Nov. 10, 1959 M. V. FRIEDELL 2,912,064

METHODS AND APPARATUS FOR RECLASSIFYING AEROSOLS

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FIG. 1

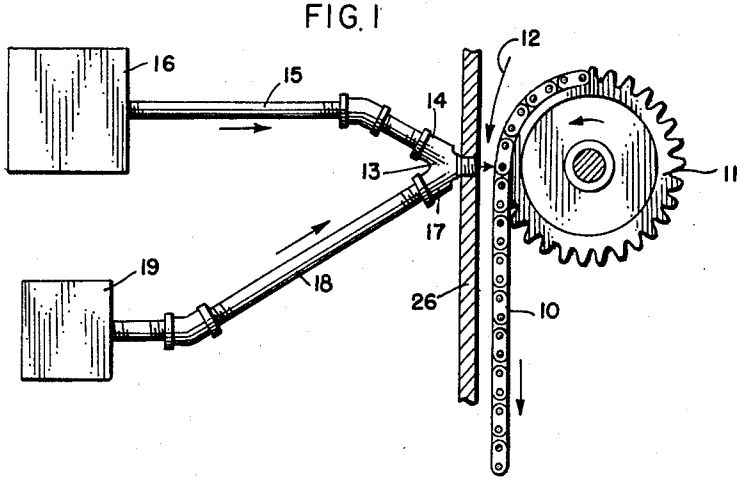


FIG. 2

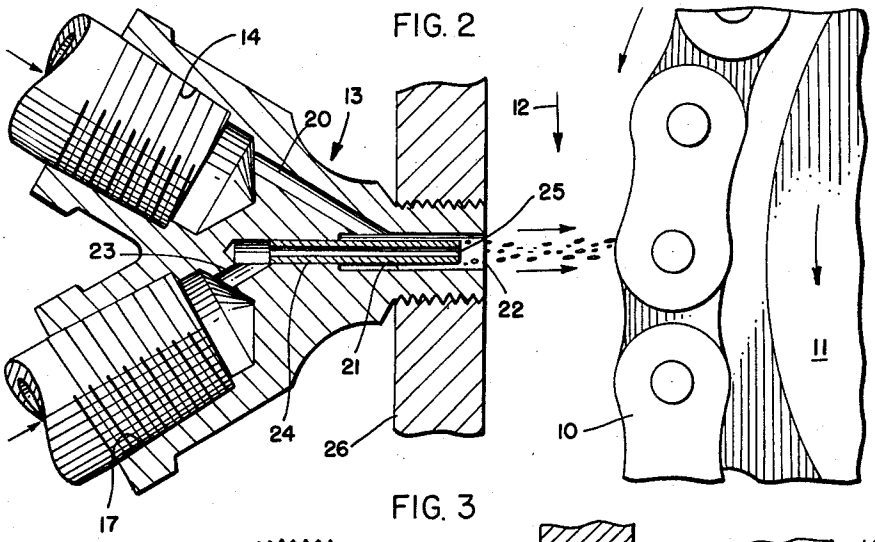
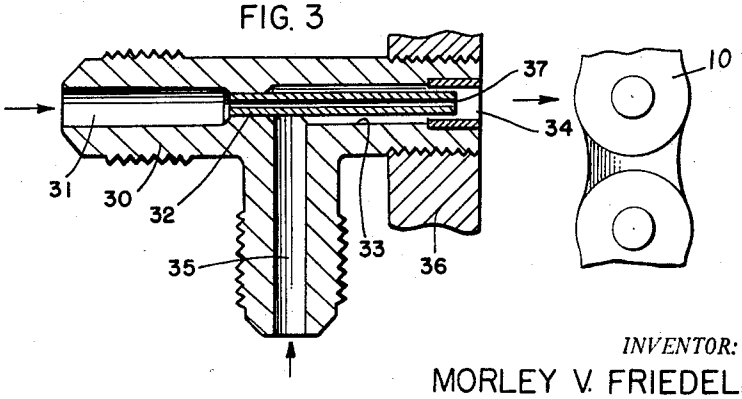


