to the Manufacture of Methacrylic Acid Esters
Seven sheets of white paper 8 1/2" X 11" pertaining to Nylon and containing chemical formulas
One 8 1/2" X 11" sheet of graph paper containing chemical formulas

1st one Manila folder 12¢

6-6-50 65-#307

In one Manila Folder 12C

(continuation of contents of Manila Folder 12C)
one yellow sheet 8 1/2" x 11" containing notation "Tare or manometer"
Three yellow sheets of paper 7 15/16" x 12 1/2" containing notation Nylon C A 1945 and reflecting information concerning processes
Two white sheets of paper 4 7/8" x 7 15/16" relating to chemical experimentation found by FBI

In one Manila Folder 12D

One fourth shelf of wooden cabinet
Four sheets of white paper 8 1/2" x 10 15/16"
Three of which bore notation "Am OH - Hexine Run" and the fourth sheet notation "Theory"
Letter re statement of American Cyanamid Co dated 7/16/47 addressed A Brothman & Associates concerning submission of sample of Special Wax #1111
Leaflet of Scientific Glass Apparatus Co, Inc, Bloomfield N J re "The Improved Heating Jacket"
Booklet of Hendrick Mfg Co re "Hendrick Mixing Equipment"

6-6-50 65-4307

(continuation of contents of Manila Folder 12 D)

Leaflet captioned "Precise Fractionation Assembly Used by the National Bureau of Standards" distributed by The Emil Greiner Co, N Y C.

Leaflet of The Emil Greiner Co, N Y C re Cartesian Manostat.

Leaflet of The Emil Greiner Co, N Y C re Stainless Steel Weights

Pages 217 and 218 Chemical & Metallurgical Engineering issue Jan. 1946 - Page 217 concerns Heat Transfer Equipment Pages 219 and 220 Chemical & Metallurgical Engineering issue Jan 1946 - Page 219 concerns General Chemical Co - Supply Lines for American Industry

One white sheet of paper 8 1/2" X 11" with notation "Conditions" and containing diagram found by FBI on fourth shelf of wooden cabinet

Thirty seven sheets of white paper 8 1/2" X 11" which bear the dates of Feb. March, April and May 1947 some of which are captioned "Esterification with P_2O_5" and pertain to experimentation, dist chemical processes found by FBI

Contents of Manila Folder 12 D

Contents of Manila Folder 12 E

6-6-50

65-4307

In One Manila Envelope 12 F

On fourth shelf of wooden cabinet
One white sheet of paper containing caption "Continuation Sheet No 1" with sub caption "Item 16 Experiment" pertaining to Harry Gold
Three sheets of blank white paper 8 1/2" X 11" found by FBI

In One Manila Envelope 12 G

On fourth shelf of wooden cabinet
Sixteen sheets of white paper 8 7/16" X 10 15/16" captioned "Appl 21 The Oxidation of Derivatives of Acetylenic Alcohols and Glycols"
Thirteen sheets of white paper 8 7/16" X 10 15/16" captioned "Appl 21 The Oxidation of Acetylenic Alcohols and Glycols"
Eleven sheets of white paper 8 7/16" X 10 15/16" captioned Appl 6 Synthesis of Acrylic monomers
Three pieces of paper were clipped together the sixteen sheets in one group, the thirteen in another group and the eleven in another group found by FBI

6-6-50 65-4307

In one manila folder 12 H

On fourth shelf of wooden cabinet

One two page letter dated 2/21/47 on the stationery of Pennie, Edmonds, Morton and Barrows Counsellors at Law, N.Y.C. addressed to Mr Abraham Brothman signed Arnold R Workman referring to Brothman's patent data relating to the process of manufacturing methyl methacrylate monomer - On Page 2 it is reflected that Russian literature citations were not used against the Vaughn patent.

Letter dated 1/7/47 on the stationery of American Cyanamid Co, N.Y.C. addressed to A Brothman and Associates signed E.J. Tuthill, Synthetic Organic Chemicals Dept. referring to Brothman's interest in Ammonium Metavanadate, and a shipment of the same.

A sheet of white paper 8 1/2" X 10 15/16" containing several numbers, the numbers "0.453 X 454 = 206 grms" is at top of page

Three sheets of white paper with captions "Seminar 1", "Lab vs Office" "Lecturer Preparation" found by JOD

6-6-50 65-4307

On fourth shelf of wooden cabinet
Three sheets of white paper 8 1/2" X 11" with captions "Polymer on higher Ketone soln - then steams distil Ketone," also "Particle shape," and "Surface Theory"
One white sheet of paper 8 1/2" X 11" with inked notations - first line reads "Sample bottle full = 346.6 gms.
One white sheet of paper 4 15/16" X 7 15/16" - first line reads "Diethylene Glycol monolaurate" and word "Glaurin" appears on second line
Two sheets of white paper with captions "Program for Mr Mc Powder Work" and "Work and captions"
I Removal of Adhered (?) Gum Arabic Film
II Use of Emulsifying Agents Requiring Smaller Amounts than Gum Arabic
III Use of Diallyl Phthalate Polymers as a Dispersing Agent
IV Emulsification in Alkaline Medium

1 - One manila folder
12 I

6-6-50 65-4307

(Continuation of contents of Manila Folder 12 I)

Reprint from India Rubber World, June 1944 of article entitled "Polymerization of Vinyl derivatives in Suspension" by W I Hohenstein, F Vingiello, and H Mark Polytechnic Institute of Brooklyn. This article reprinted with compliments of The Whitney Blake Company, New Haven, Conn.

