

Nov. 17, 1942.

H. F. FISHER

2,302,386

PROCESS FOR DEWAXING OIL

Filed Jan. 11, 1937

3 Sheets-Sheet 1

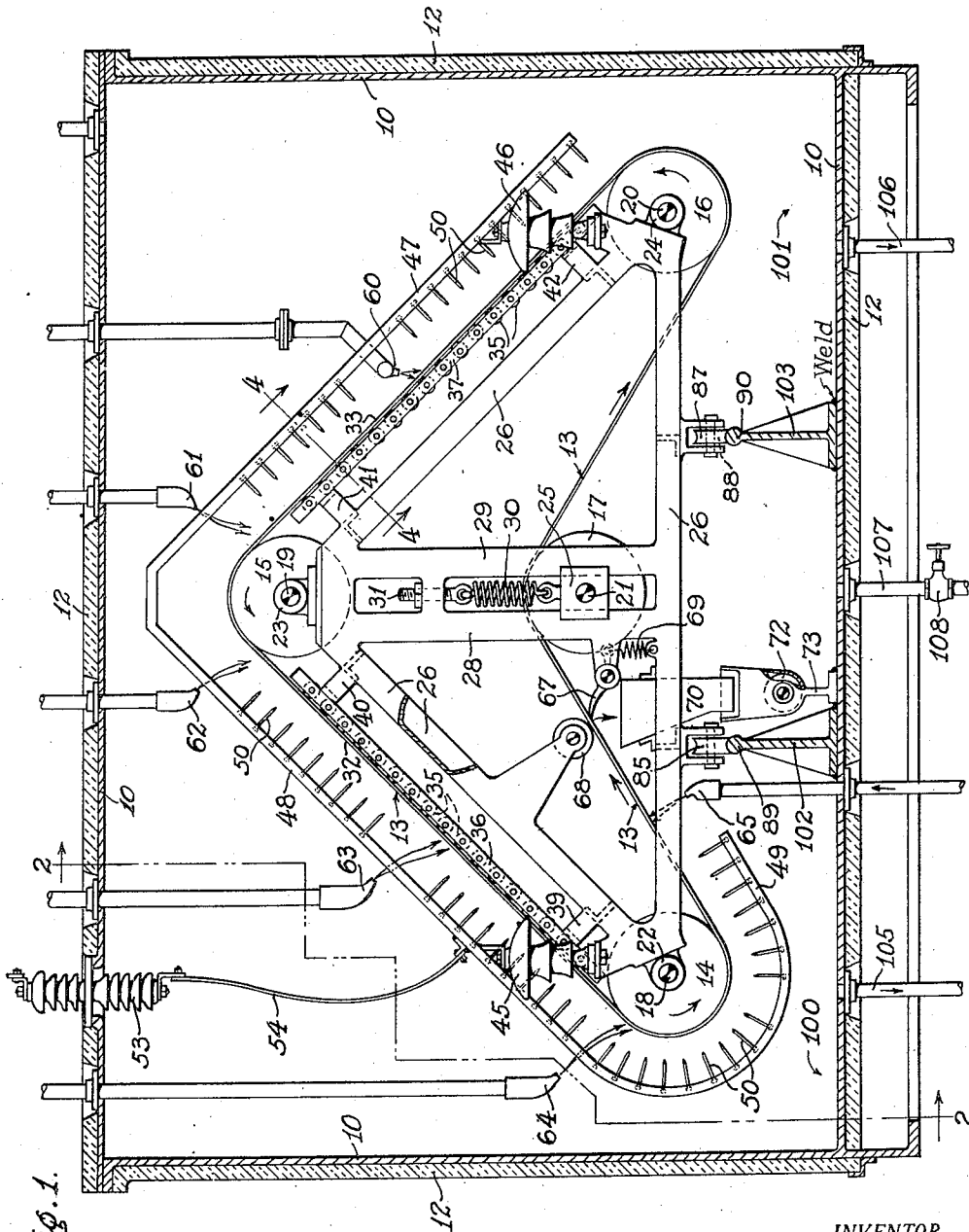


Fig. 1.

