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FLUE CLEANER

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Fig. 1.

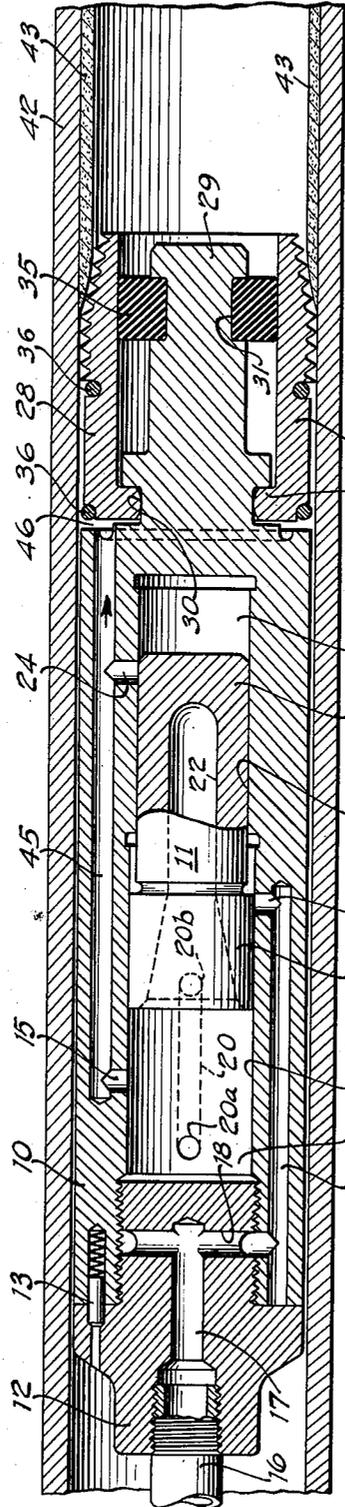


Fig. 2.

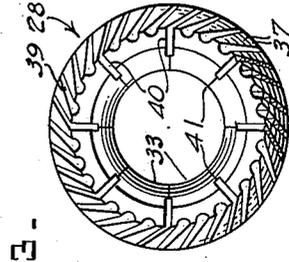
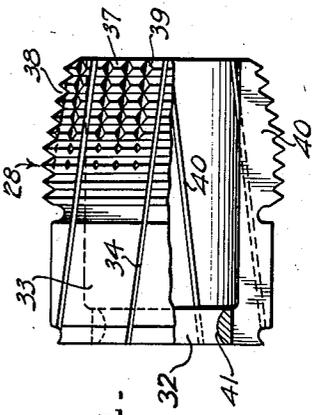


Fig. 3.



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## UNITED STATES PATENT OFFICE

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## FLUE CLEANER

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## 1 Claim. (Cl. 15—104.07)

This invention relates to a flue cleaning tool operated by a reciprocating motor. The present invention is designed to meet the demand for a practical tool to remove carbon deposits in oil still tubes of two inches or less in diameter, but is applicable also to tubes of larger diameter. An object of the invention is to increase the efficiency of machines of this type.

Another object is to operate the cutting tool by reciprocating impulses imparted to it by the cylinder of a fluid pressure motor. In accordance with this object, the cutting tool is arranged to be carried by the cylinder and to vibrate therewith in response to the recoil produced by the piston at the end of each stroke.

A feature of the invention resides in a novel form of cutter comprising jaws yieldingly held in contact with the inside of the tube and having on its periphery cutting teeth arranged in circumferential and spiral rows.

Another object is the provision of a flue cleaning tool that is simple in construction, inexpensive in manufacture and effective in operation.

Other objects and features of the invention will appear more clearly from the following description taken in connection with the drawing and appended claim.

In the accompanying drawing:

Fig. 1 is a longitudinal sectional view of the flue cleaning tool in operative relation to a tube.

Fig. 2 is a longitudinal view partly in elevation and partly in section of the cutting element of the tool, and

Fig. 3 is an elevational end view of the cutting tool shown in Fig. 2.

Referring to the drawing, the illustrative embodiment of the invention comprises a cylinder 10 in which a piston 11 reciprocates. The cylinder has a backhead 12 threadably connected thereto and locked by a spring pressed lock pin 13. The interior of the cylinder is defined by a bore 10a and a counterbore 10b adapted to fit the piston extension 11a and piston head 11b respectively. The counterbore 10b provides a piston chamber which is supplied with live air through an inlet port 14 near its front end and which is in communication with an exhaust port 15 toward the rear end. A hose 16, screwed to the backhead 12, supplies pressure fluid through passages 17, 18 and 19 in the cylinder to the inlet port 14. A longitudinal passage 20 in the cylinder connects two ports 20a and 20b to provide a by-pass for live pressure fluid around the piston head 11b when the latter lies between said ports,

and thereby admits pressure fluid behind the piston. The piston 11 has a capacity chamber 22 which is closed at its front end but communicates with the piston chamber 10b at the rear end of the piston.