Reprint from India Rubber World, January 1945 of article entitled "The Formation of Vinyl Polymers in Emulsions and in Suspension" by S. Siggia, W I Hohenstein and H. Mark Polytechnic Institute of Brooklyn

Photostatic copy of item from Industrial and Engineering Chemistry Vol 37, No 4 April 1945 entitled "Emulsion Polymerization of Acrylic Esters by W C Mast, Lee T Smith and C H Fisher, Eastern Regional Research Laboratory, U S Department of Agriculture, Philadelphia, Pa including pages 366 through 369.

Ind Chem Industries Folder 12 I

6-6-50 65-4307

(Continuation of contents of Manila Folder 12I)

Seven sheets of white paper 8½" x 11"
containing respective captions at top of page

U.S. 2,163,305 June 20, 1939 H. Rohrmann (du Pont)
U.S 2,201,395 May 21, 1940 W. A Fletcher (du Pont)
U.S 2,244,702 June 10, 1941 L P Habbuch (du Pont)
Br, 437,284 Oct 28, 1935 du Pont
U.S. 2,265,242 H Marks (du Pont)
U.S. 2,133,257 Oct 11, 1939 W.E. Strain (du Pont)
U.S. 2,171,765 Sept 5, 1940 Rohm + Haas

these relate respectively to

use of methyl + ethyl stearic emulsifying agent
mixture of methyl methacrylate and distilled water
" " distilled water and methyl methacrylate
solution prepared from methyl methacrylate, water and methanol
polymethacrylic acid as a granulating agent
solution of water soluble polymethacrylamide
colloidal suspension of aluminum hydroxide

Twenty-nine sheets of yellow paper with pencilled
writing and one blank piece of yellow paper 8 1/2" x 11 1/8"
some of these pages pertain to methylation of

Manila Folder 12I

6-6-50 65-4307

(continuation of contents of Manila Folder 12 I)

1½ Manila Folder 12 H

starch, ethoxy-methylene-malonic. dinitrile, ethyl. orthoformate, Liebig's annalen der Chemie, possible modification on vitamin synthesis, Riboflavin, Vitamin C (l-ascorbic acid)

One sheet of white paper first line reads "2,071,250 (next numbers and words not completely discernible). this sheet 8½" x 11"

One sheet of yellow paper 8 5/16" x 11" dated 9/25/46 first line reads "Run diethyl Phthalate Polymer for Reaction Time" contains notation "Russian gal bicalle Juer"

One blank piece of paper 8 5/16 x 10 7/8"

Two sheets of white paper 8½" x 11" captioned "a New Way of Using CaC_2"

White sheet of paper 8½" x 11" with inked notations concerning metal reflector on prism box of abbe refractometer - name Mr. Wayne

U B 9863 also on this sheet of paper found by FHB

6/6/50 65-4307

On fourth shelf of wooden cabinet

Two sheets of white paper containing pencilled notations and one sheet of blank white paper 8½" x 11" - one piece of paper has caption "Distillation" - second piece of paper contains notation which appears to be S V_2 -1 Hexine

Ten pieces of white paper 5½" x 8½" stapled together with stamped date of Nov 29 1946 appearing on first page and pencilled notation of date 12-1-46 and 12-3-46 on subsequent pages notations on pages referring to Hexine and Ketone possibly refers to experimentation

One piece of yellow paper 5½" x 8 7/16" refers to mixture of benzene and HOH (water)

One piece of white paper 3 15/16" x 5 15/16" with diagrams of butane and acid

Four pieces of white paper 5½" x 8½" with notation on first page 12-6-46 and "butane by Kazarian's method" and

12 and Numbers Added 12 JT

6-6-50 65-4307

(continuation of contents of Manila Folder 12 J)

In Manila Folder 12 J

dated 12/6 and 12/6/46 on succeeding pages
Nineteen sheets of white paper 5 1/2" X 8 1/2"
stapled together - penciled notation of
date on first page "12-5-46" and on some
of succeeding pages and stamped date
and penciled date 12-16-46 on other pages -
thirteen of above mentioned pages blank
aside from penciled notations appearing
thereon - first page has notation wt.
of KOH, acetone, third page has
notation hydrolysis of last five.
Nine sheets of white paper 5 1/2" X 8 1/2"
contain reference ether solution, distillation
and ether distillation - other sheets
have dates of 12-23-46 and 12-26-46
appearing at tops of some of the pages
and also the notations C-23 + C 24
Four sheets of white paper 4 5/16" X 7 5/16"
containing chemical formulae