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3 Sheets-Sheet 2

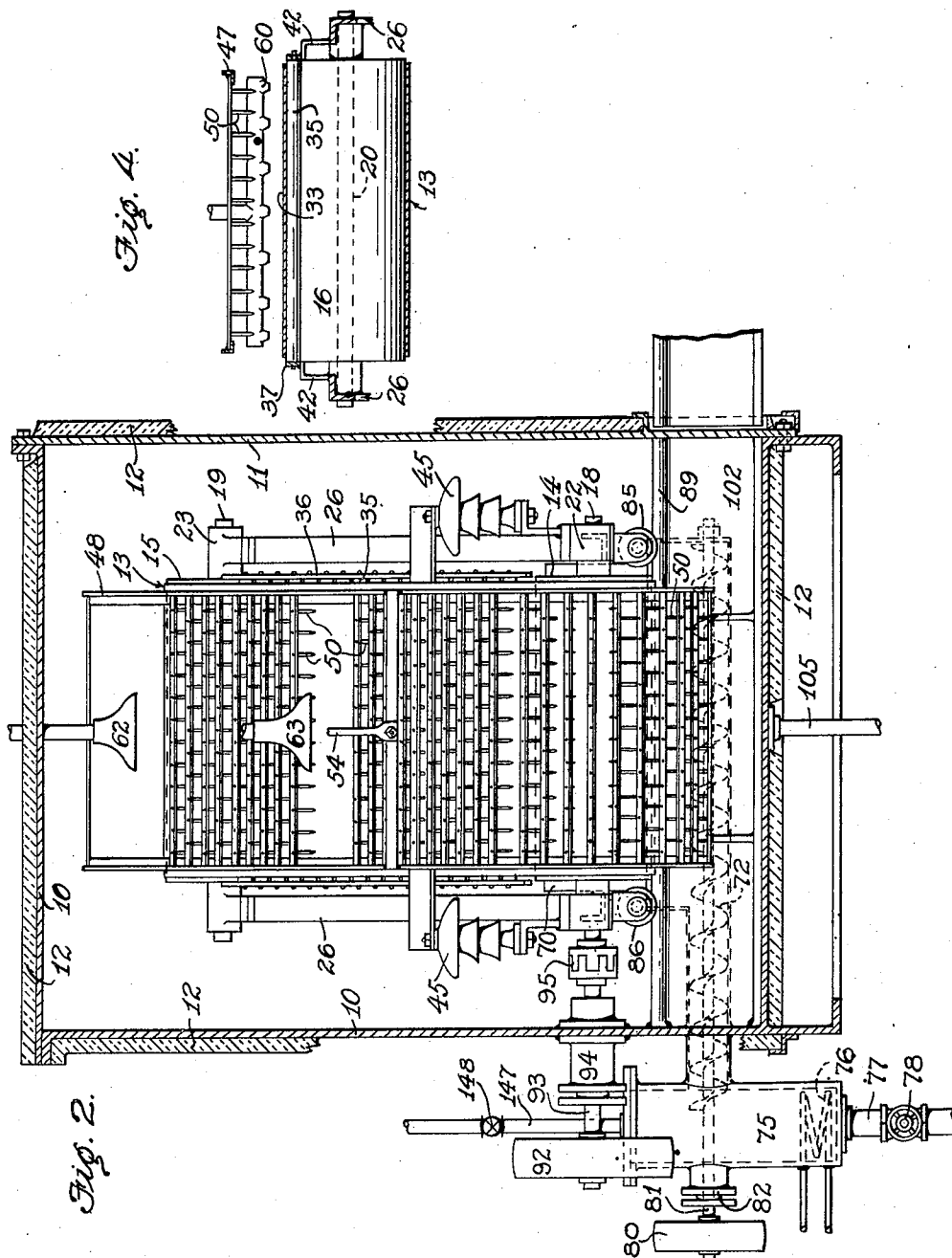


Fig. 2.

Fig. 4.

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3 Sheets-Sheet 3

Fig. 3.

