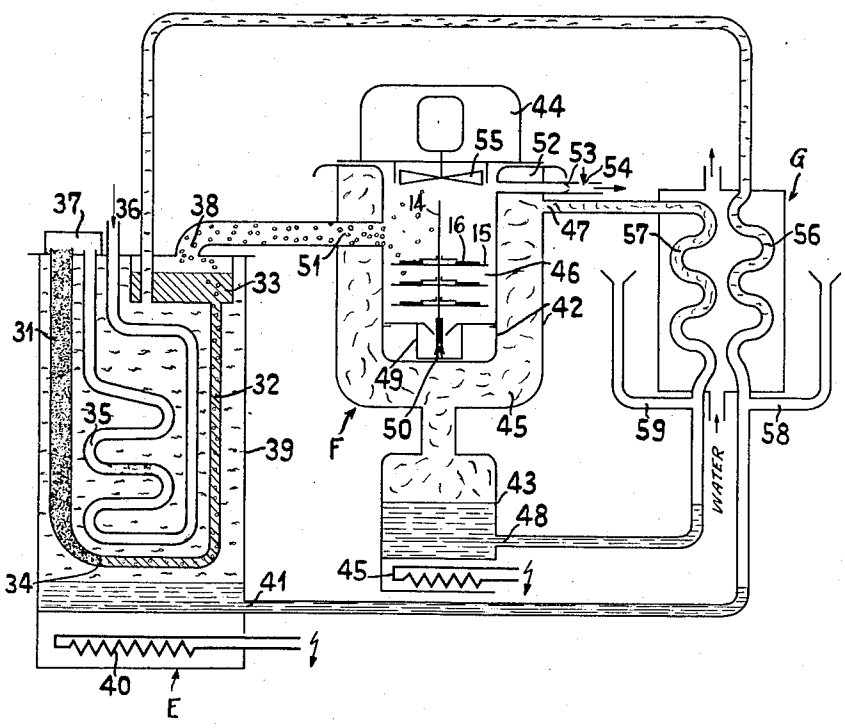
Aug. 4, 1959 F. HELD ET AL 2,897,778

APPARATUS FOR EPILAMIZING SURFACES

Filed Dec. 9, 1954



Inventors
Fritz Held
Robert Petermann
Willi Maag
by Pierce, Scheffler & Parker
attys

United States Patent Office 2,897,778
Patented Aug. 4, 1959

2,897,778

APPARATUS FOR EPILAMIZING SURFACES

Fritz Held, Robert Petermann, and Willi Maag, Zurich, Switzerland

Application December 9, 1954, Serial No. 474,260

Claims priority, application Switzerland December 15, 1953

4 Claims. (Cl. 118—48)

It is known that the state of lubricating surfaces greatly affects the chemical and physical behaviour of the lubricant. Thus in the case of very small bearings like watch bearings, particles of dirt, such as dust, metal particles, cellulose fibres, as well as microscopically nonvisible residues such as grease, oil, soap, etc., often left by a previous cleaning process, will generally cause an increased spreading of the lubricant and a resulting rapid aging of the same by chemical changes. To eliminate these drawbacks, attempts were made in practice to apply a thin layer of, say, stearic acid, a so-called epilam. The molecules of the epilamic substance are so constituted that they adhere with their strongly polar ends to the surface of the article to be epilamized, and produce with their non-polar ends an inert protective film on the surface. The purpose of this is to protect the lubricant from the specific action of the surface and thus to prevent it from spreading and from chemical change. The quality of the epilams with respect to protection against spreading and aging of the lubricant is dependent on their thickness, the degree of orientation of the single fatty molecules with respect to each other and to the surface, the purity of the epilam, as well as on its adherence to the surface. The conventional epilamizing methods, such as the dipping epilam or coating epilam do not permit producing epilams with maximum and reproducible quality. Thus for instance, in the case of dipping epilams, the thickness of the layer is not definite and is moreover locally different. Due to capillary action thicker layers will form in the narrow cavities and holes than on the flat portions and edges. The fact that it is not possible with methods known heretofore to make reproducible and qualitatively first-rate epilams, is the main reason why the utility of these epilamizing processes has up to the present been so seriously disputed in lubrication technique.

