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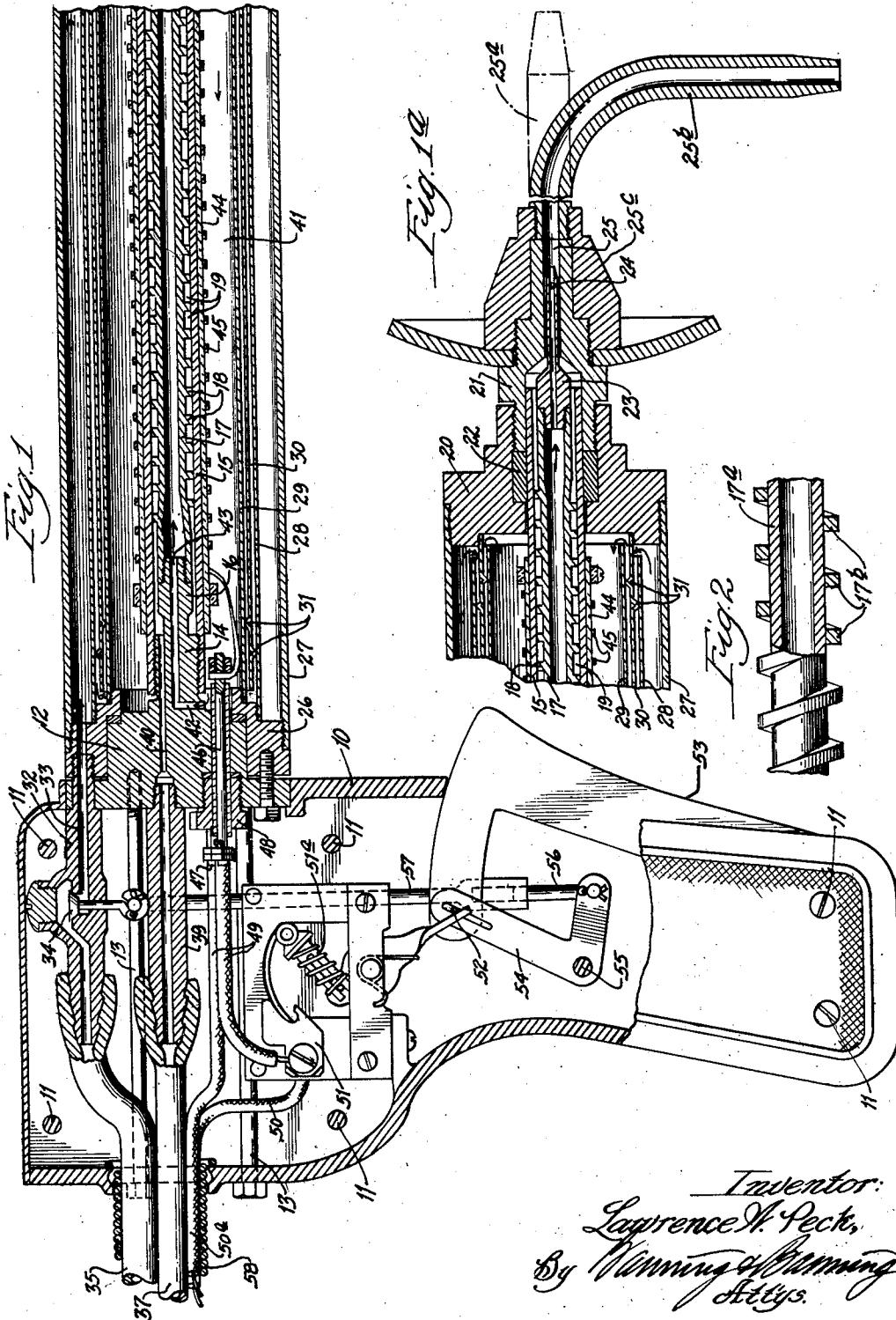
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GUN FOR CLEANING DIFFERENTIALS AND THE LIKE