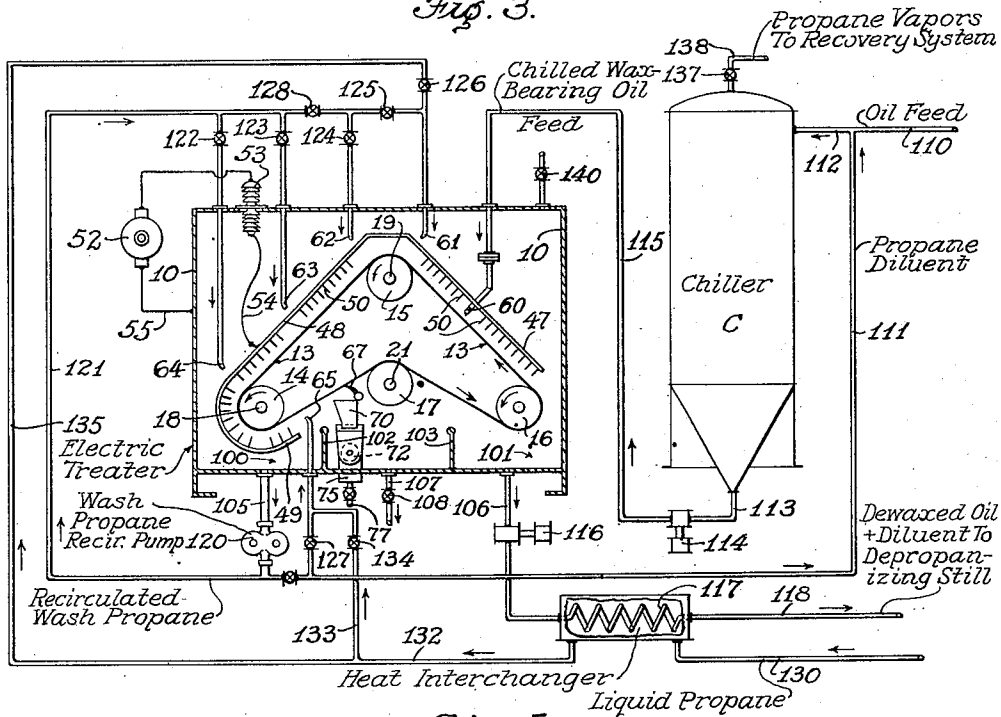


Fig. 5.

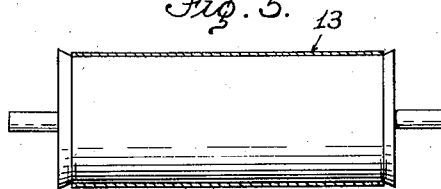


Fig. 6.

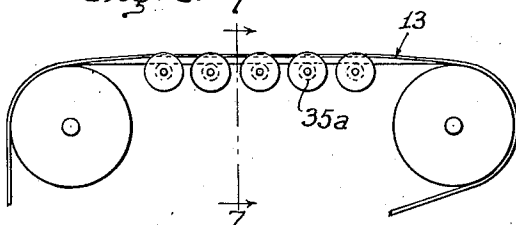


Fig. 7.

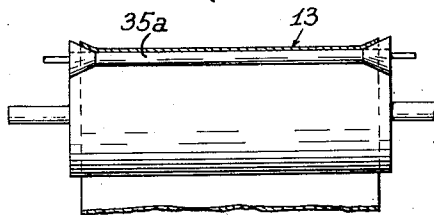
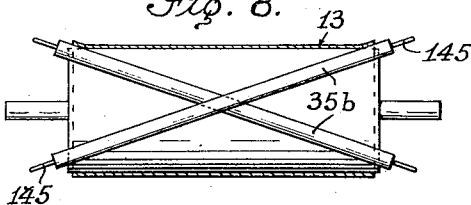


Fig. 8.



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UNITED STATES PATENT OFFICE

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PROCESS FOR DEWAXING OIL

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Application January 11, 1937, Serial No. 119,998

4 Claims. (Cl. 204—184)

This invention relates to the separation of precipitates such as wax, asphalt, resin and like substances from oils, and particularly to the electrical separation of hydrocarbon oils from waxes which they contain to produce relatively oil-free high melting point waxes.

Many oils such as lubricating oil, fuel oil, motor fuel and other similar oils which were derived from crude oils contain paraffinic, waxy, asphaltic and resinous constituents which may appear there by reason of having been present in the crude oil from which they were derived or by reason of their formation in intermediate treating processes, such as distillation or cracking. The wax-like constituents which may thus be present limits the minimum temperature at which these oils can be used by solidifying or congealing at low temperatures. The asphaltic and resinous bodies also are objectionable for numerous other reasons well known in the art of lubricating oil and motor fuel refining. Therefore in the refining of such oils, it is common practice to remove a substantial portion of these waxy asphaltic and resinous constituents in order to lower the pour points and improve the quality of such oils.

The separation of the undesirable paraffinic and waxy bodies from oil fractions has been accomplished in the past by several processes, the most common and oldest of which are the "cold settling" process and the "cold pressing" process. These processes have been inefficient, time consuming, mechanically involved and have heretofore produced separated constituents having a high percentage of oil contamination.

Asphaltic, resinous and tarry constituents and color bodies have been separated by well known processes employing acid, alkali, clay or other chemical treatment and recently by solvents. In the solvent process the oil containing the undesirable constituents such as asphalt, resin, color bodies and the like, is dissolved in a quantity of a suitable diluent such as liquid propane or other liquid normally gaseous hydrocarbon which has preferably at normal temperature a low solvent power for these bodies, while at the same time retaining practically complete solvent power for the desirable fractions of the oil. Such solvent treatment results in the rejection of asphaltic bodies from the oil diluent solution in the form of a relatively heavy insoluble precipitate or as a heavy liquid phase, a substantial portion of which may be separated from the oil solution by settling in a reasonable length of time. In this solvent process, however, not only a sufficient quantity of the precipitate material often remains in the oil solution in the form of an unsettled finely divided suspension, to cause serious contamination of the final oil product unless special steps are taken for its complete removal, but the

separated insoluble precipitate also still contains a high percentage of the oil from which it was desired to separate it.

