Dec. 11, 1928. 1,694,371

C. L. BURDICK

MULTIPLE TUBE CLEANER

Filed June 5, 1926 3 Sheets-Sheet 1

Fig. 1.

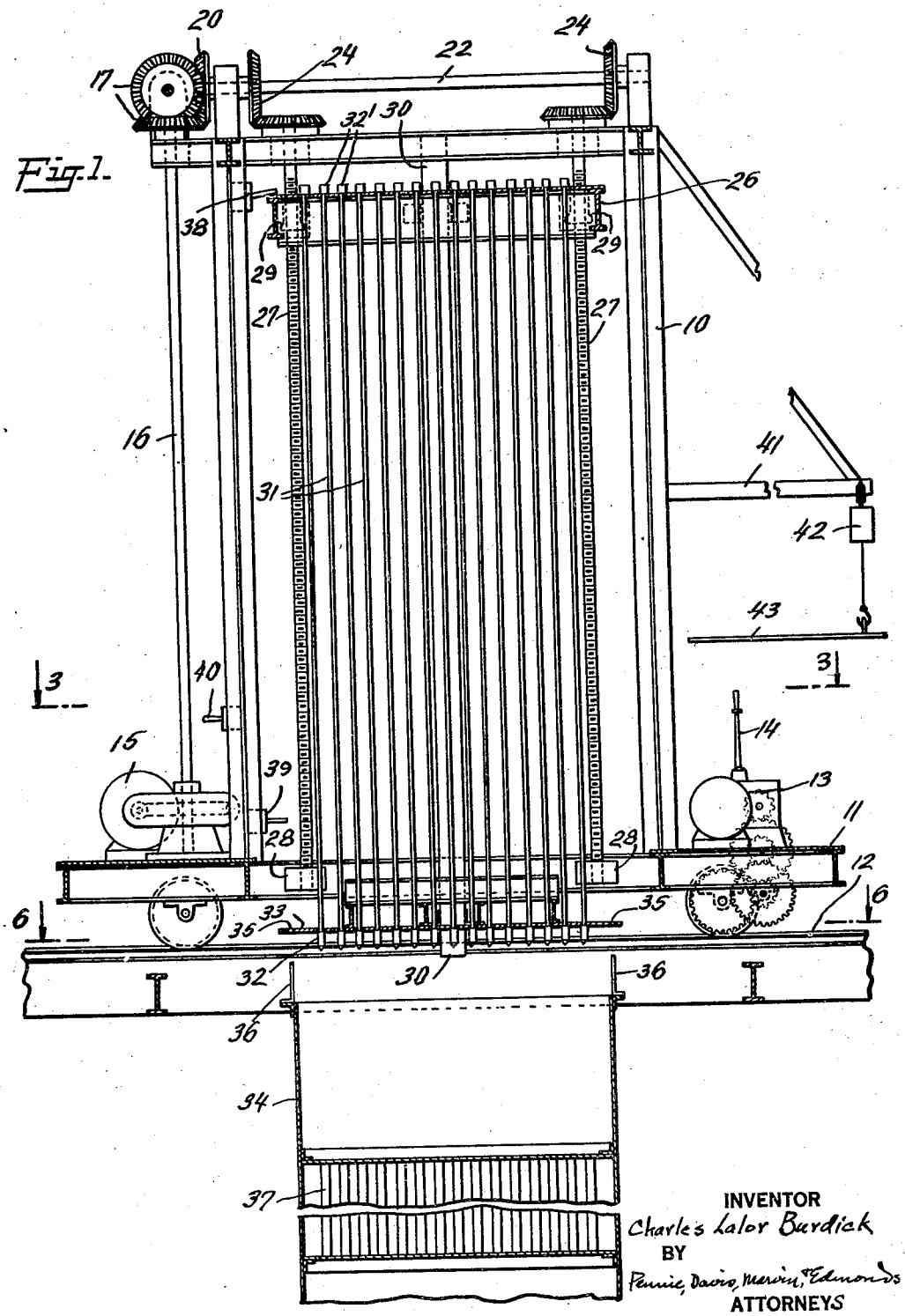

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Fig. 2.