6-6-50 65-4307

(continuation of contents of Manila Folder 12 J)

Blank piece of white paper 8 7/16" X 10 15/16"

One sheet of white paper " " "

Containing notations C 35-22 gm. 19 cc

on top line

One sheet of white paper 8 7/16" X 8 1/16"

with mathematical equations and "saturation

line" curves

Three sheets of white paper 5 1/2" X 8 1/2"

On first page notations 1) Absorber 3) Kagenin

X Today's run 3) Bender - on second

page percentage figures and stamped date

Nov 27, 1946 appears - on third page

notations 297 cms KOH appears on first two

Nineteen sheets of white paper 5 1/2" X 8 1/2"

eight of these pages are blank - pencilled

notations on other pages refer to methyl,

hydroxy, butene, acetone, butene synthesis

dates appearing at top of page 12-9-46, 12-10-46

12-11-46, 12-12-46 - these pages stapled together

Put in Manila Folder 12 J

6-6-50 65-4307

(continuation of contents of Manila Folder 12-J)

In One Manila Folder 12-J

Twenty three sheets of white paper 5 1/2" X 8 1/2" four of these sheets are blank - all twenty three sheets stapled together - dates appearing at tops of pages include 12-17-46, 12-18-46 and 12-20- notation C-21 appears at top of one page - references on these pages to acetone, distillation

Seven sheets of white paper 8 1/2" X 10 15/16" with mathematical equations appearing thereon

Four sheets of yellow paper 8 1/2" X 11" two of which bear notations at top "Class I" and "Class II" - these pages refer to heptine and butine ~~oate~~ also to oxidation of carbinols to isobutyric acid molecule

Two sheets of white paper 4 15/16" X 7 15/16" first page contains mathematical equation second page references to Acetone, Butine Heptine

6-6-50 65-4307

(continuation of contents of manila folder 12 J)

In one manila folder 12 J

One sheet of white paper 8 1/2" X 10 5/16" containing chemical formula - word "reaction" at top of left hand corner on one side of this sheet of paper - name "Mr Dougherty" C07-2119 at top of left hand corner reverse side of paper

One sheet of white paper 8 1/2" X 11" notations "May, Urbuch, Brunlich, NE 9-23-2 appear at top of page on one side - on reverse side at top left hand corner "A. Brothen" appears

One sheet of white paper 8 1/2" X 10 7/8" on stationery of A Brothen and Associates - notation at top of page reports filtration on Buchner funnel with dry-ice acetone trap to vacuum line - at lower left of page "C07-2119 after 1" or before 12" appears at lower left of page

One sheet of white paper 8 1/2" X 11" containing chemical formulae

"One sheet of white paper 8 1/2" X 11" captioned "Experiment 1-7-47" relating to 270 g of methylol added + 110 g KOH.

6-6-60 65-4307

(Continuation of contents of Manila Folder 12 J)

In One Manila Folder 12 J

One sheet of white paper dated 11-4-46 relating to experiment - page 8 3/8" x 11"

One sheet of white paper 8 3/8" x 11" - first line reads 25g Monomer

One sheet of white paper 8 1/2" x 10 15/16" - first line reads make set-up as per Expt. C 33 (water trap for methylal). reverse side has notation Call Mr Bronstein Armory 4-6520

One sheet of white paper 8 3/8" x 11" containing chemical formulas - on one side of page ether extractions mentioned - on reverse side notation agrees with 6th Ave + 42 nd Bryan 1 Pk Jewelers 1095 6th Ave Scarsin Pm

Ten sheets of yellow paper clipped together 8 7/16" x 10 15/16" captioned J. Am Chem. Soc 1347-52 (1934) New Method of Supplying Calcium Carbide

Sixteen Pages of white paper 8 1/2" x 11" containing chemical formulas

6-6-60 65-4307

(continuation of contents of Formula Folder 125)

In One Formula Folder 125

Two sheets of white paper 8 1/2" X 11" - one sheet bears caption 'Conference 3-11-47' and has sub captions monomer synthesis powder polymerization and sheet on bulk polymerization - second sheet has date 3-11-47 appearing on it and contains chemical formulas

One white sheet of paper 4 5/16" X 7 5/16" has notation at top USSR 11

1111 - 20 (1941)
found by JDS

In One Formula Folder 12 K

Found on fourth shelf of wooden cabinet

One sheet of white paper 8 7/16 X 10 5/16" containing diagram and chemical terms

Two sheets of white paper 8 1/2" X 11" one sheet contains notation - titration in alcohol second sheet " " Trial's Work