FIG. 3



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FIG. 4

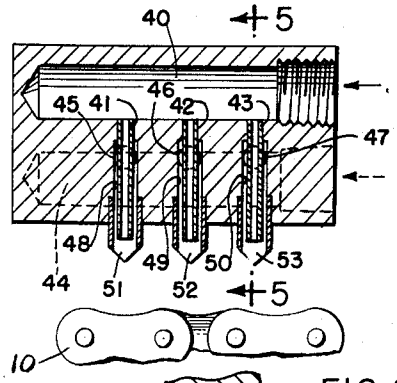


FIG. 5

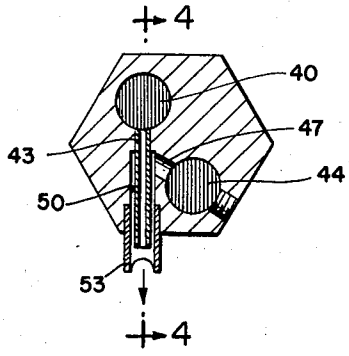


FIG. 6

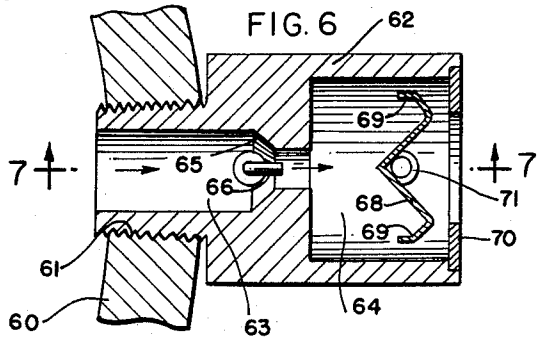


FIG. 7

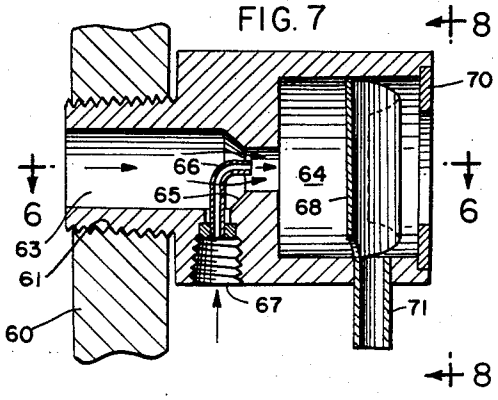
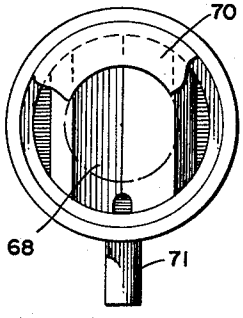


FIG. 8



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METHODS AND APPARATUS FOR RECLASSIFYING AEROSOLS

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Application January 13, 1956, Serial No. 558,907

5 Claims. (Cl. 183—75)

This invention relates to methods and apparatus for reclassifying aerosols, and more particularly to methods and apparatus for reclassifying aerosols of fine liquid particles.

It is the general object of the present invention to produce new and improved methods and apparatus of the character described.

A further object of the invention is to produce new and improved methods and apparatus for reclassifying aerosols or fogs of oil or other similar liquids used in lubrication of machine parts or used in cutting or processing operations.

It is a more specific object of the invention to produce methods and apparatus for reclassifying very fine liquid particles in an aerosol, which methods and apparatus may be used to recover fine liquid particles which formed a portion of an aerosol used for lubricating purposes, and which particles were not reclassified in the lubricatting system.

Yet another object of the invention is to produce methods and apparatus providing for aerosol lubrication of parts difficult to lubricate by aerosol methods.