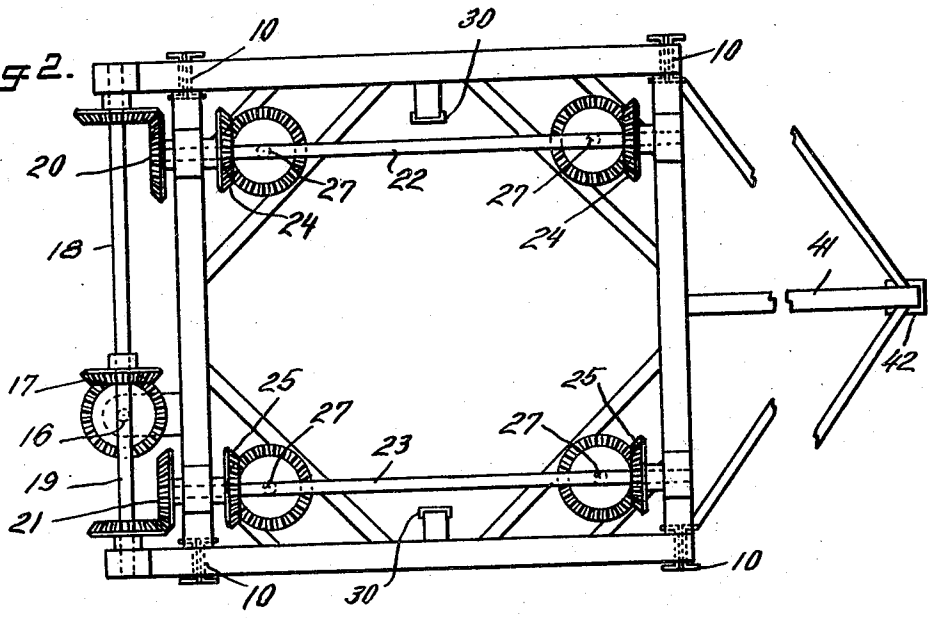

Fig. 3.

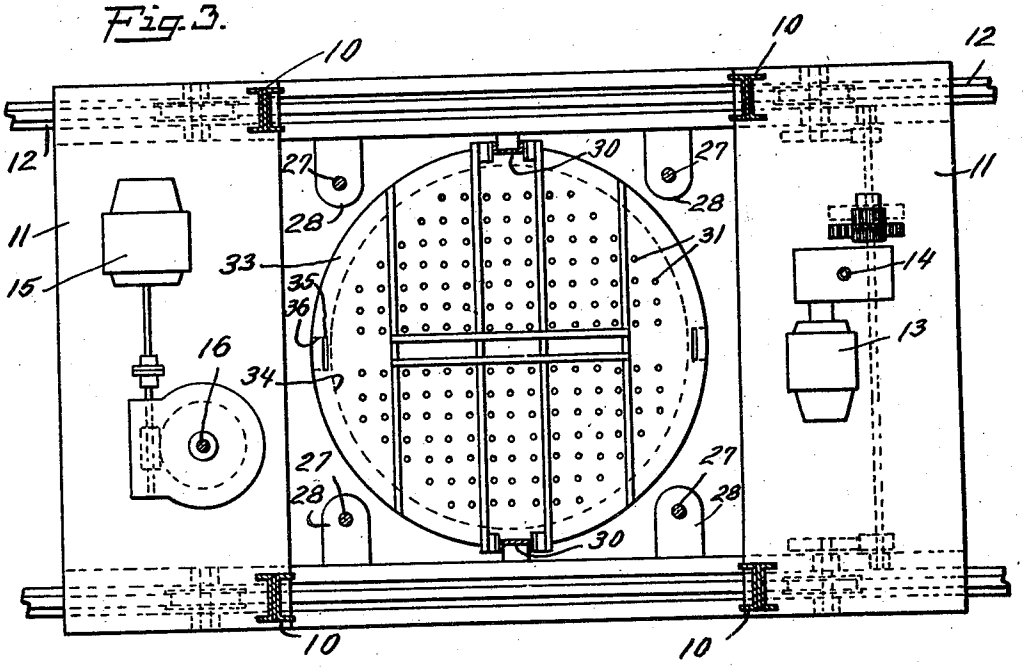

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Fig. 4.