An object of this invention is to overcome the disadvantages of the heretofore employed processes for the separation of wax, paraffin, asphaltic, tarry, resinous and color bodies from oils and to provide an improved process for the separation of these substances from oil which would be efficient, economical, of high capacity and rapid in action, less costly in time and equipment than processes heretofore employed. The particular object of this invention is to provide a method whereby the separated constituents, such as wax separated from hydrocarbon oils will be more thoroughly deoiled and freer from contamination by oily constituents than has heretofore been possible except where special and costly processes have been additionally employed for this purpose. Another object of this invention is to provide a process for separating the wax from wax-bearing oil wherein an improved recovery of oil from the wax is accomplished, resulting in a larger unit yield of dewaxed oil.

In general these objects are obtained according to the invention by subjecting the oil containing the suspended precipitate bodies to the action of an electric field and vigorously washing the electrically separated precipitate bodies by a relatively large quantity of recycled wash solvent.

Accordingly the invention resides in an improved process and apparatus for the electro-deposition of the suspended precipitates from oils wherein the oil precipitate mixture is placed in the form of a relatively thin layer upon an inclined moving belt electrode and subjected there to an intense ionizing electric field whereby the precipitate is deposited and held in a dense layer upon the moving electrode surface, thus effecting the separation of a major portion of the oil from the precipitate and whereby the precipitate layer thus separated from the oil may subsequently be thoroughly washed and further electrically treated to remove occluded and adhering oil to produce a relatively oil-free precipitate and a maximum recovery of purified oil. The invention also resides in the process and apparatus wherein the electrically deposited precipitate is vigorously washed by a large quantity of recycled wash solvent to produce a relatively oil-free precipitate. The invention also resides in washing the precipitate at a plurality of points and in the recycling and introduction of a portion of the wash oil to the oil feed prior to the precipitation step and the electrodeposition of the resultant suspended materials.

This process is particularly adapted and finds one of its major industrial applications to processes for the separation of waxes from oil to produce high pour point oils relatively free from wax

and high melting point waxes relatively free from oil. It is a particular advantage of the process that in contradistinction to processes of settling, centrifuging or filtering, a careful preparation of the wax precipitate, that is as to crystal structure or plasticity, is unnecessary and avoided. In fact all that is required is to separate the wax as a solid phase by chilling or otherwise precipitating it by reducing the solubility of the wax in the solvent or oil. We have found that the process works particularly well with flash chilled waxes, that is, those waxes formed by such rapid chilling that the wax is in a very finely divided condition and usually difficult to separate by other methods heretofore employed.

Other objects, advantages and novel features of the invention will be evident hereinafter.

In the accompanying drawings which illustrate preferred embodiments of the invention with which the process of the invention may be performed:

Fig. 1 is a partial sectional elevation of the electric treater;

Fig. 2 is a sectional elevation taken at line 2—2 in Fig. 1;

Fig. 3 is a general arrangement of the apparatus;

Fig. 4 is a partial cross section taken at line 4—4 in Fig. 1;

Figs. 5, 6, 7 and 8 illustrate methods of shaping the belt electrode to carry the liquid undergoing treatment and maintaining it in alignment on the drums.

The apparatus is as follows:

The main elements of the treaters are housed within a vapor-tight shell 10 provided with a removable end 11, the whole housing being covered by suitable heat insulating material 12. Inside of the container 10 an A shaped, movable belt electrode 13 extends between and around the four rotatable metal drums 14 to 17 which are in turn rotatably supported upon shafts 18 to 21 extending through the pairs of bearings 22 to 25 respectively. The belt electrode may be constructed of any suitable conducting material such as flexible metal webbing or fabric suitably impregnated with conductive material such as sprayed or deposited metal or fabric belting covered with a metallic sheeting, but it is preferably constructed of a metallic conducting material having a smooth polished working surface to facilitate the complete removal of deposited material. A belt electrode of this type may be satisfactorily constructed of non-annealed chrome nickel alloy steel sheets, 0.01 inch thick and of any suitable width, with electrically welded lap joints. A triangular shaped angle iron frame 26 is provided for supporting and maintaining the proper separation and alignment of the said pairs of bearings 22—25. The bearings 22—24 are suitably bolted to the corners formed by the intersecting members of the triangular shaped frame 26 while the bearings 25 carrying the shaft 21 are movably supported between the upright angle iron members as shown at 28 and 29 in order to provide vertical movement of the drum 17 sufficient to maintain the metal belt 13 in proper tension. The bearings 25 carrying shaft 21 and drum 17 is forced upward against the metal belt 13 by means of coil springs 30. Tension in these springs is adjustable by means of a bolt 31.

