

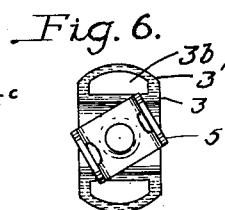
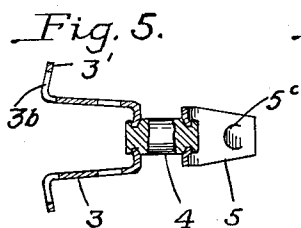
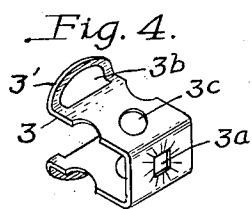
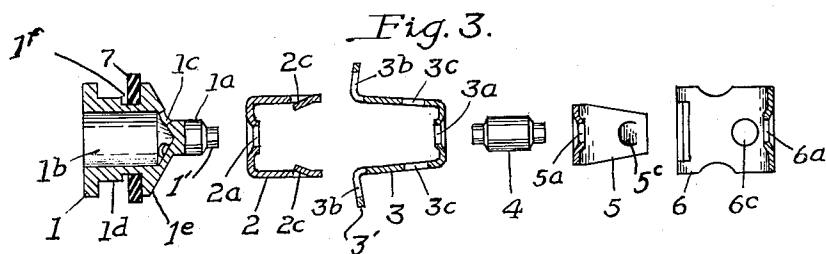
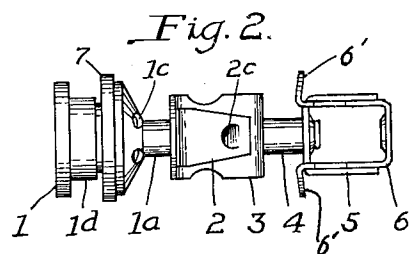
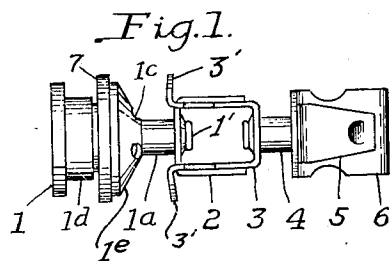
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TUBE CLEANER

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2,734,208

TUBE CLEANER

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This invention relates to tube cleaning devices, and is for a tool with resilient scraper elements, adapted for cleaning tubes on being forced, or shot, through them by fluid pressure. They are principally used for cleaning the many small tubes of the large steam condensers in power plants.

Shooting cleaning tools through the tubes by water pressure is the method commonly employed in cleaning steam condensers. This method of cleaning is used because the large number of tubes and the limited time the condenser can normally be kept out of service for cleaning makes an easy and speedy method of cleaning imperative. The need for fast cleaning makes it important that the cleaning tools be easy to use, as well as effective in their cleaning action.

The usual procedure in condenser cleaning is to insert cleaners in a number of tubes, then apply water under pressure back of them, one at a time, to force them through. The water is applied by means of a special trigger operated hand grip valve with an outlet nozzle adapted to fit into the ends of the tubes. The valve, which is commonly termed a "gun," is connected by a length of hose to the water line so it is easily movable from tube to tube.

A requirement of a cleaner for this operation is that it close the tube sufficiently to provide a piston effect to keep the water pressure high enough to force the cleaner along, and not use an inordinate volume of water.

An important feature of the cleaner of this invention is the provision of an elastic ring of rubber or rubber-like material on the head part which seals off water leakage past the periphery of the head, as contrasted with an inflexible metal head to provide the piston effect, as in previous cleaner constructions illustrated for example in my patents Nos. 2,170,997 granted August 29, 1939 and 2,503,042, granted April 4, 1950. With solid metal heads as shown in these patents, it is customary to use different sizes of heads to provide adequate water leakage past the head to flush away dirt ahead of the cleaner and avoid the sticking of the cleaners in the tubes. The rubber ring obviates the need for many head sizes and also provides means of controlling the water volume, which permits use of a smaller and easier to handle gun and hose.

For effective cleaning action, some water must leak past the cleaner to flush the dirt away to prevent clogging. In the present invention calibrated holes through the head by-pass the required volume of flushing water through the cleaner so that close control of volume and pressure are made possible.

Another feature of this cleaner, designed to prevent clogging and thus enhance the cleaning efficiency, is the provision of large openings in the scrapers near their cutting edge. These let the dirt and flushing water mix readily as the dirt is scraped from the tube. The small size of condenser tubes, about $\frac{3}{4}$ " inside diameter being most commonly used in steam condensers, makes the job

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of devising a tool for cleaning them a special and difficult one. For example, the outturned part of the scraper that contacts the tube is limited to about $\frac{3}{16}$ " long at the highest point of the contacting arc. Hence without ample openings to let the dirt and water mix, the scrapers would tend to clog and become ineffective.