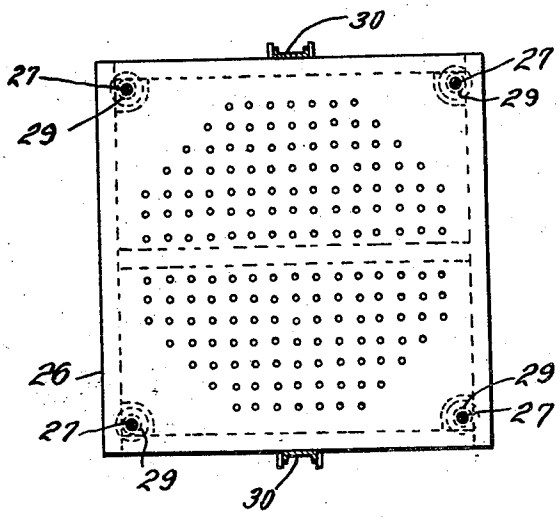


Fig. 5.

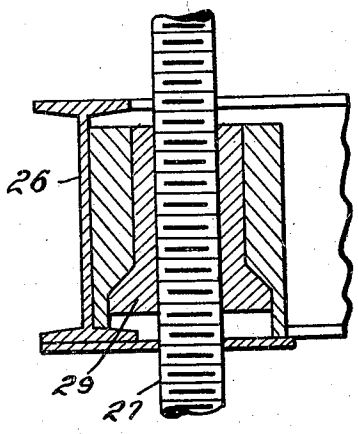
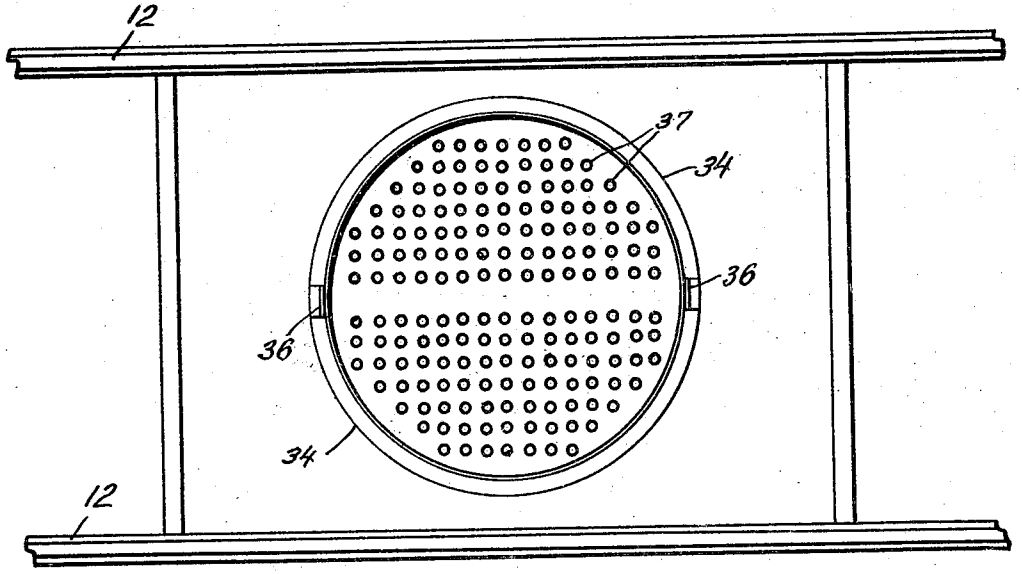


Fig. 6.



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UNITED STATES PATENT OFFICE.