Aerosols or fogs of fine oil particles have been used for lubricating many forms of machinery. In such systems an aerosol generator is used which finely subdivides the liquid lubricant into particles sufficiently small as to remain suspended for a considerable period of time in a carrier air stream. In such form, the particles may be carried by the stream to a point or points where lubrication is desired. A suitable aerosol generator of improved design is shown in my copending application, Serial Number 512,416, filed June 1, 1955. In conventional oil fog lubrication, the fog is generated through the use of compressed air at moderate pressure (20–40 p.s.i.), but the carrier air stream which carries the fog to the point of lubrication is of much lower pressure, of the order of ⅓ p.s.i. At the point where the lubricant is to be applied, means are provided for reclassifying the fog, i.e. so treating it that the very fine particles are caused to coalesce and form larger particles capable of depositing either on the part to be lubricated or upon a baffle, wherefrom the oil particles may drip onto the part to be lubricated. With the baffle type of reclassifier, only a small portion of the aerosol is reclassified, and the remainder remains in the area to settle out and deposit on other parts of the machine or to escape as waste fog. In another form of reclassifier, the fog is passed through a jet so that it (with the impelling pressure of ⅓ p.s.i.) attains a velocity of 8,000–10,000 feet per minute, so that when the moving aerosol impinges on the part to be lubricated, reclassification takes place. In both systems, very fine particles, of the order of less than ½ micron, will not be reclassified or deposited by the systems used.

Thus, it is a further object of the invention to produce a reclassifying system and apparatus wherein a much larger percentage of the fine liquid particles are reclassified and deposited, including those of sizes smaller than ½ micron.

In many machines, there may be certain parts which are difficult to lubricate in an aerosol system of the type just described, because of the fact that the parts to be lubricated are moving rapidly and in a manner to create a current or baffle of air which quite effectively shields the part from the normal current or jet of aerosol, and thus the part does not receive proper lubrication. According to the present invention, however, an aerosol reclassification system is provided wherein such shields or baffle air currents can successfully be penetrated and efficient reclassification and deposition of lubricant be obtained on the desired parts.

Other and further objects and advantages of the present invention will be readily apparent from the following description and drawings, in which:

Fig. 1 is a somewhat schematic view of an aerosol lubricating system incorporating the present invention;

Fig. 2 is an enlarged view partly in section of a portion of Fig. 1;

Fig. 3 is a vertical sectional view showing a modified form of aerosol reclassifier;

Fig. 4 is a vertical sectional view showing a further modification of the reclassifier of the present invention wherein multiple outlets are used;

Fig. 5 is a sectional view of Fig. 4 taken along line 5—5 thereof;

Fig. 6 is a vertical sectional view showing a form of recovery reclassifier attached to a machine housing;

Fig. 7 is a horizontal section along line 7—7 of Fig. 6; and

Fig. 8 is an end elevational view as indicated by the line 8—8 of Fig. 7.

While this invention is susceptible of embodiments in many different forms, there is shown in the drawings and will herein be described in detail several embodiments, with the understanding that the present disclosure is to be considered as an exemplification of the principles of the invention and is not intended to limit the invention to the embodiments illustrated. The scope of the invention will be pointed out in the appended claims.

Referring now to the drawings, there is shown in Figs. 1 and 2 a device for supplying lubricating aerosol to a machine part otherwise difficult to lubricate by such methods because of the air currents involved. As seen in Fig. 1, the device in question is a link chain **10** carried by a rotatably mounted sprocket **11** wherein rapid movement of the sprocket and chain creates an air current passing along and in the direction generally indicated by the arrow **12**. For applying lubricant in aerosol form to the chain, there is provided a reclassifier having a casing **13** provided with a first inlet **14** connected by means of a pipe **15** to an aerosol generator **16**. A second inlet **17** in the casing **13** is connected by means of a pipe **18** to a source of air under pressure. As will be obvious to those skilled in the art to which this invention pertains, the aerosol generator **16** may be connected to a number of outlet nozzles for directing the aerosol against other parts to be lubricated.

As best seen in Fig. 2, the aerosol inlet **14** is connected by means of a restricted passageway **20** to a passage **21** formed in the casing **13** and terminating in an opening **22**. The air inlet **17** is connected by means of a short passage **23** to a tube **24** extending generally coaxially of the passage, with the latter, of course, being larger in diameter than the tube so as to provide an annular passage surrounding the tube **24** at the portion adjacent the end **25** thereof.