Filed Aug. 30, 1930

2 Sheets-Sheet 1



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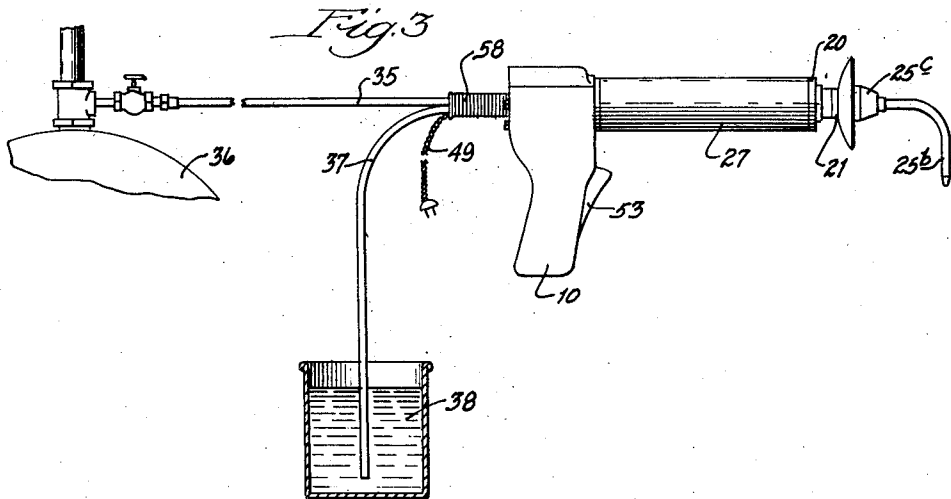
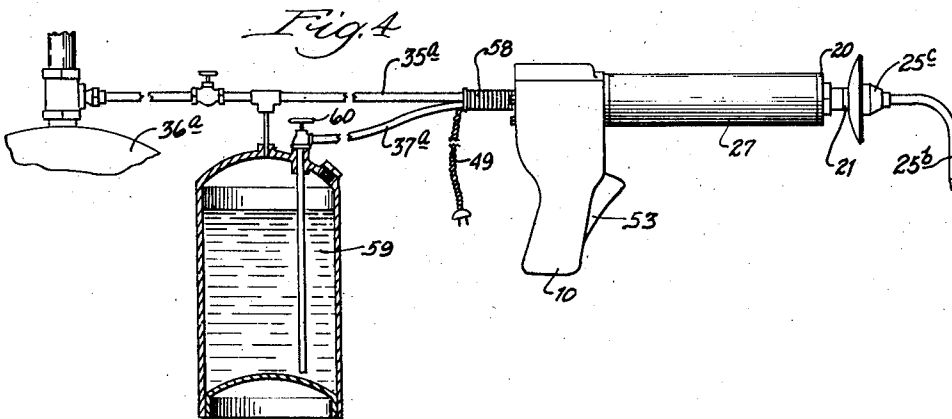
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GUN FOR CLEANING DIFFERENTIALS AND THE LIKE

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UNITED STATES PATENT OFFICE

1,940,506

GUN FOR CLEANING DIFFERENTIALS AND THE LIKE

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Application August 30, 1930. Serial No. 478,921

6 Claims. (Cl. 184—1.5)

An object of this invention is to provide a simple and efficient form of gun for cleaning differentials, transmissions, and the like, in which air or air and a liquid passing therethrough is heated to a high degree while the gun remains cool enough to permit of easy and safe handling. Another object is to provide means for protecting the heating element of such a cleaning gun from the action of any liquid which is being heated thereby.

These and other objects as will hereinafter appear are accomplished by this invention which is fully described in the following specification and shown in the accompanying drawings, in which—
Figs. 1 and 1^a show a longitudinal section through the gun;

Fig. 2 is an enlarged partial section of a modified form of the central tube;

Fig. 3 is a view showing the gun and associated parts when used for aspirating oil or other cleaning fluid from a bucket; and

Fig. 4 is a similar view showing the device hooked up for use with a pressure tank.

This invention is a continuation in part of my application for Letters Patent of the United States, Serial No. 367,604, filed May 31, 1929.

The embodiment illustrated in Figs. 1 and 1^a comprises a gun having a hollow handle 10 which is preferably made of two parts split longitudinally and held together by means of screws 11. This handle has an opening in which is secured a metal block 12 by means of screws 13. This block has an extension 14 which is threaded to receive a steel tube 15. The extension 14 carries a further extension 16 which in turn is threaded to receive a tube 17 which lies within the tube 15 and which is provided with suitable vanes or threads 18, whereby it is spaced from the tube 15 and thereby providing a long spiral groove 19 between the two through which oil or other liquid to be heated may be passed, as will hereinafter be explained.

The outer end of the tube 15 passes through a collar 20 and into a nipple 21 which is threaded to be screwed into the collar 20 so as to compress the packing 22 to prevent liquid within the tube 15 from passing back into the space surrounding that tube. The outer end of the tube 17 is threaded to receive a pointed tip 23 having a relatively small hole 24 therethrough, the end of the tip extending into an opening 25 in the nipple 21, so that, as will later be explained in more detail, air under compression passing through the tube 17 will induce a flow of oil or other cleaning liquid through the spiral groove 19.

The block 12 carries a ring 26 which has three concentric shoulders which are also concentric with the tubes 15 and 17 and which are threaded to receive an outer casing 27 and sleeves 28 and 29. An intermediate sleeve 30 lies between the sleeves 28 and 29 and is threaded into the collar 20 at the outer end of the gun. The sleeve 30 is provided at both ends with inwardly and outwardly struck indentations 31 which serve to space the intermediate sleeve 30 from the sleeves 28 and 29.