Tertiary Butyl Hydroperoxide

Tablet of fourteen sheets of white paper - only two white containing any writing - this consists of numbers and chemical terms

6-6-60 65-4307

(continuation of contents of Manila Folder 12K)

In one Manila Folder 12K

One sheet of lined paper 8 1/2" X 11" containing numbers and chemical terms found by Lyon

In one Manila Folder 12L

Found on fourth shelf of wooden cabinet

Five sheets of white paper 8 1/2" X 11" containing chemical formulas and note on synthesis

Two sheets of white paper referring to chemical synthesis - three pages stapled together

Two sheets of white paper 4 5/16" X 7 5/16"

One page has notation CA 29, 3926

Second page " " Beilst Handbuch 1936 (9) 12

Four sheets of white paper 8 1/2" X 11" containing chemical formulas + experimental notes

Two sheets of white paper 8 1/2" X 11" containing chemical formulas

Sheet of graph paper containing caption solubility - GFW PER 1000 g H_2O

One sheet of white paper dated 6-9-47 captioned Vanishing Cream Formulas

6.6.50 65.4307

(continuation of contents of Manila Folder 124)

In One Manila Folder 124

Two sheets of paper of A Brothman and Associates - first page contains caption Scientific Glass - the first line of second page begins "3 only #5.732

One sheet of paper with stamp of A Brothman and Associates relating to the manufacture of Thioglycolic Acid (6.20.47)

One sheet of white paper 5 9/16" x 8 1/2" captioned "VC Formulation"

One typewritten sheet dated 8.21.46 captioned The Preparation of Urea Formaldehyde Cold-Setting Glue

One sheet of paper of A Brothman & Associates first line reads Satisfactory Monomeric Mixture found by JJD

From One Manila Folder 124

Found on fourth shelf of wooden cabinet

Three sheets of white paper dated 3.10.48 referring to Organolysis of Dimethyl Thexine Diol and Organolysis of Methyl Butenol found by JJD

6-6-50 65-4307

Found on fourth shelf of wooden cabinet
Manila folder labled Patent Literature
Search on Methyl Methacry.
One sheet of paper on Co Brothman
and Associates stationery which is
captioned Improved Mo Mo Monomer Synthesis
Nine sheets of lined paper dated
7-25-46, 4-9-46, 4-15-46 and 4-24-46
Them are captioned Mo Mo Molding
Powder, Preparation of Peton, Recrystalliz-
ation of Peton from Acetone - last
page appears to be stenographic notes
Four sheet of paper clipped together
dated 5-2-47 captioned The Synthesis
of 2, 5 Dimethyl - 2, 5 Dihydroxy - Hexine 3
One white sheet of paper 8 1/2" X 11"
middle of page contains notation Ber 669, 870
Ber 12, 1938 Walhelm Kuch
One sheet of graph paper containing notation
diol, water, methylal

Manila folder 12-N

6-6-60 65-4307

(Continuation of contents of manila Folder 12N)

In one manila folder 12N:

Two typewritten pages containing sub-captions methyl-butenolone, vapor phase esterification, methyl ester, chloroform, methoxy-isobutyric acid, methyl methoxy-isobutyrate and catalytic de-alkoxylation - date Dec 14, 1946 appears at bottom of second page

One sheet of yellow paper 8 9/16" x 10 15/16" containing chemical formulas

found by JOD

On fourth shelf of wooden cabinet

In one manila envelope/folder 12O:

One sheet of white paper captions mold, Wt. of Me Me, In 80-85° oven and Low temp oven over four columns

One sheet of paper captioned Castings.

One sheet of paper " Physical-Test Specimens

One sheet of paper captioned 3/16" sheets

found by JOD

6-6-50 65-4307

In brown manila folder 12 P

Found on fourth shelf of wooden cabinet one sheet of paper 8 1/2" X 11" first line of which reads 2, 4 Dr chloro. Benzaldehyde - notation in middle of page on this sheet US Tariff Comm Wash D C

Four sheets of paper dated 4-3-47 captioned VC relating to VC for sun and wind burn found by FBI

In one manila folder 12 Q

Found on fourth shelf of wooden cabinet Two typewritten copies, three pages in length, of a "Report of Plate Coating Tests on Modified R-21 Dope" These copies were identical in content with the exception that the date Oct 3, 1932 appeared on one copy but no date appeared on the other. Under a sub caption "Discussion of Results" it was reflected in the past year (possibly 1931) a method had been found by which all methyl alcohol soluble nitrocellulose could be made with a yield which, in small experiments,

6-6-50 -23- 65-4307

(Continuation of contents in Manila Folder 12 Q)

compares favorably with those obtained with P.R. and R P types.

Seven graphs captioned as follows

Electrometric Titration of 1.73% Kodak Pack Experimental Gelatin 50-366.