The two uppermost inclined surfaces 32 and 33 of the metal belt are supported to prevent sagging by means of a plurality of metal rollers 35 which extend across the width of the under sur-

face of the belt and which in turn are rotatably supported at their ends upon suitable bearings carried by angle irons 36 and 37. These angle irons 36 and 37 extend along the edge of the metal belt and are supported in place by means of angle iron clips 38, 39, 40 and 42.

Standing at each of the lower four corners of the triangular iron frame 26 substantially directly above each of the lower drum shaft bearings is a high tension insulator as indicated at 45 and 46. From the tops of the four insulators is supported a substantially triangular metallic framework which constitutes the support for the pointed ionizing electrode system. This electrode supporting system comprises angle irons 47 and 48 between which extend a plurality of transverse metal bars forming a gridwork which extends above and substantially parallel with the upper inclined surfaces of the metal belt and also around and below the drum 14 as illustrated at 49. From these transverse metal rods forming the gridwork extend the plurality of ionizing electrodes as illustrated at 50. These ionizing electrodes may be constructed of metal wires approximately 6 inches long and $\frac{1}{16}$ " in diameter, preferably sharply pointed at the unsupported ends which are most adjacent to the metal belt electrode. These ionizing electrodes may be spaced approximately at 1 to 2 inch centers.

The electrode system just described is maintained at a high electric potential difference with respect to the adjacent surface of the belt electrode by means of a suitable high potential generator 52, which is electrically connected through the high tension lead-in insulator 53 and the flexible conductor 54. The opposite electrical circuit from the high potential generator 52 is completed to the belt electrode by way of the ground connection 55, through the container 10 and the metallic belt electrode supporting mechanism.

A plurality of nozzles 60—65 are supported by their connecting pipes from the walls of container 10 and positioned adjacent the working surface of the metal belt electrode so that liquid supplied thereto can be jetted upon the belt surface through the ionizing electric field at the various points illustrated.

A scraper 67 bears across the width of the metallic belt 13 at a point approximately midway between the supporting drums 14 and 17 and serves to move the deposited material adhering to the active belt surface. A roller 68 extends across the belt surface at a point opposite the line of contact of the scraper 67 to receive the pressure from the scraper which is applied to the belt surface by means of spring 69. A hopper 70 having a rectangular shaped top opening is provided directly below the scraper 67 to receive deposited material removed from the belt and to guide this material into the screw conveyor 72 by means of which the deposited material is removed from the treater and introduced into the accumulator 75. A heating coil 76 serves to introduce heat into the bottom of the accumulator and an outlet connection 77 carrying valve 78 serves to drain accumulated liquid material. The screw conveyor 72 is permanently supported from the bottom surface of the container 10 by means of suitable supports 73 and is driven by means of pulley 80 which is connected to shaft 81 which in turn extends into the accumulator 75 and into the treater through a bearing and stuffing box 82.

The primary framework 26 together with all of the associated mechanical and electrical ap-

paratus hereinbefore described, which includes the drums 14-17, the metal belt electrode 13 and the ionizing electrode system comprising the electrodes 50 and their supporting gridwork, is movably supported upon four grooved metal wheels 85-88. These grooved metal wheels rest upon two rails 89 and 90 which extend across the width of the container 10 so that upon removal of the end 11 the whole treater assembly can be readily rolled out of the container and repaired or replaced by another similar unit. The container as illustrated at 10 may be sufficiently long to contain a number of these treater units, any one of which may thus be readily removed from the container for repairs or replacement with a minimum of lost time.

The belt electrode and the supporting drums are driven by means of pulley 92 which is attached to the end of shafting 93 which passes into the container 10 through the bearing and stuffing box 94. The flexible splined coupling 95 is provided for connecting the shaft 93 to the end of the drum shaft 18.

In the opposite sides of the container 10 and, directly beneath the lower drums 14 and 16 is provided rectangular reservoirs 100 and 101, formed by means of the metal partitions 102 and 103 respectively which also constitute the flange portion of the before mentioned rails 89 and 90. These reservoirs are provided for collecting liquids which have been treated on the belt electrode surface and which drain therefrom at these points. Provision is made for withdrawing accumulated liquids from these reservoirs through pipes 105 and 106. Provision is also made for withdrawing extraneous accumulated liquids and condensate from the bottom of the container through pipe 107 and valve 108.

It has been found that a moving metallic belt will not remain in stable alignment upon rotating pulleys or drums which are flat or crowned as they are commonly constructed for ordinary fabric or leather belts, but that in the absence of other means for maintaining alignment the drums or pulleys must be provided with upturned edge portions as illustrated in Fig. 5. As the metal belt moves from one side of the pulley to the other one or the other of its edges comes in contact with the upturned end portions of the drum, resulting in increased tension and elongation along that contacted edge. This elongation has the effect of curving and guiding the belt away from the upturned edge and to the center of the drum surface. The metal belt with this arrangement may thus oscillate slightly from side to side but remains stable and without departing materially from the desired alignment.

