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TUBE CLEANING NOISE SILENCER

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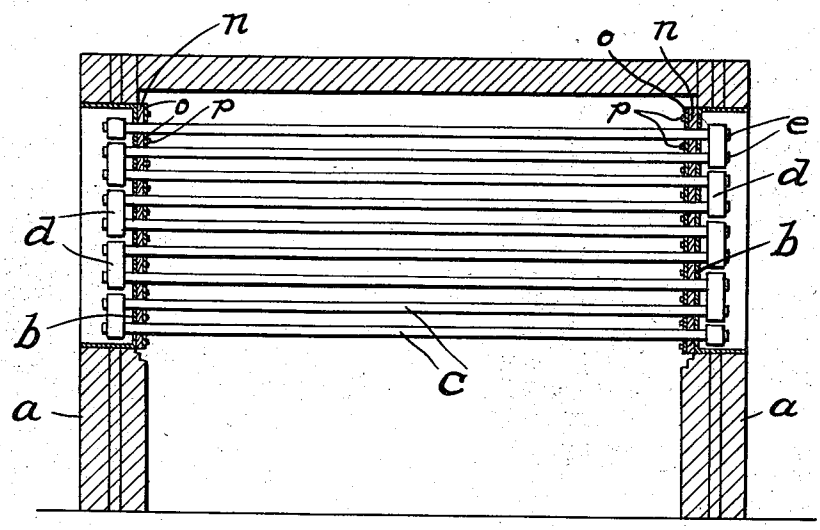


FIG. 1.

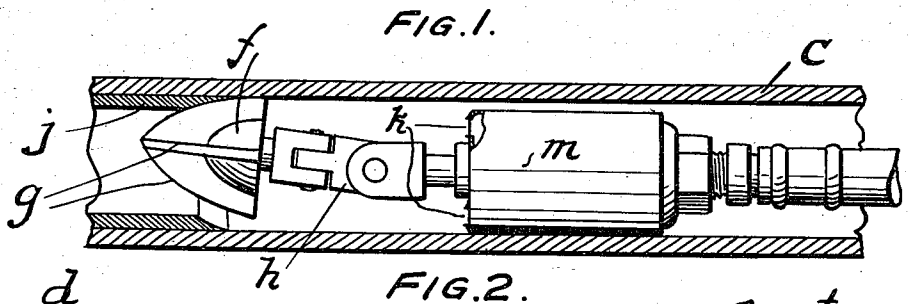


FIG. 2.

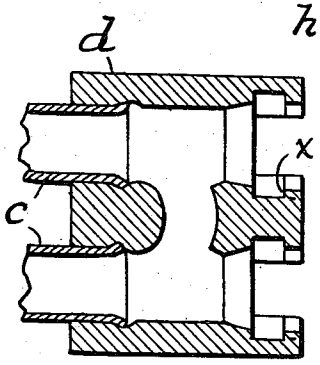


FIG. 4.

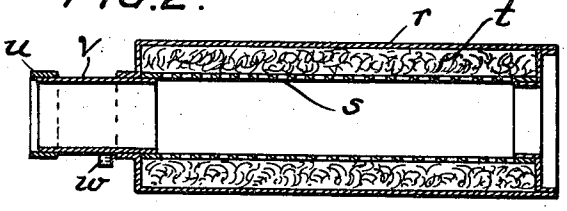


FIG. 3.

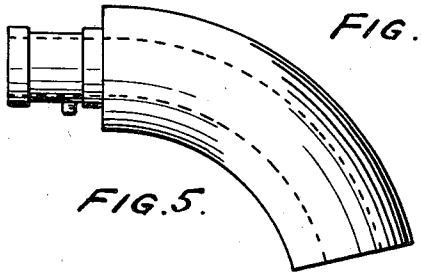


FIG. 5.

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TUBE CLEANING NOISE-SILENCER

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Serial No. 413,976

2 Claims. (Cl. 257—240)

It is common practice in refining and cracking petroleum to supply heat to the material in process by flowing it through tubes and surrounding the tubes by hot furnace gases or other heat supplying media. During operation, a hard scale-like material is deposited on the inner wall of the tubes, presumably as a result of the high temperature of the heating agent and the difference in temperature between the tube wall and the material in process.