Electrometric Titration of 1.76% # 26707 First run calf skin Gelatin

Electrometric Titration of 1.74% # 1581 Un-ashed Acid Pig Skin Gelatin

Electrometric Titration of 1.70% # 17912 Deashed Pig Skin Gelatin

Electrometric Titration of 1.73% Bone Stock (Glenitella) gelatin

Electrometric Titration of 1.72% # 5351 Ewald Gelatin

Electrometric Titration of Stoess Blended Gelatin # 1164

A two-page document captioned: Method of operating machines above the Upper

In one manila folder 12 Q

6-6-50 (Continuation of Contents of Manila Folder 120) 65-4307

Explosive Limit, July 27, 1933, and signed Harold W Crouch. Attached to this document was a graph captioned: CO_2 - Acetone - air Graph for Thermal Conductivity Cells, Cell Jacket Temp. 98.8 - 99° C. Cell Current 260 M.A.

A two page copy of the minutes of meeting discussing change to low viscosity Linters for R. P. Cotton dated September 27, 1933. The minutes were signed by E. K. Barnes, Department of Manufacturing Experiments.

A photostatic copy, four pages in length, of report number V 1.185 captioned: Report on Improved "Kodatrace" by R. Zenducci, Vincennes Factory, dated March 21, 1935. Kodak Pathe, Vincennes, France. attached to this photostat was a diagram captioned Installation Required for Coating Improved Kodatrace.

A two page typewritten copy dated November 25, 1935 captioned Proposed Change on Wind Ups for Machines Located in Building 20.

In one manila folder 120

6-6-50 65-4307

(Continuation of Contents of Manila Folder 129)

A six page typewritten copy captioned Chemical Plant, Kodak Park, dated December 19, 1935, on the subject Analysis of Solvent Mixtures of Butyl Alcohol, Ethylene Dichloride, and Propylene Dichloride.

A three page typewritten item dated November 12, 1935, captioned Conference for Discussion of Position vs Tendency Rights for R.C. Machines - November 12, 1935.

A two page typewritten copy of the minutes for a sub-conference dated November 29, 1935 signed D. S. Babcock

A three page typewritten document captioned The Sub Conference of October 2, 1936.

A two page typewritten document captioned Sub Conference of October 16, 1936

A two page typewritten document captioned Sub Conference of October 23, 1936

A two page typewritten document captioned Sub Conference of October 30, 1936

In one Manila Folder 129

6-6-50 65-4307

(Continuation of contents of Manila Folder 12 Q)

In Manila Folder 12 Q

A two page typewritten document captioned
Sub-Conference November 6, 1936

A three page typewritten item captioned
Sub-Conference of November 13, 1936

A four page typewritten document captioned
Sub-Conference of November 20, 1936

A four page typewritten document captioned
Sub-Conference of November 27, 1936

Five page typewritten document captioned
Sub-Conference of December 4, 1936

Four page typewritten document captioned
Sub-Conference of December 11, 1936

Six page typewritten document captioned
Sub-Conference of December 18, 1936

Four page typewritten document captioned
Sub-Conference of January 8, 1937

Three pages typewritten document captioned
Sub Conference of January 15, 1937

Four page typewritten document captioned
Sub Conference of January 22, 1937

6-6-50 65-4307

(Continuation of contents of Manila Folder 12 Q)

Five Manila Folder 12 Q

A five page typewritten document captioned
Sub-Conference on February 5, 1937
Four page typewritten item captioned
Sub-Conference of February 12, 1937
Four page typewritten document captioned
Sub-Conference of February 19, 1937
Four page typewritten document captioned
Sub-Conference of February 26, 1937
Three page typewritten item captioned
Sub-Conference March 12, 1937
Four page typewritten document captioned
Sub-Conference of March 19, 1937
Seven page typewritten document captioned
Sub-Conference, Friday, April 2 and
Tuesday April 6, 1937
Four page typed document captioned
Sub-Conference of April 9, 1937
Five page typewritten document captioned
Sub-Conference of April 16, 1937

6-6-51 65-4307

(continuation of contents of Manila Folder 12 G)

Manila Folder 12 G

Three page typewritten document captioned
Sub-Conference of April 23, 1937

Three page typewritten document captioned
Sub-Conference of May 7, 1937

Three page typewritten document captioned
Sub-Conference of May 14, 1937

Three page typewritten document captioned
Conference May 21, 1937

Three page typewritten document captioned
Sub Conference May 28, 1937

Two page typewritten document captioned
Sub-Conference June 4, 1937

Two page typewritten document captioned
Sub-Conference June 11, 1937

Two page typewritten document captioned
Sub-Conference June 25, 1937

Five page typewritten document captioned
Status of Sub-Conference Matters
August 31, 1937

6-6-50 65-4307

(Continuation of contents of Manila Folder 12 Q)

