July 29, 1930. G. WOLFF 1,771,698

APPARATUS FOR CLEANSING AND REMOVING GREASE AND THE LIKE FROM SOLID ARTICLES

Filed May 8, 1928 3 Sheets-Sheet 1

Fig. 1.

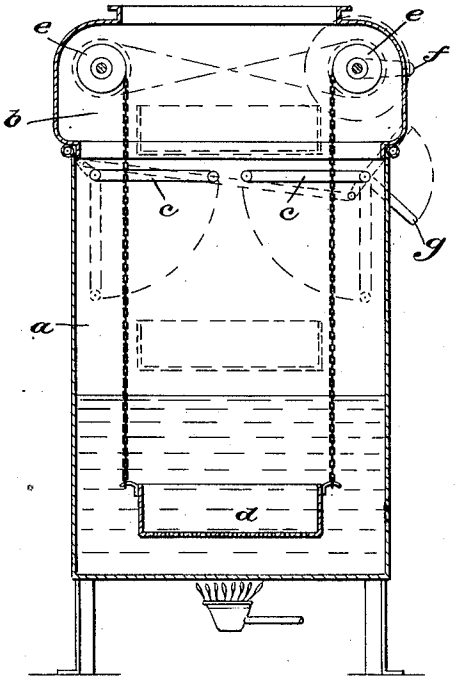


Fig. 2.

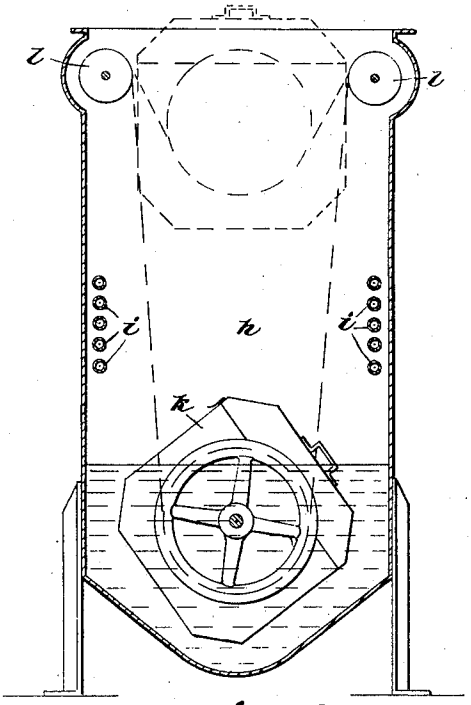


Fig. 1a

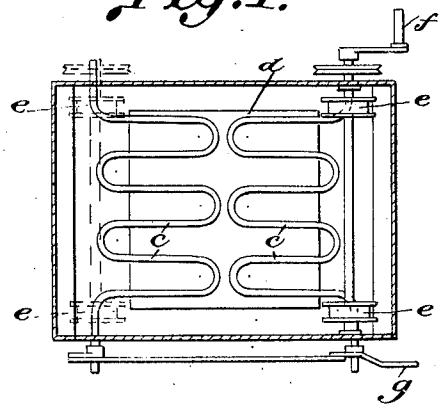
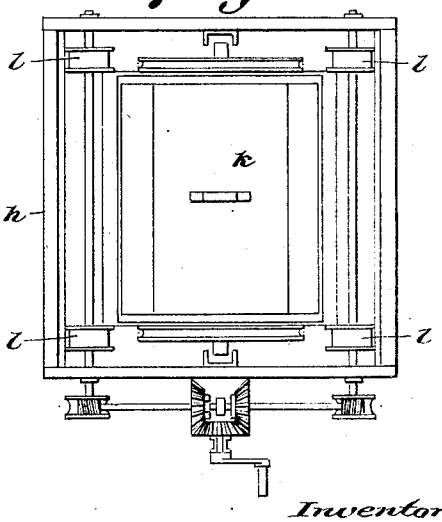


Fig. 2a



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July 29, 1930. G. WOLFF 1,771,698