Other means as illustrated in Figs. 6-8 may be successfully employed for maintaining alignment of the metal belt. A number of rollers 35a with upturned or conically shaped ends of increased diameter may be substituted for the rollers 35 shown in Fig. 1, with results similar to that obtained with the before mentioned specially shaped drums.

Another method optional to that illustrated in Figs. 6 and 7 is shown in Fig. 8. Here a single pair or a plurality of pairs of crowned rollers 35b may be employed to exert the necessary pressure upon the edges of the metal belt to retain its proper alignment. The rollers 35b may be supported at the end shafts 145 upon suitable bearings, variable as to height so as to adjust the desired belt edge pressure.

Another desirable feature of the apparatus as

illustrated in Figs. 6-8 is in the resultant raising of the belt edge as shown in such a manner as to confine the applied waxy oil layer to the belt surface. This raising of the belt edges eliminates the necessity for providing special dams bearing upon the moving belt edge to prevent spillage of the oil.

The invention accordingly also resides in the special roller means for maintaining stable alignment of the metal belt and for retaining the waxy oil mixture upon the belt surface.

The herein described apparatus is adapted to perform the process of electrically separating precipitates and solids from oils in general. It is particularly adapted to separate wax, asphalt and color bodies from lubricating oils, waxy, resinous and colored bodies from gasoline and Diesel fuel oil, asphaltic and carbonaceous substances from residuums and tars from coal tar oils and the like. It is also adaptable to the separation of high melting point waxes, fats and fatty acids from animal or vegetable oils containing them.

Since the process and operation of the apparatus for the separation of any one of these substances from oil is similar, the following typical operation as applied to electrical dewaxing of wax-bearing oil is given for example.

The wax precipitate may be formed in the wax-bearing oil preparatory to the electrical dewaxing process by any suitable means such as by chilling in the presence of a suitable diluent by indirect heat exchange with a suitable refrigerant, or it may be formed by direct internal refrigeration in the presence of a liquid normally gaseous diluent such as propane. The wax precipitate is preferably formed by the latter self refrigeration method wherein a wax-bearing-oil-liquid-propane solution is continuously flashed into a region of low pressure accompanied by the rapid evaporation of a portion of the propane and the resulting sudden chilling and precipitation of the wax in the remaining oil propane solution. Rapid chilling such as this is known as "flash chilling" or "shock chilling" and apparently results in the formation of a finer wax precipitate than is formed by slower cooling methods. The formation of such fine precipitates is advantageous in the electrical dewaxing process.

In the present process the warm wax-bearing oil feed preferably prediluted with a diluent such as liquid propane in the proportion of $\frac{1}{2}$ - $1\frac{1}{2}$ to 1 so as to be sufficiently fluid to be readily pumped, is supplied through line 110 and meets and mixes with the liquid propane diluent from line 111 and enters the chiller C through line 112 where, at a reduced pressure and a resulting evaporation of a portion of the propane the temperature is reduced sufficiently to precipitate wax in the oil propane mixture. Sufficient propane is generally added at this point through line 111 to form a remaining solution having an effective propane oil ratio, after evaporative refrigeration, of from 2 to 6 volumes of propane to one volume of oil. It is preferable to operate with an effective propane oil ratio of approximately $2\frac{1}{2}$ to 1.

The propane oil mixture generally at a ratio of approximately $2\frac{1}{2}$ to 1 and at a temperature of approximately -35° F. containing the precipitated wax, is withdrawn from the bottom of the chiller C through line 113 by means of pump 114, and is forced through line 115 to the nozzle manifold 60 by means of which it is applied in a layer upon the sloping metal belt electrode surface and runs down under the influence of

gravity toward the drum 18. The thus applied wax-bearing oil diluent layer containing precipitated wax is subjected to an intense ionizing electric field between the lower points of the adjacent pointed electrodes and the upper belt surface resulting in the electrodeposition of the wax in a dense coating upon the upward moving belt surface. The oil propane mixture thus relieved of the precipitated wax continues downward under the influence of gravity over the belt surface and over the deposited wax layer and drops therefrom at the underneath surface of the drum 16 into the reservoir 101 and is removed from the electric treater container through pipe 106. The thus removed dewaxed oil is forced by pump 116 through the heat interchanger 117 and through line 118 to a suitable depropanizing still where the propane diluent content of the dewaxed oil is evaporated. The dewaxed oil from which the propane diluent has thus been removed is transported to storage. The evaporated propane diluent is subsequently recovered by compression and condensation and returned to the treating system.