Another feature of this invention is the bore in the head providing a convenient socket for receiving a projecting nipple on the gun nozzle whereby the cleaners are held by the gun for insertion into the tubes as the gun is brought into position. This not only holds the cleaner in straight alignment so it enters the tube easily, but it guides the nozzle into the tube as well.

My invention, therefore, has for its principal objective to provide a tool that will facilitate the work of cleaning condensers by being easy to use and effective in its cleaning action, and in which variation in the head size for different conditions is not required. Ease of use is also facilitated by the more economical use of water, making a smaller gun possible. A further object of my invention is to provide a cleaner of extraordinarily simple, unique, rugged and inexpensive construction.

My invention may be more fully understood by reference to the accompanying drawings, in which:

Fig. 1 is a side elevation of a cleaner embodying my invention;

Fig. 2 is a view similar to Fig. 1 but with the cleaner rotated 90°;

Fig. 3 is an exploded vertical section of Fig. 1;

Fig. 4 is a perspective detached view of a scraper element;

Fig. 5 shows a step in the assembly, termed a sub-assembly; and

Fig. 6 illustrates how the sub-assembly can be made so the scraper elements will be angularly or rotationally spaced 60° instead of 90°, whereby six instead of four equally spaced scraper contacts with the tube interior would result.

Referring to the drawings, Figs. 1 and 2 show the assembled cleaners which here comprise a head part 1, two identical clevis parts 2 and 5, two identical scraper elements 3 and 6, a stud 4, and a ring 7 of rubber or rubber-like material.

The head part 1 is at the outer or back end of the cleaner. The head 1 has an axially extending neck or connecting portion 1a, which in turn has a reduced terminal 1' to fit into the hole 2a in the clevis 2, to which it is solidly attached by upset riveting.

The scraper elements 3 and 6 are made of resilient strip material bent flatwise so they comprise a substantially U-shaped body portion, and have their free ends turned outward to form blade portions 3' and 6' respectively, which contact the tube surface. The base of the U has a non-circular or square hole therethrough at its middle, such as indicated at 3a. The blade portions are trimmed or rounded to conform substantially to the tube contour they are to clean. The scraper 3 is made with openings 3b (see Fig. 4) therethrough formed at the base of the scraper portions. The scraper 6 has similar openings as shown. These openings 3b in the scrapers are made as wide as can be and as close to said rounded cutting edges as possible and still leave sufficient margins for the required strength. The flatlegs of the scraper elements 3 have a hole 3c therethrough. The scraper 6 has similar holes 6c.

The clevises 2 and 5, like the scrapers, are made of resilient strip material bent flatwise, and they, like the scrapers, are substantially U-shaped. They each have a hole 2a and 5a respectively, through the middle of the base of the U, these holes like 3a being square or non-circular. The flat legs or arms of these clevises have in-

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wardly pressed integral tongues or barbs near their outer ends, as indicated at 2c and 5c.

The assembly procedure is as follows: First two sub-assemblies are made, one of them being that shown in Fig. 5, comprising one scraper and one clevis connected by the stud part 4; the other assembly comprising the other clevis connected to the neck 1a of the head 1 (see Fig. 1). The two sub-assemblies are then put together by simply passing the arms of the clevis through the openings 3b telescoping the scraper 3 and the clevis 2 until the barbs 2c on the arms of the clevis snap and catch in the holes 3c in the scraper. The remaining scraper 6 is assembled with the clevis 5 in like manner. The arms of the clevis in each case will pass through the openings as 3b in the scrapers, and no further fastening is required to hold the parts securely together. The rubber ring 7 is assembled on the head part 1 by stretching and forcing it on, the head having an abutment 1e to the rear of the part 1a, there being a deep annular groove 1f next to this abutment to receive ring 7.

The free unassembled scraper elements normally spring open somewhat, as is shown in Fig. 5, and must be compressed to assemble them into the clevises. This compressing of the scrapers serves to keep the size of the cleaner down so it will enter the tubes more readily, and it adds tension to the scrapers so they will bear with sufficient force against the tube surface to clean effectively. This compressing or "preloading" of the scrapers also serves to hold the parts more firmly together, and adds desired rigidity to the assembled unit.

The head member 1 is provided with an internal cavity or bore 1b which may be used as a socket to receive a nipple on the gun, so that the cleaner can be applied to the gun and forced into the tube as the gun is brought into position at the end of the tube. Holes 1c, extending into the bore 1b in the head part 1 of the cleaner serve to let water flow through the cleaner forwardly of the head to flush the dirt away to prevent clogging. These holes may be calibrated to pass a predetermined flow of water. The large openings 3b in the scraper elements receive the legs of the clevises to keep the parts axially aligned, and as heretofore stated, they function in the operation of the cleaner by helping to prevent clogging.