In One Manila Folder 12 Q

Four page typewritten document captioned
Sub-Conference for September 10, 1937
attached to this document was a page captioned:
Average Brittleness Results on Safety X-ray
from 1934 to Present Time.
Three page typewritten document captioned
Sub-Conference of September 17, 1937
Four page typewritten document captioned
Sub-Conference of September 24, 1937
Four page typewritten document captioned
Sub-Conference of October 1, 1937
Three page typewritten document captioned
Sub-Conference of October 8, 1937
Three page typewritten document captioned
Sub-Conference of October 22, 1937
Four page typewritten document captioned
Sub-Conference of October 29, 1937
Two page typewritten document captioned
Sub-Conference of November 5, 1937

6-6-50 65-4307

(Continuation of contents of Manila Folder 12 Q)

Manila Folder 12 Q

Two page typewritten document captioned
Sub-Conference November 12, 1937
Two page typewritten document captioned
Sub-Conference November 19, 1937
Two page typewritten document captioned
Sub-Conference December 3, 1937
Three page typewritten document captioned
Sub-Conference December 10, 1937
Three page typewritten document captioned
Sub-Conference December 17, 1937
Two page typewritten document captioned
Sub-Conference December 31, 1937
Three page typewritten document captioned
Sub Conference January 7, 1938
Two page typewritten document captioned
Sub-Conference January 14, 1938
Two page typewritten document captioned
Sub-Conference January 21, 1938
Three page typewritten document captioned
Sub-Conference January 28, 1938

6-6-50 65-4307

(Continuation of contents of Manila Folder 12 Q)

Five page typewritten document captioned
Suit Conference February 4, 1938
Four page typewritten document captioned
Suit Conference February 11, 1938
Four page typewritten document captioned
Suit Conference February 18, 1938
Four page typewritten document captioned
Suit Conference February 25, 1938
Four page typewritten document captioned
Suit Conference March 4, 1938
Four page typewritten document captioned
Suit Conference March 11, 1938
Four page typewritten document captioned
Suit Conference April 1, 1938
found by JOY

In all of the documents captioned Suit Conference on the various above mentioned dates there were suit-captions dealing with chemicals and processes used in photographic work and experimentation

In Manila Folder 12 Q

6-6-50 65-4307

[redacted]

In one manila folder 12R

Found on fourth shelf of wooden cabinet
Twenty eight sheets of white paper 8½" x 11" -
Only seven of them page contain writing -
first page captions Stoddard Solvent - it
and the succeeding pages contain chemical
formulae and mathematical equations
found by JDD

In one manila folder 12S

Found on fourth shelf of wooden cabinet
Six sheets of yellow paper 8½" x 11"
which contain chemical formulae and notes
on experimentations - these are enclosed
in a manila folder, which bears notation
on outside "Notes from Doc"
found by JDD

In one manila folder 12T

Found on fourth shelf of wooden cabinet
One sheet of white paper with caption Evaluation
of the New Unit for Absorbing CO_2
Blank sheet of white paper
Three typewritten pages concerning absorption
of CO_2 -

[redacted]

6-6-50 65-4307

Four sheets of paper - three yellow and one white clipped together - white page captioned "Outline of Rept. - four yellow sheet re Denver Flotation Equipment addressed to Doc from Harry Gold and Joseph E. P. Bowman 2nd yellow sheet contains table of results 3rd " " captioned discussion of results

Two blank pieces of paper

Piece of white paper containing captions Latest Aeration Unit, Turbo, Old Rect., Denver

Twenty nine yellow sheets relating to tests and calculations concerning CO_2 - none of these sheets are blank

Pages 283, 286 & 307 of the May 1941 issue of The Glass Packer containing article entitled "How to reduce the instability of vitamin content" - on Page 283 is pencilled notation Ronald, Dougherty, Harry

Two typewritten sheets of paper dated 4/30/41 captioned Run #3 signed Harry Gold & Joseph E. P. Bowman

66-50 65-4307

(Continuation of Contents of Manila Folder 12T)

In One Manila Folder 12T

Forty eight sheets of yellow paper
One page captioned "Use of the Denver
Flotation Apparatus as an Absorber" -
results of small runs in 1941 reflected.
Typewritten sheet headed Henry Gold
June 30, 1938 captioned Recovery of
CO_2 from Flue Gas
Nine typewritten sheets four sheets captioned "Use of
the Turbo-Mixer as an Absorber Unless
The Investment Cost of the Equipment
Per Pound of CO_2 is Known."
Drawing concerning some equipment
(possibly covering diffusion of gas stream
meter is enclosed on drawing.) Manila
folder containing these documents captioned
"CO_2 Recovery"
found by JDS

In One Manila Folder 12V

Found on fourth shelf of wooden cabinet
One white sheet of paper captioned
"discussion 1. Mac Mar Lab
on reverse side is notation Rpt #3
C O - Recovery