CHARLES LALOR BURDICK, OF NEW YORK, N. Y., ASSIGNOR TO GUGGENHEIM BROTHERS, OF NEW YORK, N. Y., A COPARTNERSHIP.

MULTIPLE-TUBE CLEANER.

Application filed June 5, 1926. Serial No. 113,353.

This invention relates to tube cleaners, and is more particularly directed to improvements in multiple-tube cleaners.

My invention comprises the combination in a multiple-tube cleaner of a plurality of cleaners individually actuated by their force of gravity for simultaneously cleaning a plurality of vertically disposed tubes.

The multiple-tube cleaners heretofore employed have a number of undesirable drawbacks which are overcome by the use of my invention.

For example, the multiple-tube cleaners generally used are driven into the tubes to be cleaned by an artificially applied force which is frequently not to be resisted by the structure of the tubes. Thus, if the cleaners, during the progress of their trip through the tubes, meet an obstruction, the force which drives the cleaners will continue to be applied whether the obstruction yields or not. If the obstruction fails to yield, as is frequently the case, either the cleaner or the tube must yield to the applied force. Since the cleaners are generally very strong and durable, the tubes are consequently forced to yield. This means that the tubes will be bent or burst, which of course, is not to be desired.

Again, the multiple-tube cleaners generally employed are not adapted to be quickly and precisely spotted over their corresponding tubes. They must be carefully spotted—each cleaner into each tube. This is a particularly undesirable feature when it becomes necessary to clean tubes which are constantly submerged in liquids which are not transparent. In such instances the tube cleaner operator cannot see the tube openings. He then invariable fails to clean some of the tubes.

The use of the improved multiple-tube cleaners of my invention makes it possible to avoid injuring heavily obstructed tubes as well as to quickly and precisely spot the cleaners over their corresponding tubes.

I have found the practice of the present invention of particular advantage when employed in conjunction with the refrigerating or heat-interchanging apparatus disclosed in my co-pending applications: Serial No. 37,924, filed June 18, 1925; and Serial No. 70,512, filed November 21, 1925. These applications describe the use of tubes through which are circulated liquids to be cooled. As the liquid cools, precipitation of solids takes place. Most of the solids will fall to the bottom of the apparatus, but others will attach themselves to the tubes and thus form undesirable incrustations. Such obstructions decrease the rate of heat transfer, and therefore the capacity and efficiency of the refrigerating equipment. In order to maintain clean tube surfaces and therefore the maximum capacity and efficiency of a cooling unit, periodic removal of the precipitated solids from the inside of the tubes is advisable. I successfully employ the present invention for that purpose.

The advantages of an improved multiple-tube cleaner constructed according to the principles of my invention will be better understood by reference to the accompanying drawings, taken in conjunction with the following description, in which:

Fig. 1 is a side elevation partly in section of an apparatus embodying the principles of the invention;

Fig. 2 is a plan of the same;

Fig. 3 is a sectional plan on the line 3—3 of Fig. 1;

Fig. 4 is a plan of the cleaner guide;

Fig. 5 is a sectional elevation of the thrust bearings in the movable header; and

Fig. 6 is a sectional plan on the line 6—6 of Fig. 1.

The multiple-tube cleaner framework 10 is appropriately built upon a truck 11 which is designed to run upon the rails 12. The truck is equipped at one end with motor and gears 13, so that the forward or backward motion of the truck may be controlled by means of a lever 14.

Suitable motor and gear equipment 15 is provided at the other end of the truck 11 in order to lower and raise the cleaners. This motor control equipment has a main power shaft 16 with which to operate the bevel gears 17 located at the top of the apparatus. Power can be supplied by a flexible cable, a third rail or trolley wires. I prefer to use power derived from side arms extending to trolley brackets suspended along the walls of the building (not shown). This, of course, applies equally well to the power supplied to the motor equipment 13 which operates the truck.

The bevel gears 17 are in turn attached to the shafts 18 and 19 which operate sets of bevel gears 20 and 21, respectively. The

gears 20 and 21 are associated with the shafts 22 and 23 to which are attached the bevel gears 24 and 25.