APPARATUS FOR CLEANSING AND REMOVING GREASE AND THE LIKE FROM SOLID ARTICLES

Filed May 8, 1928 3 Sheets-Sheet 2

Fig.3

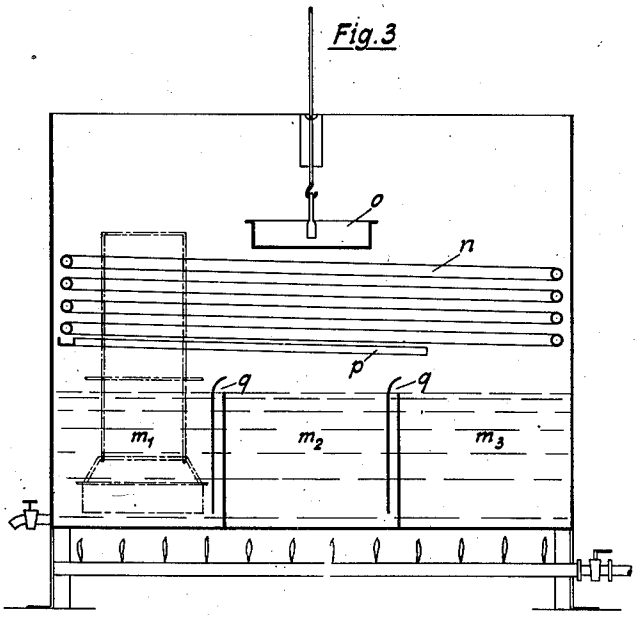
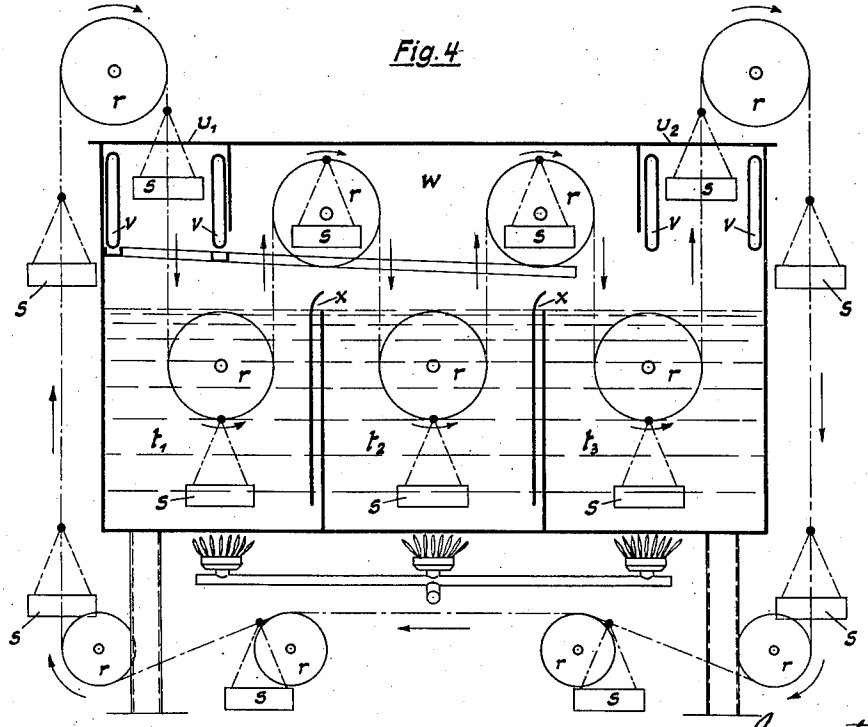


Fig.4



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July 29, 1930. G. WOLFF 1,771,698