The admission of compressed air through the hose 16 results in vibrating cylinder 10, the cycle of operation being as follows: Live air delivered by the hose is conducted through passages 17 and 18 in the backhead 12, cylinder passage 19 and inlet port 14 to the piston chamber 10b in front of the piston head 11b, thereby causing the piston to move rearwardly. When the piston head has moved rearwardly to uncover the port 20b, live air passes around the piston head 11b through port 20b, passage 20 and port 20a to the rear end of the piston chamber and fills the capacity chamber 22 in the piston as well as the space in back of the piston. Due to the fact that the rear surface of the piston 11 is of greater area than the opposing surface at the front end of the head 11b exposed to live pressure fluid, the piston will reverse and move forward with great speed until stopped by reason of the fact that the piston head on its forward movement cuts off the live air through inlet port 14 and opens exhaust port 15. The drop in pressure behind the piston and the building up of pressure on the forward ends of both piston head 11b and piston extension 11a stop the piston in its forward movement and return it to the rearward position to repeat the cycle. A vent port 24 in the cylinder bore 10a acts as a breather hole to permit air within the bore 10a forward of the piston extension to surge in and out according to the movement of the piston. The port 24 is spaced from the front extremity of the cylinder bore 10a and is designed to be covered by the piston so that air will be trapped to form a cushion 25 to stop the piston in its forward movement. A similar cushion 26 is provided at the rear end of the piston chamber 10b in back of the port 20a.

When the piston strikes the front cushion 25 it delivers a blow thereto jarring the cylinder 10 forwardly. The forward movement of the cylinder is further augmented by the expansion of live air in front of the piston head 11b as the piston starts to move rearwardly. Similarly, the cylinder is jarred rearwardly by the momentum of the piston and the admission of live air in back of the piston as the latter reaches the end of its rearward stroke.

The vibrations of the cylinder 10, caused by the action of the piston and pressure fluid, are utilized to operate a cutting tool 28 connected

to the front extremity of the cylinder and vibrating in unison therewith. The cutting tool is mounted on the cylinder extension 29 which is provided with two annular grooves 30 and 31. 5 The cutting tool has the general shape of a cylinder, on the rear end of which is formed a flange 32 adapted to seat in the groove 30. In the form shown (see Fig. 3), the cutting tool is made up of eight detachable segments 33, the longitudinal edges of which extend spirally. 10

The segments are urged outwardly by an expanding spring 35 made of rubber or other suitable material. In the form shown, the rubber is of annular shape to fit the recess 31 in the cylinder extension 29 and engage the interior surface of the segments 33. Wire rings 36 15 mounted in cooperating grooves in the segments 33 retain the cutter segments in assembled position when not in use.

The peripheral surface of the cutting tool 28 20 is partly cylindrical and partly tapered. Cutting teeth 37 are provided on the outside surface of segments 33, said teeth being defined by circumferential grooves 38 and longitudinal grooves 25 39, the longitudinal grooves being parallel to the spiral edges 34.

The cutting tool 28, which is preferably made of steel, is first formed in one piece and milled to provide the teeth 37 and slots 40. The slots 30 40 are of such depth that small connecting portions 41 are provided on the flange 32. The cutter is hardened as a unit and then broken up into segments 33. After the cutter is assembled on the support 29, the portions 41 act as spacers 35 to keep the sections equally divided in assembled position.

The cutting tool 28 and cylinder 10 are inserted as a unit into a tube 42 which is lined with a carbon deposit 43. The tapered surface of the 40 cutting tool permits the latter to contract slightly to the size of the tube. The entire device may be reciprocated by manipulating the hose 16.

When air is admitted through the hose, the cylinder and cutting tool vibrate in unison in response to the reciprocations of the piston 11, as previously described. The vibration of the cutting tool results in an abrading action of the cutting teeth 37 to remove the carbon deposits 5 43 from the tube. Due to the spiral arrangement of the grooves 39 and slots 40, the entire area of the inside surface of the tube 42 is covered by the cutting teeth. 10

The cutter grooves 38 and 39 and slots 40 provide a means of escape for the particles removed by the abrading action. The carbon particles are removed from the cutter by a stream of exhaust air from the cylinder 10. The air is conducted 15 to the cutter by means of a longitudinal passageway 45 in the cylinder receiving the exhaust air from ports 15 and 24 and discharging the air against the cutting tool 28. An annular space 46 between the cutting tool and cylinder 10 20 permits the exhaust air to circulate so that it will pass over the entire peripheral surface of the cutting tool.

While the invention has been particularly described with reference to a single illustrative embodiment, it will be apparent that many changes and adaptations may be made within the spirit of the invention and within the scope of the appended claim. 25

What is claimed is:

30 A tube cleaner comprising a cutting tool having a cylindrical cutting surface adapted to engage the interior of a tube, said cutting surface having longitudinal grooves, a support for said cutting tool, an air operated percussive motor 35 connected to said support to impart movement thereto for operating the cutting tool, said motor having an exhaust passageway positioned to discharge a stream of compressed air through said grooves and over the cutting surface of the tool 40 to remove particles tending to adhere to the tool.

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