A movable platform header 26 is suspended on the main framework 10. This movable header is operatively connected to the screws 27 which run the full length of the cleaner apparatus. These screws are attached to the sets of gears 24 and 25, at their upper ends, and rest at their lower ends in the bearings 28. An appropriate bearing 29, which is more fully illustrated in Fig. 5, is proivded in the movable header platform 26 for absorbing thrusts of the movable header as it is conducted up and down the screws 27.

The movable header 26 is preferably kept in alignment by means of a guide frame 30 fastened to the framework 10. Hanging from the movable header are a plurality of cleaner rods 31, one for each tube to be cleaned. The cleaner heads 32 attached to the lower ends of the cleaner rods may consist of a brush, or plunger scraper. The plunger motion is straight, and is solely actuated by the force of gravity of each individual cleaner. The tops of the cleaner rods 31 are equipped with nut-like heads 32′ so that the cleaner rods may remain freely suspended from the movable header 26. The cleaner rods are sufficiently long to allow the cleaner heads to pass completely through the tubes to be cleaned. They must be sturdy enough to transmit the force applied to the cleaning head without undue bending or distortion. The strength of the force of gravity of each cleaner will of course depend upon the weight of the cleaner. This can be made to vary within limits so that incrustations of a certain tenacity may be scraped from the tubes.

A floating cleaner guide 33 rests directly over the cleaner heads 32 when the cleaners have been completely withdrawn from the tubes to be cleaned. This floating guide is adapted to register with the top of the tube container 34. Slots 35 are provided in the cleaner guide to fit over the angle lugs 36 attached to the top of the tube container. When the floating cleaner guide 33 is lowered toward the tube container 34 in such manner that the angle lugs 36 fit into the slots 35, the cleaner heads 32 will automatically be spotted directly over the centers of the tubes 37 in the tube container 34.

The movement of the movable header 26 is controlled in such manner that the tube cleaner heads 32 will pass completely through the tubes 37, and then automatically return to their normal starting position, as indicated in Fig. 1. To that end, appropriate control switches 38 and 39 are provided in the path of the movable header 26. This control may be effected by the use of straight reversing magnetic control equipment in conjunction with traveling nut limit switches. A starting switch 40 is appropriately placed at a point intermediate the main current supply line (not shown) and the motor equipment 15, as well as the control switches 38 and 39.

A crane 41 is attached to the main framework 10. This crane has a pulley 42 which may be operated in any appropriate manner. The ordinary triplex chain pulley would do, but I prefer to operate this pulley by means of appropriate connections with the motor and gear equipment 13, so that the operator of the apparatus, who has control of the lever 14, may from the same point control the operation of the crane pulley. This crane device is employed to remove cover 43 from the tube container 34.

The operation of the apparatus just described is as follows:

The truck 11 is set into motion by appropriate movement of the lever 14, so that the crane pulley 42 may be directly located above the tube container cover 43 as it rests in its position upon the container. The cover is lifted out of position, after which the truck is moved farther along the tracks 12 so that the cleaners may be approximately located directly over the tubes 37. The switch 40 is thrown into place, whereupon the motor equipment 15 is set into motion and the movable header 26 is lowered.

The operator is careful to see that the cleaner guide 33 is fitted into the lugs 36. After the cleaner guide 33 and the container 34 have been brought into appropriate juxtaposition to one another, as determined by the insertion of the lugs 36 into the slots 35, the cleaner heads 32 will be spotted directly over the centers of the tubes 37. The movable header 26 is allowed to continue its downward direction, as the cleaner guide 33 rests on the container, and the tube headers will in due time enter the tubes 37.