In utilizing the reclassification system shown in Figs. 1 and 2, the casing **13** is threaded into a support **26** located adjacent the chain to be lubricated. The air pressure generated by the apparatus **19** should be between 5 and 15 p.s.i., and the air supplied thereby should be

clean and filtered. The restricted passage **20** acts in the manner of an orifice so that its diameter regulates the quantity of aerosol supplied to the passage **21**. The diameter of the tube **24** is less critical, and a 1/32 inch diameter has been found to be sufficient to supply proper air under a wide range of oil deliveries. With air under the pressures mentioned supplied to the inlet **17**, and hence exiting from the opening **25**, oil is drawn through the restricted passage **20** which, it will be noted, extends at an acute angle relative to the passage **21** and tube **24** so that aerosol passing therethrough is aimed at and impinges upon the tube. A small portion of the oil particles forming the aerosol will reclassify upon striking the tube and be carried into the air stream as larger droplets of oil. The larger portion of the aerosol will be drawn into the air stream emitted from the opening **25** and by virtue of the violent change of velocity which thereupon occurs will be reclassified into larger particles. These particles are then carried by the jetting air stream with considerable force against the surface of the chain **10** and the air barrier indicated at **12** will easily be penetrated thereby, not only because of the high velocity stream of air and aerosol mixture being emitted from the tube **24**, but also because of the fact that the particles are reclassified due to the acceleration thereof which occurs as they enter the airstream. The reclassified particles, being larger, more easily penetrate any air baffle or barrier created by the moving chain.

A somewhat similar form of apparatus is shown in Fig. 3, wherein there is provided a casing **30** having an air inlet **31** connected to a tube **32** extending through a passage **33** formed in the casing. The passage terminates in an opening **34** directed at a part to be lubricated, such as the chain described in connection with the previous embodiment. The aerosol is admitted into the passage **33** through an inlet **35**. The casing **30** is secured to a support **36** positioned adjacent the part to be lubricated, as in the previous embodiment. In this particular embodiment little, if any, reclassification takes place upon the tube **32**, and practically all the fog is reclassified into larger particles upon entering the jet stream emitted from the open end **37** of the tube. It should, of course, be understood that the inlets **31** and **35** correspond to the inlets **14** and **17** of the previous embodiment, and are to be connected to similar aerosol generators and sources of air under pressure.

In the modification shown in Figs. 4 and 5, multiple jets are used, each connected to an air inlet **40** by means of air tubes **41**, **42** and **43**. The aerosol generator is connected to the aerosol inlet **44**, which in turn connects by means of restricted passageways **45**, **46** and **47** to passages **48**, **49** and **50** extending through the casing of the device and surrounding the air tubes **45–47**. It will be noted that the passageways **45–47**, which interconnect the aerosol inlet and the passages **48–50**, are directed against the general flow through the passages. In such case reclassification within the passages and upon the tubes may be quite high, of the order of 50% or more. The multiple jets shown are particularly adapted for use for lubricating chains where it is necessary to direct a stream of droplets into each set of side plates in a roller chain or uniformly to distribute oil on a silent chain. It should be noted that drip tubes **51**, **52** and **53** surrounding each of the air tubes **41–43** are provided. The drip tubes are cut so as to have generally V-shaped lower ends so that oil reclassifying within the passages will not collect along the lower edge of the casing, and furthermore, the shape of the tubes assists in drawing reclassified oil from within the passages.

As in the previous embodiments, the air inlet **40** is connected to a source of air under pressure, such as the source **19**, while the aerosol inlet **44** is connected by suitable means to an aerosol generator, such as the generator **19**. The operation of the apparatus of Figs. 4 and 5 is generally similar to that of Figs. 1–3, with the exceptions noted.

In Figs. 6–8, the same principle is utilized, but in a device for recovering aerosol. As illustrated in those figures, there is shown a housing **60** which may form part of the housing of a machine adapted to be lubricated by an aerosol, with the housing having a threaded vent opening **61**, in which the recovery or precipitating device **62** of the present invention is threadedly received. The precipitator or reclassifier is provided with a passage **63** opening at one end into the interior of the housing and at the other end into a reclassification chamber **64**. The passage is provided with a narrowing portion **65** forming, in effect, a venturi throat in which is positioned the open end of an air tube **66**, which is directed generally through the passage and toward the reclassification chamber. The air tube is connected at **67** to a source of air under pressure, preferably at 10 p.s.i., but at least within the range of 5 to 15 p.s.i.