The electrically deposited wax layer travels upon the upward-moving belt towards the drum 15 during which travel it is subjected to continued electrical treatment from the ionizing electrodes and to simultaneous washing by a liquid propane spray from nozzle 61. The washed deposited wax layer continues over the drum 15 and downward toward the drum 14 during which time it may be subjected to vigorous scrubbing by means of additional liquid propane sprays from nozzles 62, 63 and 64 and to simultaneous electric treatment from the adjacent pointed ionizing electrodes. The liquid propane wash containing a small percentage of oil and wax which is removed from the thus electrically treated and scrubbed deposited wax layer drops from the belt at the lower side of the drum 14 into the reservoir 100 from which it is withdrawn through pipe 105. The thus withdrawn wash propane may be recirculated at any desirable rate by means of pump 120 through return line 121 to any of the spray nozzles 61 to 65 in any desirable proportion regulatable by means of valves 122-127. For example the recirculation rate distributed to the wash sprays may be from say 1 to 10 times the quantity of propane utilized for diluting the waxy oil feed.

Ordinarily in operation the liquid propane supply from the before-mentioned propane recovery system is supplied to the treater system through line 130, heat exchanger 117, lines 132 and 133 and valve 134 to the spray nozzle 65 which is the last spray to contact the treated deposited wax prior to its removal from the belt by means of the scraper 67. The liquid propane is thus supplied to the system in sufficient quantity to replace that which is continually withdrawn from the propane wash circulating system through lines 111 to be mixed with the oil feed entering the chiller C through line 112 and to replace that withdrawn from the treater with the treated wax and oil. The liquid propane thus supplied through line 130 is the approximate quantity necessary to be added to the oil feed through line 111 to maintain the desired propane oil ratio in the chiller C. Under these operating conditions, valve 127 is normally closed and valve 134 open. The line 135 is also provided so that oil-free liquid propane directly from the propane supply and recovery system may also be supplied through valve 125 directly to either or both of

the wash spray nozzles 61 and 62 if desired. Under this condition, valve 128 is closed and valve 126 is open.

The dewaxing operation may be satisfactorily carried on without employing any wash spray from nozzle 61, depending entirely upon the washing effected by sprays 62-65.

However, it has been found at times desirable to supply fresh liquid propane wash to spray 61 to control the propane-oil ratio upon the treating surface of the depositing electrode surface and to supply make-up propane to compensate for that lost at this point of treatment by evaporation from the thin film of the waxy mixture running down over the depositing surface.

The wash propane is maintained at a temperature sufficiently low to prevent appreciable redissolving of the deposited wax, and the make-up liquid propane supply entering through line 130 may be adequately precooled by suitable means such as heat interchanger 117 to maintain this temperature-solubility condition. Additional precooling means may be employed if necessary. However, the temperature of the incoming propane may be adjusted to cause partial solution of the deposited wax if desired. The effect of the propane spray is obviously to thoroughly scrub the deposited wax layer and to remove a substantial portion of the included and adhering oil which has been sweated from the compactly deposited wax layer under the influence of the intense ionized electric field. This scrubbing and washing thus produces a recovered wax which is substantially more oil-free than would be possible by simple electrodeposition alone.

A particular feature of this invention resides in the recirculation by means of pump 120 to the sprays 62-64 of a large volume of wash propane without increasing the over-all propane-oil ratio as would be ordinarily necessary where such recirculation was not employed and where an independent stream of propane from the propane supply system was so employed, all of which was subsequently added to the oil feed. In other words, heretofore in similar processes for electrical dewaxing the quantity of wash propane employed to free the deposited wax from oil has been necessarily limited to that which was required to maintain the proper oil-propane ratio of the feed mixture. Any increase in wash propane heretofore had resulted in an undesirably high propane-oil ratio of the feed mixture.

The recirculation of a relatively large volume of wash propane to the wash sprays also results in producing a recovered wax which is substantially more oil-free than would be possible by washing only with the volume of propane necessary for dilution of the oil feed to the proper propane-oil ratio as has been the method heretofore.

The deposited washed wax is removed from the belt electrode surface by means of the scraper 67 and is guided by means of funnel 70 into the wax screw 72 by means of which it is withdrawn from the treater and forced into the wax accumulator 75. The wax is melted and freed of propane by means of heat introduced into the accumulator 75 through the coil 76 and the resulting depropanized liquid wax withdrawn to storage through line 77 and valve 78. The wax thus removed from the electric treater constitutes the finished relatively oil-free high melting point wax and may be delivered to storage through suitable means. The propane vapors are exhausted from the wax accumulator 75 to

the propane recovery system through pipe 147 and valve 148.