6.6-50

65-4307

(Continuation of Contents of Manila Folder 12 V)

In Manila Folder 12 V

February 20, 1939 issue of the Industrial and Engineering Chemistry News Edition

February 10, 1939 issue of the Industrial and Engineering Chemistry News Edition

One sheet of white paper captioned Note on CO_2 Recovery H 2 with sub caption data for a 1 ton Plant

Eighteen sheets of yellow paper with caption appearing at top Ethers, Acids, Cyanids + Nitro Cpds found by JHD

Consigned to Exhibit 13

Found in fourth shelf of wooden cabinet

One hundred and forty miscellaneous sheets of paper described as follows:

Thirty one sheets of paper on stationery of a Brathman + Associates relating to the subjects Vanillin, Chloroform from CCl_4 and Standardization of Molding Powder Tests - several of these sheets bear date in 1947 and have notation by H G

66-50 65-4307

Attachments to Exhibit 13

Three sheets of blue lined white paper addressed Dear Abe, one which sheets is signed Harry and Phil, referring to the Stanton job being in a precarious state and indicating it would be impossible to develop a modification of the cyanhydrin process in a few days so that Abe could demonstrate it in Switzerland

Eight pages of blue lined white paper captioned Charges - them pertained to lies concerning the Stanton job, personnel problems concerning Oscar, Phil, Harry, Bill, Bernie and Moskowitz

Seventeen blue lined yellow sheets captioned Preparation of Substituted Benzaldehydes

Eight pages of white paper dated 4-5-48 captioned Analytical methods for Tests of 316 ELC "Standers"

6-6-50 65-4307

Designation - Exhibit 13

One two page letter on stationery of Julian Paul Brodie dated Sept 13, 1946 addressed by Julian P Brodie to A Brothman referring to agreement by Brothman's organization to develop mens vanishing cream with expenses for such work being borne by Brodie and listing the other terms of this agreement

3 typewritten page captioned "Program of Work For The Chinese Jar dated 8/26/46 sixteen sheets of blue lined white paper some of which bear date of April 1948 containing chemical formulae notes on experimentation and one sheet referring to specific jobs apparently under consideration by A Brothman + Associates

3 unlined sheets of white paper some of which bear dates in May 1947 containing experimental notes in chemistry

Three sheets of blue lined bright yellow paper one of which contains Chemical notation - the other two are written in French

6-6-50 65-4307

Fifteen sheets of blue lined yellow paper containing chemical experimental notes

Five sheets of red paper 3 15/16" X 6" bearing diagram and chemical symbols - one of these sheets contains name of Amcon Corp 29 Bdwy, N Y C and the name of Mr Turner to phone to call

Twenty sheets of white paper 4" X 6" containing chemical symbols and notes on experimentation

Laboratory notebook as Exhibit 13

found by FBI

Found in pants shelf of wooden cabinet

One envelope postmarked Philadelphia, Pa June 2, 1948 addressed Harry Gold Elmhurst, N Y C having return address on reverse side of envelope Morrell C Dougherty 5517 Litchfield St Phila Pa

Note enclosed in envelope from Dloc to Harry states "Hope you get this in time see you soon"

Laboratory notebook as Exhibit 14

found by FBI

6-6-50

65-4307

Found on fourth shelf of wooden cabinet
Budget Corporation notebook - writing
first page of
on book refers to Patent of Jan 28, 1941
2,229,897 American Cyanamid Co -
succeeding pages refer to Analysis of
Ozone, hydroxyisobutyric acid,
esterification of 2-OH isobutyric acid,
keying synthesis - dates in this
book include Jan 23, 1946 to 3/25/47
- enclosed in this book were also eleven
sheets of blue lined yellow paper,
most of which bear date of September
1946, referring to chemical experimentation
found by JDD

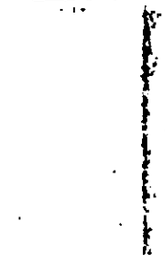
Designation as Exhibit 15

Found on fourth shelf of wooden cabinet
Two page photostatic copy of US Patent
office document # 2,030,901 concerning
Process for depolymerizing Alpha Substituted
Acrylic Acid Esters
found by JDD

Designation as Exhibit 16

Found on fourth shelf of wooden cabinet
Two page photostatic copy of US Patent
office document # 2,359,213 concerning
Process for depolymerizing Polystyrene
found by JDD