A valve body 32 is located within the upper portion of the hollow handle and connects through an opening 33 with the air space between the casing 27 and the sleeve 28. The valve body 32 carries a valve 34 and suitable seat for controlling the passage of air to the gun, the mechanism for operating which will later be described. This valve connects through a flexible tube 35 with a suitable source of air pressure 36, as shown in Fig. 3.

A similar flexible tube 37 (Fig. 3) leads to a bucket of oil 38 which is closely adjacent the cleaning gun and into which the tube 37 may be dropped, the opposite end of the tube being connected to a nipple 39 which is screwed into the block 12 and connects to a passage 40 therein with the space between the extension 16 and the tube 15 which communicates with the end of the spiral groove 19. Thus it will be seen that air entering the gun through the passage 33 will pass from the rear toward the front of the gun through the space between the outer casing 27 and the sleeve 28, will then enter the annular space between the sleeves 28 and 30 and pass rearwardly and thence, as indicated by the arrows, around the rear end of the intermediate sleeve 30 and forwardly again between the sleeve 29 and 30 and thence into the heating chamber 41, the means for heating which will later be described, thence again to the rear of the gun, as indicated by the arrows, and out through the passages 42 and 43 to the center of the tube 17 and thence out forwardly and out through the hole 24 at the outlet end.

As the air thus passes into the opening 25 it induces a flow of fluid through the spiral groove 19 and as this connects through the pipe 37 with oil or other cleaning fluid in the pail 38, the fluid will be drawn up and will pass in a relatively slow stream through the spiral groove 19 where it will be heated, as will now be described.

Around the tube 15 is wrapped an insulation 44 of mica, or the like, and around this is wrapped a wire heating element 45 which is connected

- at its two ends to binding posts 46 and 47 which are suitably insulated from the block 12 and retained and made air tight by means of suitable stuffing boxes 48. One of these binding posts connects through a lead 49 with a suitable source of current electricity, the other binding post connecting with a similar lead 50 through a suitable switch 51 which is operated through a pin 52 by means of the operating lever 53 which, when firmly grasped by the hand of the operator, throws the movable member 51^a of the switch to a position to close the same. This is a well known type of snap switch which requires no specific description.
- If desired, a third or ground wire 50^a may be run parallel to the wires 49 and 50, the wire 50^a being connected to the metal block 12 so as to ground the same. In this way the metal parts of the gun are also grounded, thereby preventing injury to the operator in case of a short.
- The pin 52 also operates in a slot of the bell crank 54 which is pivotally connected at 55, the other arm of the bell crank carrying a plunger 56 which is slidably mounted in the end of the link 57. As the operating lever 53 is moved to a position which will close the switch 51, the bell crank 54 is also moved so as to lift the link 57 which is connected to the valve 34, thereby opening the valve. In this way, air is admitted to the gun at the same instant that a current of electricity is passed through the heating coil 45.
- The two flexible tubes 35 and 37 carrying air and liquid respectively and the flexible electric leads 49 and 50 pass out through an opening in the back of the body of the gun and are carried by a flexible coil spring 58. It will be noted that the heating coil 45 is located in a passage between the tubes 15 and 29 and that the cleaning fluid is carried entirely through the tube 15, so that none of this fluid is permitted to come in contact with the heating coil or with the mica insulation on which it is carried.
- It will also be noted that the heating, both of the air and the cleaning fluid, is accomplished mainly at the center of the gun, and that the casing 47 is carefully insulated from the hot central portion by the several concentric sleeves with intervening spaces through which relatively cool air passes, thereby absorbing from these thin walls any heat which passes through it from the heating coil near the center. A very high degree of heat is thus obtainable in the air or in the mixture of air and liquid which is discharged from the gun while the gun itself remains at all times so cool as to be handled with no inconvenience to the operator due to the system of air cooling which has just been described.
- In operation, the gun is usually hooked up substantially as shown in Fig. 3 with the tube 37 dipping into a pail of oil. When so used, the air pressure delivered through the tube 35 forces the mixed stream of hot air and hot oil through the nozzle 25^a into the differential gear housing or the like which is to be cleaned. To do this, the plug at the top of the differential (not shown), together with the drain plug at the bottom thereof, are removed and the straight nozzle 25^a, or a curved nozzle 25^b, is inserted into the upper opening.
- When the stream of hot fluid is directed into the differential or gear housing, the oil therein is rapidly heated and thinned so as to render it much less viscous, so that it will flow more readily out through the bottom drain opening. In order to add pressure to the oil in the differential, particularly after it has become heated and thinned, the base of the nozzle 25^c is tapered so as to permit it to be forced tightly into the upper opening of the differential. With the gun in operation, pressure rapidly builds up within the differential, thereby forcing the heated oil or grease therein out through the lower opening.
- The curved nozzle 25^b is useful in directing the stream of hot fluid to any desired point in the differential, so that all parts of the same may be reached and thoroughly cleaned of oil and grease and of the abraded metal which is in suspension therein.
- For some purposes, it will be desirable to use only hot air, and for that purpose, it is necessary only to withdraw the tube 37 from the liquid in the pail 38 when air will be drawn in through the passage 19 and this will rapidly carry any oil therein out through the nozzle. In a very short time, therefore, the gun will be delivering only hot air.
- Where it is desirable to force water or steam through the gun instead of oil, the construction of Fig. 4 is recommended. This consists of a pressure tank 59 which receives air pressure from the air tank 36^a which also connects through a pipe 35^a with the gun which is otherwise unchanged. The pressure tank 59 connects through a flexible pipe 37^a with the gun in the same way as did the pipe 37. The pressure tank, however, puts pressure on the liquid therein, and in case of water, this is necessary because the water passing to the gun is converted into steam in the passage 19 and the back pressure therefrom prevents any more water from being drawn into the tube. By means of the air pressure on the tank 59, water is directed into the gun in a steady stream which is controlled by means of a valve 60. In this way, either hot water or steam will be delivered by the gun depending upon the setting of the valve 60.
- In Fig. 2 is shown a modified form of the tube 17 of Fig. 1. This consists of a straight tube 17^a having the same threaded ends as the tube 17 and having a wire 17^b wound helically therearound and secured thereto as by welding. If desired, the wire 17^b may be omitted and the tube 17^a may be left smooth on the outside, or it may have outwardly struck burrs to better transfer heat from the hot air in the tube 17^a to the cleaning oil or liquid surrounding this tube. This liquid is also heated through the tube 15 by the heating coil 45.
- It will be noted that the hole 24 is made relatively small so that its resistance is so high that nearly the full tank pressure is exerted at this nozzle. Also, by so reducing the flow of air, the degree of heat is increased of the air and more heat passes to the cleaning oil or other liquid in the passage 19. If the passage 19 becomes partly clogged, it can readily be cleaned by temporarily plugging the outer end of the nozzle 25^a or 25^b when the air pressure will be exerted back through the passage 19 and will cause air to be blown out through the flexible tube 37.
- While I have shown and described but a few embodiments of my invention, it is to be understood that it is capable of many modifications. Changes, therefore, in the construction and arrangement may be made which do not depart from the spirit and scope of the invention as disclosed by the appended claims.
- I claim:
1. A hand tool of the class described comprising a barrel made up of a plurality of concentric

