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C. A. MEDSKER

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METHOD OF AND APPARATUS FOR LUBRICATING PNEUMATIC TOOLS

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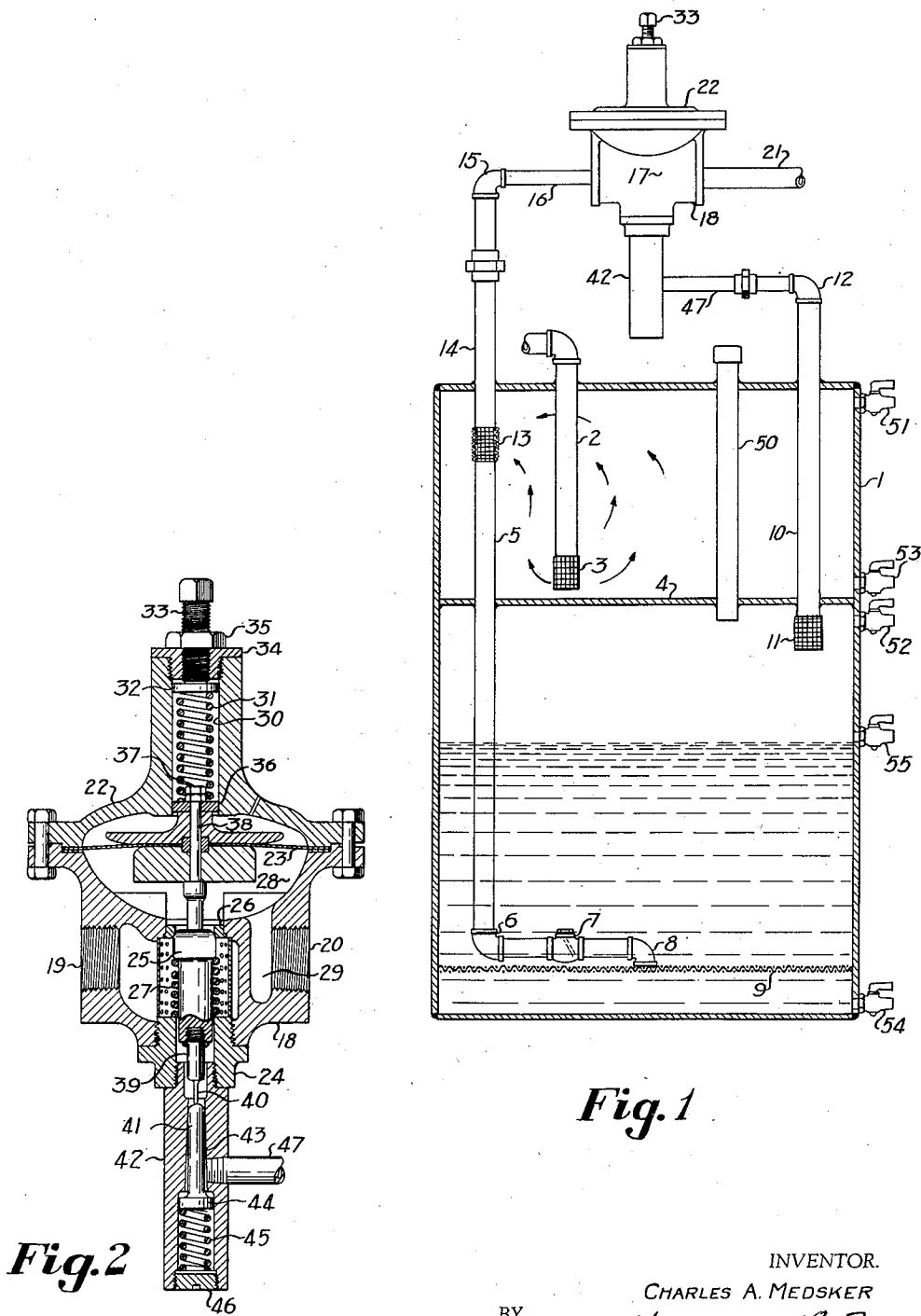


Fig. 1

Fig. 2

INVENTOR.

CHARLES A. MEDSKER

BY

Horace B. Fay
ATTORNEY.

UNITED STATES PATENT OFFICE

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METHOD OF AND APPARATUS FOR
LUBRICATING PNEUMATIC TOOLSCharles A. Medsker, Cleveland Heights, Ohio, as-
signor to William L. Ulmer, Cleveland, Ohio

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7 Claims. (Cl. 134—55)

This invention relates to a novel method of and apparatus for lubricating pneumatic tools, such as hammers, riveters, rock drills, welding machines and similar power tools utilizing air pressure as their source of power.