APPARATUS FOR CLEANSING AND REMOVING GREASE AND THE LIKE FROM SOLID ARTICLES

Filed May 8, 1928 3 Sheets-Sheet 3

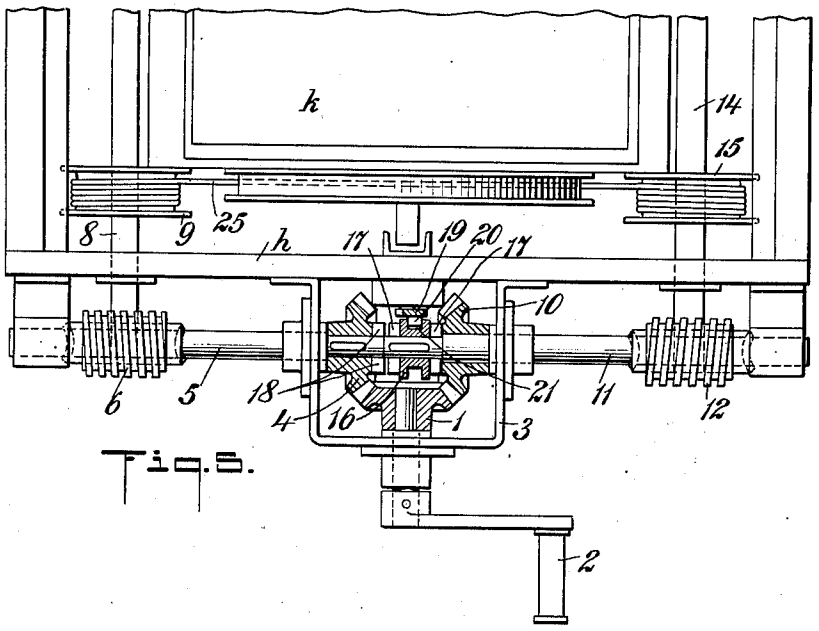
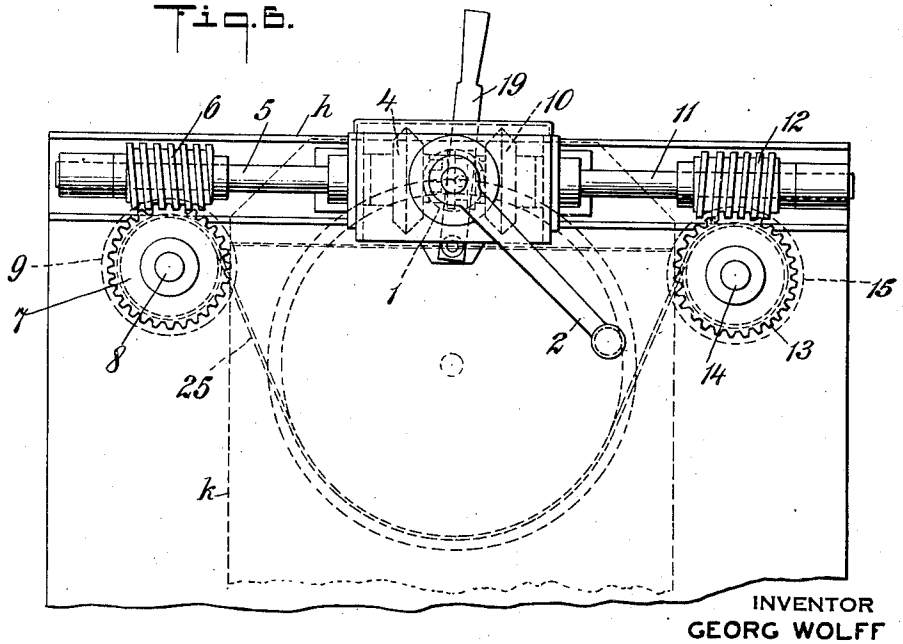


Fig. 5.

Fig. 6.



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APPARATUS FOR CLEANSING AND REMOVING GREASE AND THE LIKE FROM SOLID ARTICLES

Application filed May 8, 1928, Serial No. 276,006, and in Germany March 4, 1927.