Unless the incrustations within the tubes 37 are uncommonly large and obstructive, the cleaners 31 will simultaneously move down through the entire nest of tubes; and each cleaner will be actuated by its own force of gravity. Should any of the cleaner heads meet any particularly large incrustation, the downward movement of that cleaner will be stayed or delayed, while the other cleaners continue their downward movement. This means that a cleaner in an obstructed tube will stand out by itself, as the others move downward. This is ample notice to the operator that that tube should have special attention. In most instances, the operator can remove the incrustation by pushing or rotating the particular cleaner which has stopped moving. If he finds that this is impossible, he can wait until some appropriate time to replace the obstructed tube with a new one. Since the cleaner

heads are not forced down through the tubes, it is seen that no injury is done them by following this procedure.

When the cleaner heads 32 have been completely passed through the tubes 37, the descending movable header 26 strikes the control switch 39, which in turn reverses the direction of rotation of the motor 15, so that the movable header is promptly made to ascend. When the movable header has been raised a sufficient distance to strike the control switch 38, the motor 15 is automatically stopped, and the movable header remains in that position, in readiness for operation on the next tube container.

It is thus seen that if a multiple-tube cleaner apparatus constructed according to the principles of this invention is used, a tube cleaner is provided which can be operated in such manner as to make it impossible to bend or burst the tubes to be cleaned. Since each tube cleaner is actuated solely by its own force of gravity, any undue incrustation within the tube would be a sufficient obstacle to prevent the downward movement of the cleaner.

Such an apparatus affords an easy means whereby the operator can detect which tubes are heavily obstructed. Since the tube cleaners are constantly in a floating position, it follows that they cannot burst the tubes and thus stop a cooling operation, when the tube-container is used as a heat-interchanger. Since it is readily determined which tubes are thus unduly obstructed, a notation of the tubes obstructed may be made by the operator, and when good opportunity later affords time, these tubes may be replaced by new ones. In this manner, the apparatus may be run continuously until such time as deemed expedient to shut down the same for repairs.

It is also seen that the cleaner heads can always be accurately and precisely spotted over their corresponding tubes. This is accomplished without directly guiding the cleaners into the tubes. Such automatic spotting of the cleaners is a particularly advantageous time saver when the cleaner heads must be passed down through a liquid composition or mixture before the tubes are reached. Moreover, since the cleaners are mechanically spotted over their corresponding tubes, none of the tubes will be missed in the cleaning operation as is frequently the case when the cleaners are individually conducted into the tubes by an operator. Even though the tubes were not thus submerged, considerable time is saved by simultaneously spotting the cleaners directly over the tubes to be cleaned.

Practically any number of tubes may be simultaneously subjected to such a cleaning operation. It is only necessary that the number of cleaners be made to correspond with the same number of tubes, and that they likewise be similarly spaced in respect to one another.

I claim:

1. The combination in a multiple-tube cleaner and a nest of vertically disposed tubes of a plurality of cleaner rods, means supporting said rods allowing them to be individually actuated by their force of gravity, and means for simultaneously spotting said cleaner rods directly over their corresponding tubes.

2. A multiple-tube cleaner comprising, a plurality of vertically disposed floating cleaners adapted to be individually actuated by their force of gravity, means for lowering said cleaners a predetermined distance and automatically returning them to their original position.

3. A multiple-tube cleaner comprising, a plurality of vertically disposed individually floating cleaner rods adapted to fit into a nest of vertically disposed tubes, means for simultaneously spotting said cleaner rods over said tubes, and means for lowering and raising the cleaner rods.

4. A multiple-tube cleaning apparatus comprising, a movable carriage, a movable header operatively associated with said carriage, said header containing a plurality of loosely fitting cleaners, a cleaner guide, and means for lowering and raising said movable header a predetermined distance.

5. In a device of the class described, a support, a plurality of cleaners mounted on said support, and a guide member mounted on said cleaners; said support, guide member and cleaners being movable relatively to one another.

6. In a device of the class described, a support, a plurality of cleaners depending from said support, and a guide member mounted on said cleaners; said support, guide member, and cleaners being independently movable relatively to one another.

7. In a device of the class described, an apertured header, a plurality of cleaners loosely mounted within the apertures in said header and depending from said header, and an apertured guide member mounted on said cleaners.

In testimony whereof I affix my signature.

CHARLES LALOR BURDICK.