As above pointed out holes as 3a in the scrapers and 2a in the clevises are all squared, and they are depressed as is the hole 3a in Fig. 4. They are squared to keep the parts from rotating out of position after riveting, the riveting being done with sufficient force to cause the metal to fill in the corners of the holes. The depressing is for the purpose of stiffening that portion of the parts so they will not bend at the holes. The holes 3c in the scrapers are plain round through holes, while the barbs 2c on the clevises result from punching holes part way through.

The head part has an annular recess 1d rearwardly in the direction of the head end of the cleaner from the groove 1f in which the ring 7 is received, and of less depth than the ring-retaining groove. This provides a space for the rubber ring 7 to fold into as the cleaner is being pushed into the tube, preventing the ring from wedging between the head and the tube. When the cleaner is being forced through the tube by water pressure, the pressure against the ring keeps it against the abutment 1e in the position shown in the drawings, except as it may compress or distort slightly in adjustment to tube size variations. The ring 7 is made slightly larger than the tube and therefore must compress accordingly.

A desirable and unique feature of this cleaner is its simple functional design. By making the scraper element serve also as a body member, the entire structure is reduced to a few simple easily made parts, with a reduction in weight and a desirable degree of flexibility or resilience. With all parts, except the rubber ring, made of steel, the weight of the cleaner for 3/4" inside diameter tubes is only 3/4 ounce.

In the simple structure shown in Figs. 1 to 5 there are

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two scraper members and two clevises, and one scraper is angularly rotated 90° to the other. The assembly may comprise more scrapers, in which case an additional sub-assembly as shown in Fig. 5 is required for each added scraper. As shown in Fig. 6, the clevis 5 may then be set at an angle other than 90° to the first clevis. Fig. 6, contemplating three scraper elements, would rotate each scraper 60° instead of 90° from the preceding one.

While I have shown and described one specific embodiment of my invention, it will be recognized that various changes and modifications may be made in the construction and design of the various parts within the contemplation of my invention and under the scope of the following claims.

I claim:

1. A tube cleaner comprising a cylindrical head part, a substantially U-shaped clevis part, a connecting part connecting the head and clevis parts and holding them in fixed spaced relation to each other, with the legs of the clevis extending axially away from the head part and straddling the axis of the head part, a scraper part comprising thin resilient material bent flatwise to form a substantially U-shaped body and having integral portions at the free ends of the U turned outward and rounded to fit the inside of the tubes in which they are to be used, the outwardly turned end portions of the scraper each having an opening therethrough, the scraper part being turned with the legs of the U pointing toward the head being telescoped into the clevis, the clevis legs passing respectively through said openings in the scraper and extending along the legs of the scraper, and interlocking means on the scraper and clevis for holding them in telescoped relation.

2. A tube cleaner as defined in claim 1 wherein the cylindrical head part contains a circumferential recess intermediate its ends, an elastic ring in the recess projecting radially beyond the periphery of the head part, the head part having a bore extending partly through it, said bore being open at the back end and closed at the other end, said head having holes extending therethrough from the inner end of the bore, whereby a fluid may enter said bore and pass through the head.

3. A tube cleaner as defined in claim 1 wherein there is a second clevis, a connecting part connecting said second clevis to said scraper part and holding said scraper and said second clevis in fixed spaced relation to each other with the arms of the second clevis extending axially away from the head part, and a second scraper part similar to the first and engaged with said second clevis in the same manner as the first mentioned clevis and scraper are engaged, but with the second scraper angularly rotated from the first scraper.

4. A tube cleaner having U-shaped clevis and scraper elements, each element having two legs and a base, in which the legs of each are disposed about a common axis and are directed oppositely and toward the base of the other, an outwardly extending blade part having an opening therethrough on the free end of each leg of the scraper element, the legs of the clevis element extending through said openings and overlapping the legs of the scraper element, the overlapping leg portions of the scraper and clevis elements having interlocking barbs and recesses to keep them in said overlapped arrangement, and a head member connected with the base of said clevis with the legs of said clevis member extending axially away from the head member.

5. A tube cleaner as defined in claim 4 in which there is a connecting pin attached at the base of the scraper element, and a similar assembly of oppositely faced clevis and scraper elements having the base of the clevis element secured to the other end of the connecting pin, the second assembly of clevis and scraper elements being angularly rotated with respect to the first, said elements all being rotationally fixed about the common axis.

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6. A tube cleaner as defined in claim 5 in which the scraper and clevis elements are of resilient metal with legs of the scraper elements being biased to spring outwardly and the overlying legs of the clevis elements resiliently resist said outward spring of the legs of the scraper elements.

7. A tube cleaner as defined in claim 4 wherein the head member is substantially cylindrical with a circumferential recess intermediate its ends, an elastic ring member contained in said recess, said elastic ring member extending radially beyond the periphery of the head

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member, the head member having a bore extending partly through it, said bore being open at the back end and closed at the other end, said head having holes extending therethrough from the inner end of the bore, whereby a fluid may enter the bore and pass through the head member.

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