In my co-pending application, Serial No. 206,414, there is disclosed an apparatus whereby a lubricant, such as oil, in a finely divided, vaporous or suspended form, is entrained in the air pressure supply for pneumatic tools and the like. In that apparatus, the amount and proportion of lubricant entrained in the ultimate air supply delivered to the tool lines is variably regulated by means of control valves provided for this purpose.

It has been found, however, that in cases where the air supply demand increases to any considerable extent that a drop in the air pressure occurs ahead of the valve openings without a corresponding increase in the pressure behind the valve openings. This results in an undesired variation in the amount of oil entrained in the air, and makes it necessary to frequently adjust the valves in order to compensate for the variation in pressure and maintain the desired differential between the pressures ahead and behind the valve openings, which, in actual practice, should be approximately 20 pounds. Such adjustments are not only difficult, but are time-consuming as well.

It is a primary object of the present invention to provide in combination with apparatus of the aforesaid character valve mechanism whereby a constant differential is maintained between the pressures ahead of and behind the valve openings and whereby uniformity in the air-oil ratio is maintained at all times irrespective of the demands made upon the apparatus.

To the accomplishment of the foregoing and related ends, said invention, then, consists of the means hereinafter fully described and particularly pointed out in the claims; the annexed drawing and the following description setting forth in detail certain means of carrying out the invention, such disclosed means illustrating, however, but one of various ways in which the principle of the invention may be used.

In said annexed drawing—

Fig. 1 is a vertical cross-sectional view through the apparatus; and

Fig. 2 is an enlarged cross-sectional view of the valve mechanism illustrated in Fig. 1.

Referring more particularly to the drawing, the apparatus will be seen to comprise a container 1 into which the main air pressure supply is introduced through the inlet 2. This inlet is provided at its lower end with a cylindrical screen 3 for entrapping dirt and other foreign matter in the air supply.

The container has a horizontal dividing wall 4

which separates the interior of the container into an upper moisture and foreign particle eliminating or precipitating compartment and a lower oil entraining compartment. Excess moisture and foreign particles entrained in the air supply are precipitated and eliminated in this upper chamber, due to the increase in volume or expansion of the air stream and also its change in direction of flow.

A pipe or conduit 5 leads from the upper portion of the upper chamber of the container 1, through the wall 4, to the lower portion of the lower compartment of the container, where it connects with an elbow 6. To this elbow is joined a check valve 7, which prevents reverse or flow "back-up" from the oil entraining compartment. To the other end of the valve 7 is secured an elbow 8, which rests on a perforated baffle plate or screen 9 extending across the oil entraining compartment and spaced somewhat from the bottom of the container.

A conduit 10 having a screen 11 on its lower end, extends from the upper portion of the oil entraining compartment through the wall 4 and upper compartment of the container through the upper wall of the container and has fitted to its upper end a reducing elbow 12.

The upper end of the conduit 5 has mounted thereon a cylindrical screen 13, so that the air entering this conduit must pass through this screen. Another conduit 14 leads from the upper end of the screen 13 through the upper wall of the container and has connected to its upper end a reducing elbow 15, from which extends a nipple 16. This nipple communicates with the inlet opening of a pressure regulating and reducing valve, which has been generally designated by the reference numeral 17.

The reducing valve 17, as best shown in Fig. 2, comprises a body 18, having an inlet opening 19 an outlet opening 20, the outlet opening communicating with a conduit 21, from which branch lines, not shown, may lead to the individual pneumatic tools. The valve body 18 has secured thereto a cover 22, and a diaphragm 23 is interposed between the body and cover. The body has secured in its lower central portion a plug 24, in which is slidably mounted a valve stem 25 which cooperates with the valve seat 26, the valve stem being urged against its seat by means of a coil spring 27. The valve stem 25 establishes communication between the inlet 19 and the valve compartment 28 below the diaphragm 23, and the compartment 28 in turn is in communication with the outlet opening 20 by means of a passage-way 29.

The cover 22 has an axial bore 30 therein, in which is disposed a coil spring 31 which bears at its upper end against a washer 32 secured to the lower end of a screw 33 in threaded engage-

ment with a plug 34. A lock nut 35 is mounted on the screw 33 to lock it in adjusted position. The lower end of the spring 31 bears against a washer 36 which is secured, as by nuts 37, to an extension 38 of the valve stem 25.

Secured to the lower end of the valve stem 25 is an opener element 39 having a reduced lower end 40 which bears against the needle 41 of a needle valve 42 secured to the plug in axial alignment with the latter. The valve 42 has a tapered seat 43 therein against which the needle bears when the valve is closed. The needle 41 has an enlarged base portion 44 and a spring 45 is interposed between this base portion and a plug 46 secured to the lower end of the valve. A conduit 47 establishes communication between the reducing elbow 12 and the valve 42.