This deposit gradually increases in thickness, and, if not removed, results in conditions not conducive to good operating practice; such conditions being the overheating of the tube wall by the heating medium and a reduction in capacity of the plant caused by partial stoppage of the tubes and by the lowering of the heat transfer between the heating medium and the heated material.

It is customary to remove this scale-like deposit from the tubes whenever the processing equipment is shut down, either for the express purpose of cleaning the tubes, for repairs, or for other reasons. In general, the cleaning is done by mechanical means, the apparatus in common use consisting of a cutting tool rotated at high speeds by a compressed air or steam driven turbine motor.

Operation of the cleaning apparatus in a tube produces a very loud and objectionable noise and may be heard for distances of several thousand feet. This noise, which emanates from the mouths of the tubes and through the tubes and tube-supporting plates, has the effect of decreasing the efficiency of the workers in the plant and, when the plant is located in or near a town, constitutes a serious public nuisance. The noises are caused by rapid motion or vibration of the cleaner head of the cutting tool contacting with the tube walls and by the high velocity at which the air or steam passes through the turbine motor.

The object of the present invention is to provide a means of muffling, deadening, or greatly diminishing the audibility of the noise produced in mechanically cleaning tubes. I have found it impracticable to provide a single means for the deadening of the sound which passes through the tube wall into the furnace and thence through the metal tube sheet to the outside of the furnace, and also the sound which emanates from the mouths of the tubes. Any adequate suppression of sound requires the muffling of the noises produced in both of the described ways, and my invention therefore contemplates two different sound-muffling provisions, which must be operative simultaneously unless a mere reduction in the intensity of the noise will satisfy special conditions.

The invention may be more readily understood by first describing the particular embodiments of the invention which we have successfully used. Reference is made to the accompanying drawing, in which—

Fig. 1 is an elevational view of a pipe still such as is used for distilling or cracking petroleum oil, with one of our sound-deadening devices applied thereto.

Fig. 2 is a side view of a tube cleaner such as is in use for cleaning tube walls of the deposits that accumulate thereon.

Fig. 3 is a longitudinal sectional view of a silencer adapted to suppress the noise from the mouth of a tube.

Fig. 4 is a section through one of the return bends or headers of Fig. 1, adapted for engagement with the silencer of Fig. 3.

Fig. 5 is a side view of a modified shape of silencer.

In Fig. 1, which illustrates a typical tube still to which the invention is applicable, the brick walls *a* support tube sheets (tube-supporting plates) *b*, between which are supported tubes *c*. The tubes *c* are shown as arranged in series and to this end adjacent tubes at corresponding ends are connected by return bends or headers *d*. The headers are provided with plugs *e* in line with the respective tubes. These plugs are removed preparatory to cleaning the tubes.

In Fig. 2 is shown a typical cleaner comprising a cleaner head *f* equipped with a number of cutting edges *g*. The cleaner is rotated at high speed by a motor *m*, with which it is flexibly connected by a universal joint *h* to permit the cleaner head *f* to knock about or vibrate against the scale or scale-like formation or deposit *j* formed on the inner wall of the tube *c*. Compressed air or steam is supplied to motor *m* through hose, which is also used to push or pull the apparatus through the tube. The exhaust air or steam is discharged through ports *k* in a forward direction and blows the loosened material out through the tube. Our invention, it will be understood, is not dependent, for its successful operation, on the type of cleaner used, which will depend, in any given case, on the hardness of the deposit and the difficulty of removing it.

One feature of the invention comprises means for muffling or deadening the sound which passes through the tube wall into the furnace and

through the metal tube sheet *b* to the outside of the furnace. This muffling or deadening is effected by placing a heat-resisting sound-deadening material, *n*, such as mineral wool or rock wool, against the tube sheet (see Fig. 1). We have found it effective to place the material on either the inside or the outside of the tube sheet. It may be secured in place by metal plates *o* and bolts *p*.

The other and major feature of the invention comprises means for reducing the audibility of the sound which emanates through the ends of the tubes and the openings in the return bends by which the tubes are connected. It consists of a portable silencer, shown in Fig. 3, which is placed in or at the end of a tube only while the tube is being cleaned and which is moved from tube to tube as the work progresses.