This invention relates to an apparatus for cleansing and removing grease and the like from solid articles by means of organic solvents, and has for its object to greatly save time necessary for cleansing, and to avoid completely the loss of volatile solvents in an open washing vessel, therefore being without any danger for persons.

Liquid solutions such as benzine, benzol, trichlorethylene, carbon tetrachloride, have been used for cleansing solid articles such as metals, glass, celluloid and horn, which are coated with oil, grease, resin, wax or the like. These solutions are particularly effective if they are used in a warm condition, but care must be taken that the vapours developed from the solution do not escape from the washing vessel, since considerable loss and danger to the operators may in this case occur. For such warmed solutions, closed gastight washing vessels are usually employed and the vapours remaining in them after the washing process are removed either by suction or deposited by cooling before the cover is raised. This process is inconvenient and wastes time and generally is by no means perfect.

According to the present invention, heated solutions of the kind named can be employed in an open washing vessel without the above-mentioned drawbacks, by arranging cooling bodies, for example a coiled tube traversed by cold water, above the level of the washing liquid. The gases developed are then directly condensed by contact with the cooling bodies and the condensate drops back into the washing liquid. If the cooling effect is proportioned so that the whole heat of evaporation is carried away, the vapours, since they are heavier than air, are only present below the cooling bodies, and cannot rise above the latter and escape from the open vessel. It is not at all necessary that the whole upper surface of the heated washing liquid should be covered by the cooling bodies; on the other hand, it is quite sufficient if they are arranged at the walls of the vessel, so as to leave sufficient room for the immersion of the substances to be treated in the liquid.

If the walls of the washing vessel are sufficiently high, so that there is an open space above the cooling bodies, and if the substances which have been cleansed in the liquid are brought while still hot and wet into this space, they dry in a very short time by the evaporation of the liquid adhering to them. The vapours formed in this way do not leave the vessel, but fall down by gravity and are deposited on the cooling bodies. This particular property of the vapours is of particular advantage when trichlorethylene and carbon tetrachloride are used as the washing liquid, because their vapours have a very high specific gravity (specific weight). Since also these two solutions have the great advantage of complete non-inflammability, and on that account can be heated without danger by open flames, they are specially adapted for the described method of operation in open washing vessels.

The figures of the accompanying drawings represent diagrammatically examples of washing apparatus of the kind described, and with the aid of which further advantages of the method of operation will be explained.

In Fig. 1 a washing vessel is represented of which the lower part *a* is partly filled with a washing liquid of the kind mentioned which is warmed by heating the base of the vessel. Between the part *a* and the upper part *b* of the vessel there are two pivoted sets of coiled tubes *c* traversed by cooling water, and the vapours arising from the heated washing liquid are deposited on these coils, so that they do not reach the upper part *b*. The articles to be cleansed are placed in a perforated basket *d* which is suspended by chains or cords and is lowered into the part *a* by gearing *e* operated by a crank *f*. For this purpose the coils *c* are turned for a short time by means of a handle *g* into a vertical position shown in dotted lines against the side wall of the vessel, and after the passage of the basket are again returned to their horizontal position. The main operation of cleansing of the articles is effected by the immersion into the hot washing liquid, whereupon the basket is again raised above the level of the liquid, but is left for some time

in the vapour space below the tubes *c*. The perfectly pure condensate deposited on the cooling tubes drops down on the articles with the considerable advantage that they undergo a second washing process. The basket *d* is then raised into the upper part *b*, the tubes *c* being again turned for a short time to the side of the vessel. In this position the warm articles are quickly and completely dried, the vapours sinking down and being deposited on the cooling tubes below. The purified and dried articles are then removed from the basket and replaced by impure articles, with which the operation described is repeated.