An oil filler pipe 50 is also provided for admitting oil into the lower compartment of the container.

Vents 51 and 52 are located in the side wall of the container 1 and in communication with the upper and lower chambers, respectively. Drain cocks 53 and 54 are also connected to the bottoms of each one of these two chambers. An oil test cock 55 is also mounted in the side wall of the container for ascertaining when the oil is at the desired level.

The operation of the above described apparatus is as follows: The main air supply is introduced through the inlet 2, and passes into the upper chamber of the container, where excess moisture and foreign particles are precipitated. This air supply then follows the direction of the arrows through the screen 13 and thence the stream is divided to the conduits 5 and 14. That portion of the air stream going through the conduit 5 passes up through the bath of the lubricant or oil in the lower chamber of the container 1 where it entrains particles of lubricant in the form of a "fog" or a vapor, and such lubricant-containing air then enters the conduit 10 and passes into the reducing valve 17 by way of the elbow 12, conduit 47, and valve 42, where it is mixed with the remainder of the air stream from conduit 14, and nipple 16.

The reducing valve 17 automatically serves to maintain a constant pressure differential between the air entering the valve and that leaving the valve. Thus, if the pressure at the outlet drops due to a heavy increase in the demand, the spring 31 forces the valve open, thereby restoring the out-going pressure to its original value within the limits of the main air supply pressure. If the outgoing pressure increases, the diaphragm is forced against the spring and the valve closes. By screwing down the adjusting screw 33 the low pressure is increased, and by releasing the screw, the low pressure is decreased. The valve is preferably set at 10 pounds below the main air supply line pressure, so that a 10 pound differential is maintained at all times irrespective of the air demand.

Due to the operation of the valve 42 simultaneously with that of valve 17, the pressure in the air-oil mixing chamber will be regulated in the same manner as that in the air line.

Since the valve 17 opens and closes according to the demand, and since the valve 42 is actuated by the valve 17, the proportion of the air-oil mixture to the air is determined by the simultaneous movement of the two valves. Since the ratio is fixed, the final air-oil mixture is constant irrespective of the outlet demand for air.

Other forms may be employed embodying the

features of my invention instead of the one herein explained, change being made in the form or construction, provided the elements stated by any of the following claims or the equivalent of such elements be employed.

I therefore distinctly point out and distinctly claim as my invention:

1. In apparatus of the character described, the combination of a source of air under pressure, means for dividing said air into two streams, means for entraining a lubricant in one of said air streams, and means for reuniting said lubricant-entraining air with said other stream, said last-named means comprising a valve and means associated with said valve for maintaining a uniform pressure differential between the mixture entering said valve and that leaving said valve.

2. In apparatus of the character described, the combination of a source of air under pressure, means for dividing said air into two streams, means for entraining a lubricant in one of said air streams, a valve for receiving said lubricant-entraining air stream along with said other air stream, and a second valve actuable by said first valve for controlling the amount of lubricant-entraining air stream admitted to said first-named valve.

3. The method of preparing lubricant-entraining air for the operation of pneumatic tools, which comprises dividing an air stream into two parts, entraining a lubricant in one of said air streams, reuniting said lubricant-entraining air with said other air stream, and automatically maintaining the proportion which each division of said air stream bears with respect to the other, irrespective of the demand of said tools within the limits of the pressure of said first-named air stream.

4. In apparatus of the character described, the combination of a source of air under pressure, means for dividing said air into two streams, means for entraining a lubricant in one of said streams, means for reuniting said lubricant-entraining air with said other stream, and means for automatically maintaining the pressure of the mixture at a substantially predetermined value irrespective of the number of tools to which the mixture is conveyed.

5. In apparatus of the character described, the combination of a source of air under pressure means for entraining a lubricant in said air, a valve for controlling the flow of said lubricant entraining air, and resilient means for urging said valve open.

6. In apparatus of the character described, the combination of a source of air under pressure, means for entraining a lubricant in said air, a valve for controlling the flow of the lubricant entraining air, resilient means for urging said valve open, and means responsive to the pressure in said valve for counter-acting said resilient means.

7. In apparatus of the character described, the combination of a source of air under pressure, means for dividing said air into two streams, means for entraining a lubricant in one of said streams, and means for reuniting said lubricant-entraining stream with said other stream, said last-named means comprising a chamber, a valve for controlling the flow of one of said streams to said chamber, the other of said streams being free to flow to said chamber, and means for releasing said reunited streams from said chamber and for controlling said valve.