The temperature of the contents of chiller C is regulated by varying the pressure therein by means of valve 137 which governs the amount of evaporation of the propane. The resulting vapors are withdrawn through line 138 to the before mentioned liquid propane recovery system. The temperature of the treater within the container 10 is similarly regulated by means of valve 140. The treater is thus maintained at a temperature approximately equal to that of the chilled waxy-oil feed mixture.

In the operation described employing propane diluents and washes, the treater operates in an atmosphere of propane vapor confined within the treater shell. When other volatile diluents are employed the atmosphere within the treater shell will consist of vapors of such diluents. The process is not limited, however, to the use of volatile diluents, certain substantially non-volatile diluents, such as kerosene and gas oil and medium heavy hydrocarbon fractions being frequently employed under some conditions and when these are employed, other suitable means for refrigeration are employed. The character of the gaseous atmosphere maintained within the treater shell, although having some bearing thereupon, is not of primary importance insofar as the electrical ionization effects of the electric treating fields are concerned. It is of course necessary to avoid inflammable gaseous mixtures.

The ionizing electrodes 50 are constructed preferably of pointed wires which may be, as stated hereinbefore, $\frac{1}{4}$ to $\frac{1}{2}$ inch in diameter and from 6 to 12 inches long, and they are supported at their upper ends from the supporting gridwork with their axes perpendicular to the outer surfaces of the belt electrode. These pointed electrodes are preferably spaced from one another at distances of approximately 1 to 2 inches on centers. The lower pointed ends of the electrodes 50 are uniformly spaced from the outer surface of the belt electrode and adjusted at a distance just sufficient to prevent continuous spark-over therebetween at the operating potentials. The operating potentials which have been found to be effective for efficient dewaxing of the oil and efficient deoiling of the deposited wax, are in the neighborhood of 50,000 to 100,000 volts and under these conditions of voltage and electrode spacing a silent electric discharge or corona is observed at the ends of the pointed electrodes extending toward the belt electrode surface upon which the wax-bearing oil to be treated is flowed and upon which the deposited wax layer is washed and electrically "sweated" or dried. This electric potential applied to the electrodes by means of the generator 52 is preferably unidirectional and of a constant potential whereby the maximum average potential may be maintained between the electrodes without spark-over. The ionizing electrodes are also preferably maintained at a negative polarity while treating the majority of waxes.

Advantages of the process and apparatus of this invention reside in the separation of the washing stage from the treating stage of the treater whereby the wash propane can be separately collected and recirculated in the wash sprays in large quantity without in any way affecting the over all propane-oil ratio. The

apparatus illustrated is designed to make possible the separate collection of wash propane deoiled wax and dewaxed oil. Another advantage of this invention resides in the unitary structure of the treater and means by which it can be readily rolled from the container and thus be made completely accessible for repairs or adjustments or for replacement by an entire unit.

Other volatile diluents and wash liquids such as liquid ethane, butane, naphtha and gasoline may be employed in the hereinbefore described processes. Certain non-volatile diluents such as kerosene, gas oil and even light lubricating oil fractions may be also employed. When non-volatile diluents and wash solvents are employed, the refrigeration steps of the process may be accompanied by indirect heat exchange with suitable refrigerants through suitable heat interchangers.

The foregoing is merely illustrative of the apparatus and process of the invention and is not intended to be limiting. The invention includes any method and apparatus which accomplishes the same results within the scope of the claims.

I claim:

1. A process for deoiling wax comprising precipitating wax in the wax-bearing oil, subjecting the mixture to an electric field to separate the wax precipitate from the oil, subjecting the separated wax precipitate to washing with a wash solvent to remove occluded and adhering oil, removing wash solvent from the separated wax precipitate, and commingling the said removed wash solvent with the said wax-bearing oil mixture, subjecting the separated wax precipitate to a second washing with wash solvent to remove additional included oil, separately removing and collecting the wash solvent from the second washing of the separated wax precipitate and recycling said separately collected wash solvent to said second washing of separated wax precipitate.

2. A process according to claim 1 in which the recycled second wash solvent is applied to the separated wax at a plurality of points.

3. A process for deoiling wax comprising diluting the wax-bearing oil with a quantity of solvent, precipitating the wax in the wax-bearing oil solution, subjecting the mixture to an electric field to separate the wax precipitate from the oil solution, subjecting the separated wax precipitate to washing with a wash solvent to remove occluded and adhering oil, removing wash solvent from the separated wax precipitate and commingling the said removed wash solvent with the said wax-bearing oil mixture, subjecting the separated wax precipitate to a second washing with wash solvent to remove additional occluded oil, separately removing and collecting the wash solvent from the second washing of the separated wax precipitate and recycling said separately collected wash solvent to said second washing of separated wax precipitate.

4. A process according to claim 3 in which the second wash solvent is recycled to the second washing of separated wax precipitate at a rate greater than that at which diluent is added to the waxy oil feed prior to precipitation of the wax.

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