tubes closed at alternate ends so as to provide a plurality of connected concentric annular passages, means for passing air into the outer passage and through said passages to an inner passage, 5 an electric heating coil in one of said passages for heating the air, a chamber within said heating coil not communicating with the passage in which lies the heating coil, means for passing a fluid to be heated through said chamber, and 10 means for directing the heated air and the heated fluid into a space to be cleaned.

2. A hand tool of the class described comprising a barrel made up of a plurality of concentric tubes closed at alternate ends so as to provide a plu- 15 rality of connected concentric annular passages, means for passing air into the outer passage and through said passages to an inner passage, an electric heating coil in one of said passages for heating the air, a chamber within said heating 20 coil not communicating with the passage in which lies the heating coil, means for passing a fluid to be heated through said chamber, and means for mixing the heated air and fluid and for directing the mixture into a receptacle to be cleaned.

3. The device of claim 1 characterized by means 25 under a single control for controlling both the air and the current for heating the coil.

4. The device of claim 1 characterized by the

air passage terminating in a small hole at the point where it communicates with the fluid passage so as to control the rush of air therethrough and serving to aspirate the fluid.

5. A hand tool of the class described comprising a handle, a hollow barrel secured thereto having a plurality of communicating concentric passages for air, a resistance element for heating air in said barrel, means for supplying air to said barrel, a passage therethrough for liquid, means 85 for supplying liquid to said passage, a mixing chamber for the air and liquid, said chamber being restricted so as to control the flow of air and liquid therethrough.

6. A hand tool of the class described comprising a handle, a hollow barrel secured thereto having a plurality of communicating concentric passages for air, a resistance element for heating air in said barrel, means for supplying air to said barrel, a passage therethrough for liquid, 95 means for supplying liquid to said passage, the passage terminating in a restricted nozzle, said nozzle extending into a restricted portion of the air outlet from the barrel whereby both air and liquid passages are restricted to control the flow 100 of air and liquid therethrough.

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