Fig. 2 represents an open washing vessel *h*, the lower portion of which is filled with the washing liquid, which is warmed by a heating device, not represented. Cooling tubes *i* are arranged over the level of the liquid and are fixed to the inner wall of the vessel, and even in this position suffice to prevent the vapours from rising. A basket *k*, prepared from perforated sheet metal, containing the articles to be washed, is lowered between the cooling tubes by gearing *l* and immersed in the hot washing liquid. By a change in the gearing the basket *k* can then be rotated in the liquid about its axis. This is necessary if articles with hollow spaces, for example complete motor casings, are to be cleansed, since only by a rotary movement of this kind can the washing liquid be made to penetrate into all the hollow spaces. When the basket *k* is again raised over the tubes *i*, it must in this position be again rotated, in order that the hollow spaces of the articles which are filled with liquid can be completely emptied and dried.

The gearing means used for lowering and raising *k* in Fig. 2 is shown in detail in Figs. 5 and 6. Fig. 5 is a plan view partly in section of the gearing used in the modification of the apparatus shown in Fig. 2 while Fig. 6 is a front elevation of same. This gearing means comprises a bevel gear 1, actuated by a crank 2, mounted in the bracket 3 attached to the washing vessel *h*. The bevel gear 1 meshes with the bevel gear 4 fixed on the shaft 5 at one end thereof, said shaft carrying a worm 6 at its opposite end. The work 6 actuates worm wheel 7 fixed on one end of shaft 8 which carries a pair of drums 9 (only one of which is shown in Fig. 5) for reeling and unreeling the rope or chain 25 supporting the basket *k* on both sides. The bevel gear 1 also meshes with the bevel gear 10 rotatably mounted near one end of shaft 11. The shaft 11 carries the worm 12 at its opposite end which meshes with the worm wheel 13 fixed at one end of the shaft 14, similar to shaft 8, which carries drums 15 functioning similarly to drums 9 but on the opposite side of the basket *k*. A clutch member 16 is mounted on shaft 11 beyond bevel gear 10 so as to be capable of a limited movement along the longitudinal axis of shaft 11, but fixed to prevent angular movement about the shaft. This clutch member has projecting fingers 17 at each end thereof to fit in either recesses 18 cut in the bevel gear 4 or similar recesses cut in bevel gear 10 depending upon which end of its path clutch member is moved to. The recesses in bevel gear 10 are not shown in Fig. 5 as the clutch is in such position that its fingers 17 are inserted in the recesses in bevel gear 10, in other words, the shaft 11 is shown in gear with the bevel gear 10 in this figure. Pivoted lever 19 carrying projection 20 which fits in a recess 21 of the clutch member 16 is provided for moving the clutch member along the shaft 11 so that it may engage either one of the bevel gears 4 and 10 which gears rotate in opposite directions owing to the fact that they are on opposite sides of bevel gear 21.

To raise or lower the basket *k* the lever 19 is moved to the left (Fig. 6) throwing bevel gear 4 in gear with shaft 11 and causing shaft 11, upon actuating crank 2, to rotate in the same direction as shaft 5 and consequently causing drums 9 and 15 to rotate in opposite directions. Whether the basket *k* is raised or lowered depends upon which direction crank 2 is turned.

To rotate the basket *k* either in the washing liquid or in the cooled area above it, the lever 19 is moved to the right (Fig. 6) throwing bevel gear 10 in gear with shaft 11 and causing both shafts 5 and 11 to rotate in opposite directions and consequently causing the drums 9 and 15 to rotate in one and the same direction. With the apparatus geared this way the rope or chain 25 can be reeled on either one of drums 9 or 15 depending upon the direction in which crank 2 is turned.