Designation as Exhibit 17



-40

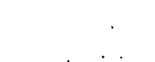
6-6-50 65-4307

Found on fourth shelf of wooden cabinet
Federal Standard Stock Catalog L-P-406
Section IV part 5 - Federal Specification for
Plastics, Organic; General Specifications,
Test Methods - catalog dated 1-24-44
found by JHD

designated as Exhibit 18

Found on fourth shelf of wooden cabinet
Envelope postmarked N Y C Nov 25, 1947
addressed to A Brotman and Associates
Long Island City, N Y bearing return
address The Cooper Alloy Foundry
Co, Hillside, N J - enclosed
in envelope was a twenty one page
document captioned Memorandum
For The Preparation of Thioglycolic
Acid Patent Papers
found by JHD

designated as Exhibit 19



Found on fourth shelf of wooden cabinet
Envelope postmarked Dec 3, 1447 Louisville
Ky addressed to A Brotman and Associates
Elevtrust, Long Island bearing return
address The Girdler Corp, Louisville, Ky
- enclosed in envelope were eight pieces

designated as Exhibit 20

6-6-50 65-4307

[redacted]

of white paper bearing date of November 1946 referring to chemical syntheses such as synthesis and degradation of acetylene - Glycols, hydrogenation of acetylene hydrocarbons, reaction between O_2 and acetylene in the presence of Nitrogen oxides, oxalic acid from acetylene etc. - also enclosed in above envelope was letter dated 12/3/47 from J. E. Houghton Vice President of the Girdler Corp submitting several circulars and piece of literature describing the Votator principle of heat transfer and processing and illustrating several models of Votator units (these enclosures still attached to letter)

also enclosed was Gold Medal Writing Tablet Book bearing name of Harry Gold

[redacted]

6.6.50 65.4307

- In this notebook are two pages dated 3-5-48 - one of these pages has as its first line "OsO_4 Ref. Mellor XV p 707," in the middle of this page is notation "1. OsO_4 not to influence rate of decomp. of alkali chlorates
- The second page has as its first line "MoO_3 Mellor XI p 545"
- Also in this notebook are four pages dated 4.20.47
first page, first line reads "Bull. de la Societé Chemique 25, 346-364 (1901) and has subscription "Formation & decomp of Acetals -
second page, first line reads "Methylal + 12% H_2O @ 14-26°C
third page, first line reads "J Phys. Chem. 36, 2325-2337 and has subscription Decomposition of Methylal in Gas phase

designated as Exhibit 20

6-6-50 65:4307

fourth page, first line reads Berichte 70, 1713-1719 (1937) and has next caption Hydrolysis of Acetals

fifth page, first line reads Berichte 67, 424-429 (1934) and has next caption Velocity of Acetal Hydrolysis

(all other pages of this notebook are blank)

Enclosed inside of this notebook is a piece of stationery of C Bristow & Associates - in upper left hand corner on the date 11-2-47 and notation "14 Dy" - beside the caption Job is the name Metter and beside the caption Subject is the writing $Ca(OCl)_2$ Process. in the body of this piece of stationery are the captions Vernon, Mathieson, Columbia also in the Bristow Corp envelope are two pieces of yellow paper 4½"X5½", one of which is blank, and the other which has a few lines writing "... use excess $Fe_2(SO_4)_3$ + add H_2O_2 slowly ... bound by 200

Examination of Exhibit 20

-44-

6-6-50

65-4307

Found on fourth shelf of wooden cabinet

Envelope postmarked Oct 29, 1946 Phila Pa addressed Harry Gold, Elmhurst, L.I., N.Y. having return address Acheson Colloids Corp. Phila Pa

Note on stationery of Acheson Colloids Corp Port Huron, Mich addressed to Harry from Klaus which read "Wish you luck - see you on the week-end" - reverse side has chemical notation

Sheet of white paper 8 1/2" x 10 5/16", first line reads "1 Variable Take-Off Still Head"

Sheet of white paper 8 1/2" x 10 5/16", first line has notation V F Powd

Sheet of white paper 8 1/2" x 11", first line reads "Solubility of p Dichlorobenzene 4" with date 4-12-47 in upper right hand corner

One sheet of notebook paper 3 1/2" x 5 7/8" first line reads "1. Vapor phase esterification found by HG"

Found on fourth shelf of wooden cabinet

6-6-50 65-4307

Designation Ex 22

Found on first shelf of wooden cabinet
Forty seven sheets of loose leaf paper
containing seven punch holes and bearing
penciled notations which pertain to
industrial, chemical processes inventions
and patents and German language notes
(These may be school notes since some
are dated in 1932 and bear two tabs
"Chem 107 and Gen 2")
found by FBI

Designation Ex 23

Found on second shelf of wooden cabinet
Twenty 3"x5" index cards - seventeen
of which pertain to Methyl Methacrylate
- molding powder with specifications
and uses for the same. Of the
three remaining cards, one is captioned
Styrene and the other two contain notations
concerning the use of methyl starch
as a dispersing agent and the continuous

6.6.60 65-4307

polymerization of org. compds in ag. solutions
found by JDB

Found on second shelf of wooden cabinet
one 3 3/8" x 6" piece of white paper
containing following writing done
with Devlin 6238 N. 4th St Phila
20 Penna 14 A 4-1078
found by JDB

Search discontinued at 6:15 PM
JDB