Positioned in the reclassification chamber **64** is a generally V-shaped baffle **68** provided with inturned sides **69**, which are spaced somewhat from the side walls of the reclassification chamber. A secondary baffle **70** is provided at the open end of the reclassification chamber, opposite to the entrance portion at the end of the passage **63**, with the secondary baffle extending inwardly generally a distance greater than the spacing of the sides **69** of the primary baffle. A drain **71** is provided at the bottom of the reclessification chamber so that oil reclassified therein may be drained off for further use.

In operation of the apparatus shown in Figs. 6–8, air passing from the inlet **67** into the tube **66** is emitted as a jet in the venturi throat, and thereby serves to draw aerosol from within the housing into the passage **63** and accelerate the aerosol rapidly as it passes through the narrowing portion toward the reclassification chamber. Because of the violent acceleration taking place in the venturi throat, considerable reclassification takes place, and the reclassified particles are directed to impinge upon the apex of the V-shaped baffle **68**. The shape of the baffle allows a continuous flow outwardly from the apex of the V, the direction of which flow is changed violently as the inturned sides **69** are reached. Thus, particles which fail to reclassify and precipitate on the sides of the reclassification chamber or on the baffle are caused to recirculate until such precipitation occurs, the secondary baffle serving to prevent the escape of reclassified oil and to assist in the recirculation just mentioned.

The reclassification apparatus just described is particularly useful to prevent the loss or escape of unreclassified aerosol from aerosol lubricated devices. As previously indicated, in most low pressure reclassifiers aerosal particles smaller than .5 micron are not reclassified and escape into the air, where their presence is often annoying and unpleasant. The reclassifier just described, however, is capable of recovering as much as 95–100% of such aerosol, which would otherwise be lost or vented.

I claim:

1. Apparatus for providing a preliminary reclassification of finely divided aerosol immediately prior to the deposition of the aerosol on a surface to be lubricated comprising a casing having a chamber therein and an outlet from the chamber, an aerosol generator remote from the chamber, a first inlet in the casing communicating with said aerosol generator and opening into the chamber, a source of air under pressure, a second inlet in the casing communicating with said source of air and with a tube extending generally coaxially of the chamber and aligned with said outlet whereby air from said source emitted from the tube in the chamber will draw aerosol into the chamber and rapidly accelerate the aerosol within the chamber to effect a reclassification of the small aerosol particles and to emit from said outlet a rapidly moving stream of air and partially reclassified aerosol, and means for mounting the casing closely adjacent the

surface to be lubricated to direct said stream thereagainst.

2. The reclassifying apparatus of claim 1 including a passage extending between the first inlet and the chamber to establish communication therebetween, said passage opening to the chamber in a manner to cause aerosol passing therethrough to impinge upon the exterior surfaces of the tube.

3. The reclassifying apparatus of claim 2 in which said passage extends at an acute angle relative to the direction of air flow through said tube.

4. The reclassifying apparatus of claim 2 in which said passage extends at an obtuse angle relative to the direction of air flow through said tube.

5. In combination with a device having a chamber supplied with aerosol, apparatus for recovering very fine liquid aerosol particles comprising a casing having a passage therein communicating at one end with the chamber and at its other end with a reclassifying chamber, said passage having a narrowing portion intermediate its ends to form a venturi throat, a tube terminating in said passage portion and opening toward said reclassifying chamber, a source of air under pressure, means connecting the tube to the source of air under pressure to produce

a jet of air out of said tube opening to draw aerosol out of said chamber and into said passage and violently to accelerate it toward said reclassifying chamber, a baffle in said reclassifying chamber positioned in the path of movement of the accelerated aerosol, and means for collecting liquid reclassified by impingement against said baffle.

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