After numerous tests it was found that the adherence of the epilamic layer is largely dependent on the activity of the surface, i.e. on its microscopic and submicroscopic degree of purity. The expression, "active conditions of the surface" is understood to mean a state in which no microscopically visible contaminations are present, and in which the surface forces are already so strongly effective that, for instance even a polar lubricant will, within a few minutes, wet the whole surface, i.e. spread over it.

The method according to the invention is essentially characterized in that the surfaces, of the objects are activated and then epilamized, the activation being effected by a preliminary surface cleaning and a final cleaning. The arrangement for carrying out the method is characterized by a functional incorporation of a cleaning device and an epilamizing device.

Other features of the invention will appear from the claims, specification and drawing, the latter illustrating by way of example an arrangement for carrying out the method.

The single figure shows diagrammatically the epilamizing arrangement.

The method of epilamizing objects, such as workpieces and the like is carried out in such a way that at first the surface to be epilamized is brought to an active condition by mechanical, physical and/or chemical cleaning processes, and on the surface thus prepared, the epilamic substance will be deposited from the gas phase in absolute purest form in the desired reproducible uniformity. The active condition will therefore be attained by preliminary cleaning which removes the coarse particles of dirt, as well as by final cleaning which removes all submicroscopic layers of residue from the surface. The preliminary cleaning may be carried out mechanically, say, by brushing and with the aid of ultrason and/or in a physical-chemical manner, say, by solvents (acids, lyes, etc.). The final cleaning of the surface may take place by bombarding the surface with ions and/or electrons, or in a chemical-physical manner with continuously renewed solvents in the extraction process. Preliminary cleaning, final cleaning and epilamizing are effected consecutively in a continuous operation. As a result, contamination of the surface after final cleaning can no longer occur.

The arrangement for carrying out the method comprises a cleaning device and an epilamizing device. The cleaning device is subdivided into a device for preliminary cleaning and a device for final cleaning in order to activate the surface.

The preliminary cleaning takes place by ultrason by means of a device, for instance according to Swiss Patent No. 308,935 which provides at least one magnetostrictive, ultrason-producing element having at least one cavitation zone to receive the body under treatment together with liquid, in such a way that the produced sound waves are directly transmitted to the liquid. Moreover, a tubular body of electrostrictive material may be provided as sound-producing element, having at least one cavitation zone to receive the body under treatment together with liquid, in such a way that the produced sound waves are directly transmitted to the liquid.

The adopted cleaning means consists of, say, a mixture of hydrocarbons with high boiling points. The viscosity of the preliminary cleaning means at 20 degrees centigrade is at least 5 cst. to prevent the particles separated by ultrason from being settled out too quickly.

The final cleaning is carried out in a physical-chemical manner in an extraction apparatus. In this case, as detergent, a liquid, say hexane with definite boiling point may be suitable, in which the preliminary cleaning means is soluble. The extraction apparatus includes a boiler for distilling the detergent, together with a return-flow cooling system to condense the vapours of the detergent, an extraction vessel for activating the surfaces of the parts by repeatedly treating them with perfectly pure detergent, further a drying chamber for completely drying the finally cleaned parts. Evaporation and condensation take place in the circuit.

The epilamizing arrangement comprises a carburettor E, an epilamizing chamber F and a cooling system G. The carburettor E consists of a tube 31 filled with a surface-active substance, such as pumice stone, a pipe 32 with tank 33 filled with epilamic substance, such as stearic acid. Pumice stone grains and epilamic substance are separated by a perforated wall 34. A pipe 35 for preheating the carrier gas, such as carbonic acid, is directly connected to the pipe 31. When at rest, the pipe 31 with the active material, is in addition also filled with epilamic substance. In service condition, however, the epilamic substance not adsorbed on the surface of the active material, will be removed in pipe 31 by the gas stream entering this at 37, so that the level of the epilamic substance rises in tank 33. This arrangement enables a steady fresh saturation of the active material in pipe 31 and hence a maximum saturation of the carrier gas with

epilamic substance. The gas, saturated with epilamic substance, leaves the carburettor E through the outlet branch **38**. The degree of saturation of the carrier gas with epilamic substance depends on the temperature. To attain constant and reproducible saturation values, the temperature should be kept constant. This is obtained by a cylindrical vessel **39** surrounding the piping system **31**, **32**, **33** and **35** and whose bottom piece houses a heating system **40** and an opening **41** for introducing the return-flow of the condensate. The vessel **39** is filled to about one fifth with a constantly boiling medium, the vapours of which serve as heating medium for the piping system **31**, **32**, **33** and **35**. Thus a substantially constant temperature and a rapid heating is assured in a simple manner. Evaporation and condensation of the heating fluid take place in the circulation through the cooling system G.