In Fig. 3 an open washing vessel is represented of which the lower portion is divided by partitions into three containers m_1, m_2, m_3 which are filled with the washing liquid and can be heated. Also, in this case the cooling bodies have the form of cooling tubes *n* which are arranged at the walls of the vessel above the containers and prevent the vapours from rising. The articles to be cleansed are placed in the perforated basket *o*, which is immersed successively by hand by means of a rod and strap in the containers m_1, m_2, m_3, the main cleansing taking place in the first container m_1 which, consequently, receives the greatest portion of the impurities, while the containers m_2 and m_3 serve for final washings. In consequence of these after immersions, the apparatus is particularly suited for washing articles which require to be very completely cleansed; for example if they are to be nickel-plated later. The pure condensate dropping from the cooling tubes is received by a trough *p* and led to the container m_3, which contains the purest liquid. From this container the liquid can flow gradually

over overflows q into the containers m_2 and m_1. After the cleansing has been completed, the basket is suspended as shown in the space above the cooling tubes and the articles are allowed to dry before they are removed from the apparatus. From time to time the very impure contents of the container m_1 are removed and fresh liquid introduced into the container m_3 by the overflow from which the container m_1 is again completely filled. Also, constantly fresh solution can be allowed to flow to the container m_3 and an equal quantity of the impure liquid from the container m_1 allowed to escape. It is possible to completely remove the impurities by distillation and recover the solution.

Fig. 4 shows an automatically operating cleansing apparatus. In this case a large number of perforated baskets s filled with the articles to be cleansed are suspended on an endless cord or chain gear running over rollers r, and by means of these are introduced through an opening u_1 into the washing vessel w and immersed in succession in the containers t_1, t_2 and t_3 filled with warm washing liquid, and are finally removed through an opening u_2 from the vessel w. Cooling pockets v are arranged at the openings u_1 and u_2 between which pockets the articles to be cleansed are slowly drawn. These cooling pockets prevent the vapours developed in the vessel from escaping from the openings and they also dry the articles as they pass through them before their discharge.

The gearing is driven preferably by a motor and so slowly that it is possible to fill and empty the baskets outside the washing vessel without bringing the gearing to rest. The container t_1 in which the articles are first immersed retains the largest portion of the impurities, while the containers t_2 and t_3 serve for the later immersions. The condensate flowing from the cooling pockets and also constantly fresh quantities of solution are introduced into the container t_3, which contains the purest liquid. There is a gradual flow from the container t_3 through the overflow x to the container t_2 and from this to t_1 from which the impure liquid is led to a distillation apparatus.

What I claim is:—

1. Apparatus for cleaning and removing grease and the like from articles comprising a washing vessel having a permanently unobstructed open top through which the articles to be cleaned are adapted to be inserted, said vessel being adapted to be partially filled with a volatile cleaning liquid, and cooling means in the upper part thereof above the level of said liquid to condense and thereby prevent vapors from escaping through the open top of said vessel.

2. Apparatus for cleaning and removing grease and the like from articles comprising an open top washing vessel adapted to be partially filled with a volatile cleaning liquid and cooling means arranged along the side walls in the upper part of the vessel above the level of said liquid to condense and thereby prevent vapors from escaping through the open top of said vessel.

3. Apparatus for cleaning and removing grease and the like from articles comprising a washing vessel having a permanently unobstructed open top through which the articles to be cleaned are adapted to be inserted, said vessel being adapted to be partially filled with a volatile cleaning liquid, and cooling means in the upper part thereof above the level of said liquid to condense and thereby prevent vapors from escaping through the open top of said vessel, said vessel extending above said cooling means to provide a space wherein articles may be dried within the vessel.

4. Apparatus for cleaning and removing grease and the like from articles comprising an open top washing vessel adapted to be partially filled with a volatile cleaning liquid, cooling means in the upper part thereof above the level of said liquid to condense and thereby prevent vapors from escaping through the open top of said vessel, and means for lowering and raising articles into and out of said liquid.

5. Apparatus for cleaning and removing grease and the like from articles comprising an open top washing vessel adapted to be partially filled with a volatile cleaning liquid, cooling means in the upper part thereof above the level of said liquid to condense and thereby prevent vapors from escaping through the open top of said vessel, and means for lowering and raising a container for said articles into and out of said liquid, said means embodying mechanism for giving the container a rotary motion both in and above said liquid.

Signed at Munich, Germany, this 26th day of April, A. D. 1928.

GEORG WOLFF.