The silencer comprises a cylindrical case *r*, preferably made of metal, within which is placed a thick lining or layer *t* of sound-deadening material, such as mineral wool or rock wool. A perforated screen *s* of wire mesh is placed inside the layer of sound-deadening material to protect the latter from damage by the flying particles of detached scale. The largest practicable percentage of the area of the screen should be composed of openings so as to permit the sound waves or vibrations to enter the sound-deadening material. A neck *v* may be slipped into the end of the casing and may be secured thereto. This neck may be provided with means for clamping or otherwise holding the silencer to or in the end of the tube or return bend. The neck may also, as shown, support one end of the silencer body proper. The end of the neck may be equipped with a semi-soft gasket *u* of such material as braided asbestos, rubber or other composition to make a reasonably tight joint against the tube or return bend.

When using a return bend *d* of the type shown in Fig. 4, the neck may be provided with a lug *w* adapted to engage a lug *x* on the return bend. To install the silencer, the neck *v* is merely inserted in the return bend and then turned until lugs *w* and *x* engage.

The efficient length of the silencer is largely dependent on the diameter of the opening through it and upon the ratio of the area of the holes in the screen to the total area of the screen. We have found that a length of 3½ feet gives good results for a 3½'' diameter opening through the silencer with approximately 50% ratio of openings through the screen.

The cross-sectional shape of the silencer illustrated is circular. This shape is convenient for its construction, but is not a requisite. The shape may be varied to suit the user. In claiming a tubular silencer or tubular silencer body it is not intended to limit the construction to a silencer or body circular in cross-section. The silencer illustrated is shown to have its longitudinal axis parallel with that of the tube. This also is not a requisite. The silencer may be built in the form of a curve or with an angular bend, as shown in Fig. 5. In fact, one of the subsidiary features of the invention is that by the use of a curved or bent silencer, the deposit, as it is removed from the tubes, may be deflected downward, upward, or sideward into a hopper or container to prevent its undesirable distribution over a relatively large area or over areas which it is desired to keep free from deposition of the material.

When a greater degree of quietness is desired than can be obtained by using the silencer at only the end of the tube through which the material is discharged, a similar silencer may be placed at the opposite end, and in this case the cleaning mechanism and hose pass through this free opening in the device.

The invention is not limited to the details of construction shown and described, such details being disclosed because they illustrate a highly efficient embodiment of the invention. Not only may the construction of the individual silencer be modified in many non-essential ways, but silencers obviously may be built or coupled in pairs or groups, or a single or multiple sound deadening box may be equipped with a plurality of tube connections. The details of construction and arrangement will not only vary with the wants of the user, but they may be governed, more or less, by the construction and arrangement of his equipment, his facilities for handling and placing silencers, and by other factors.

The invention is not limited in its application to tube stills, but may be successfully applied to any installation of tubes, such as a steam boiler, heat exchanger, or condenser, where it is desired to reduce the audibility of noise produced by cleaning tubes.

That part of the present invention which comprises the positioning of heat-resisting sound-muffling material against the face of the tube sheets and surrounding the ends of the tubes adjacent the tube sheets is not herein claimed, as it forms the subject-matter of a separate application to be filed.

Having now fully described our invention, what we claim and desire to protect by Letters Patent is:

1. The combination with a tube still comprising tube sheets, tubes extending between the tube sheets, return bends connecting corresponding ends of adjacent tubes and provided with holes aligning with the tubes, and removable plugs closing said holes: of a silencer having a sound muffling body of tubular form, a neck on one end of the silencer, and cooperating means on the return bends and on the silencer neck to allow the silencer to be removably secured to a return bend from which a plug has been removed.

2. The combination with a tube still comprising tube sheets and tubes supported by the tube sheets and extending between them and beyond them, of sound-muffling material positioned against the face of the tube sheets and means securing said material in position, a separate tubular body of mainly sound-muffling material, means affording a normally closed passage between corresponding ends of adjacent tubes, and means to open a free passage from the end of a tube to the interior of the silencer and to secure the silencer in fixed relation and proper alignment with such tube.

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