The epilamizing chamber F for bringing in the articles **16** to be epilamized consists of a double-walled tank **42**, a boiler **43** and a closing cover **44**. The boiler **43** with the heating system **45** again contains a constantly boiling medium, say, hexane, the vapours of which pass through the tubular cylinder **45** and serve as heating medium for the epilamizing chamber **46**. The vapours issue again at branch **47** and are led to the cooling system G. At **48** the condensate returns to the boiler. Evaporation and condensation of the heating medium take place in the circuit. By this means, the necessary constant temperature for condensating the epilamic substance on the surfaces of the objects **16** will be attained. The epilamizing chamber **46** itself includes a bottom piece **49** with pivot **50** for supporting the stack shaft **14** with the carriers **15**, an opening **51** for admitting the gas saturated with epilamic substance and an opening **52** where the spent carrier gas passes out. The outlet opening **52** consists of a suction pipe with adjustable nozzle **53**. To prevent any vacuum forming in the epilamizing chamber, the suction pipe of branch **52** is connected to atmosphere through an opening **54**. The epilamizing chamber **46** is closed at top by cover **44**. The latter houses a fan **55** for giving turbulence to the carrier gas. Because of this, the surface of all articles comes into contact with the carrier gas and is consequently evenly covered with epilamic substance.

The cooling system G contains a cooler **56** to condense the vapours of the heating fluid for the carburettor, and a cooler **57** to condense the vapours of the heating fluid for the epilamizing chamber. Both cooling systems **56**, **57** are connected to atmosphere via pipes **58** and **59**. The height of the pipes is so chosen as to ensure the discharge of the condensate even with slight excess pressure in the boiler.

It is understood that for preliminary cleaning the carrier disks **15** with the objects **16** should be moved individually in the ultrasonic field. The carriers **15** with the say, securely clamped articles **16** are then stacked

on the shaft **14**. The stack includes for instance six carriers **15** which, as a whole stack, are subjected to the final cleaning (for instance in the extractor) and to epilamization. The articles should be secured on the disks **15** individually, i.e. without touching or covering each other so as to ensure a reproducible final cleaning and hence also a reproducible epilamization. The individual securing of the articles has the advantage that zones which should not be epilamized may be masked off.

What I claim is:

1. Apparatus for epilamizing the surfaces of articles to be lubricated comprising a carburettor, an epilamizing chamber adapted to contain the articles to be epilamized and a cooling system, said carburettor comprising a vessel adapted to contain a volatile liquid, means for heating the liquid in said vessel, means for conveying vapor from said vessel to said cooling system, means for conveying liquid produced by condensing said vapor from said cooling system back to said vessel, a U-shaped tube in said vessel adapted to contain epilamizing agent in liquid form, a porous filling in one leg of said U-shaped tube, means for passing a gas through said U-shaped tube and means for conveying said gas carrying epilamizing agent to said epilamizing chamber, said epilamizing chamber comprising an inner chamber adapted to contain articles to be epilamized, said inner chamber being connected to receive gas carrying epilamizing agent from said carburettor, an outer chamber surrounding and spaced apart from said inner chamber, a boiler adapted to deliver the vapors of a volatile liquid into the space between said inner and outer chambers, a conduit for conveying vapors from said space to said cooling system and a conduit for returning liquid condensate from said cooling system to said boiler.

2. Apparatus as defined in claim 1 in which said inner chamber is provided with an outlet for said gas.

3. Apparatus as defined in claim 1 in which said inner chamber is provided with means for producing turbulence in the gas therein.

4. Apparatus as defined in claim 1 in which said cooling system comprises a tank adapted to contain a cooling liquid, a conduit submerged in said tank and connected to said carburettor and a second conduit submerged in said tank and connected to said epilamizing chamber.

References Cited in the file of this patent

UNITED STATES PATENTS

2,181,177	Davis	Nov. 28, 1938
2,315,422	Hildebrandt	Mar. 30, 1943
2,701,901	Pawlyk	Feb. 15, 1955

FOREIGN PATENTS

249,932	Switzerland	May 1, 1948
280,243	Switzerland	Apr. 16, 1952
286,867	Switzerland	Mar. 2, 1953