

No. 837,917.

PATENTED DEC. 11, 1906.

A. H. COLCORD.  
 APPARATUS FOR CLEANING TUBULAR STRUCTURES.  
 APPLICATION FILED MAY 25, 1906.

Fig. 1.

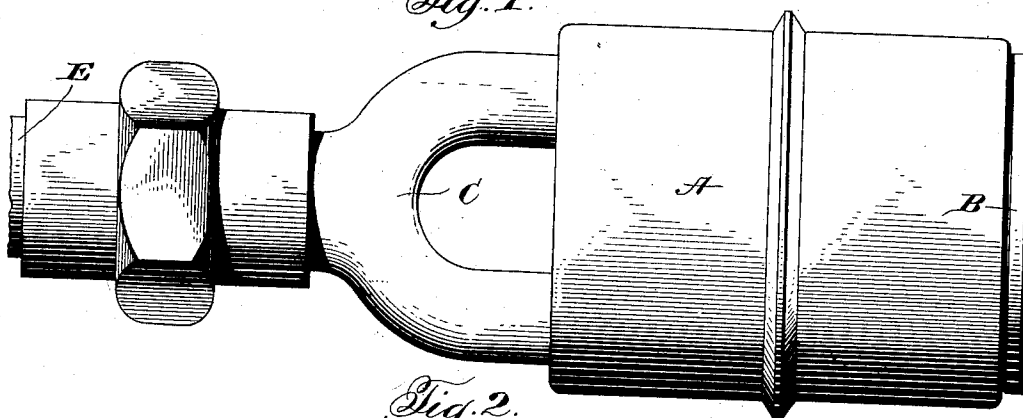


Fig. 2.

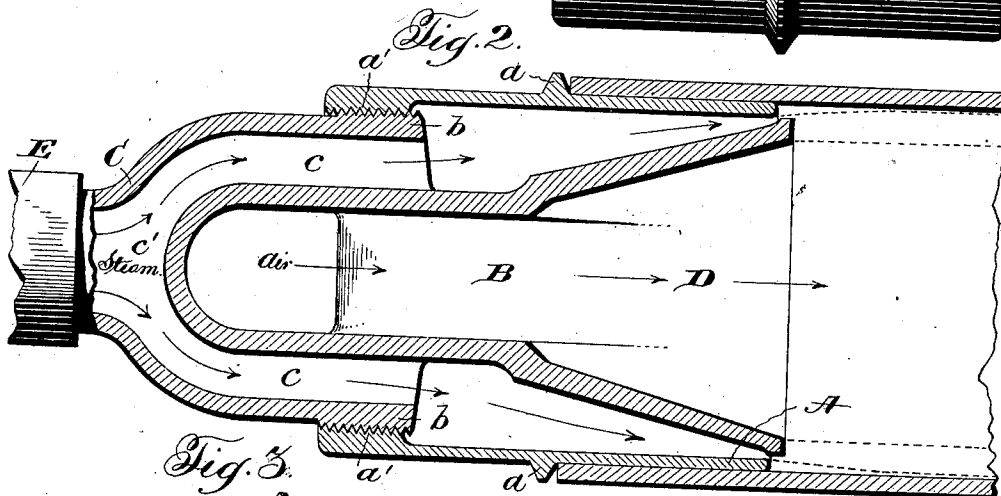


Fig. 3.

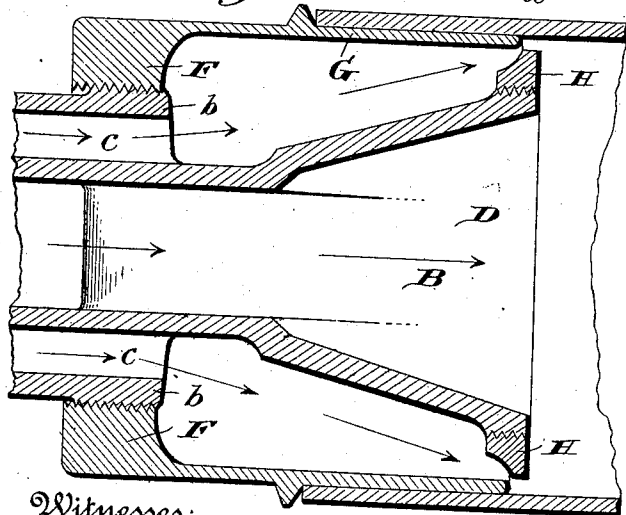
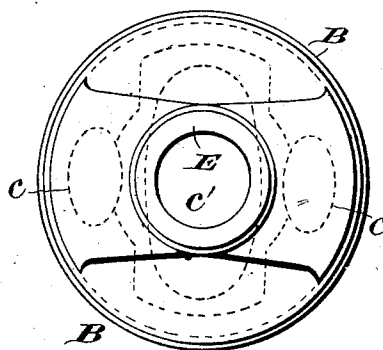


Fig. 4.



Witnesses:

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# UNITED STATES PATENT OFFICE.

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## APPARATUS FOR CLEANING TUBULAR STRUCTURES.

No. 837,917.

Specification of Letters Patent.

Patented Dec. 11, 1906.

Application filed May 25, 1906. Serial No. 313,654.

*To all whom it may concern:*

Be it known that I, ADELBERT HENRY COLCORD, a citizen of the United States, residing at Portland, in the county of Cumberland and State of Maine, have invented certain new and useful Improvements in Apparatus for Cleaning Tubular Structures, of which the following is a specification, reference being had therein to the accompanying drawings.

This invention relates to an apparatus for cleaning tubular structures—as, for example, boiler-tubes.

The invention contemplates the employment of a steam-jet to remove by forced impact the soot, ashes, or other deposits on the interior of a tube, operating in conjunction with a current of air, which constitutes a vehicle for carrying off such deposits as they are removed by the steam-jet.

A characteristic feature of the present invention is the comparatively dry treatment of the tubing as distinguished from the prior art, wherein moisture to a substantial extent is created by the more or less free intermingling of the steam and air.

It has heretofore been attempted to clean tubing by the forcing of jets of steam and air therethrough; but the underlying principle of such attempt is to introduce the steam and air in such a manner that the air will be heated after its introduction into the tubing and expanded into engagement with the steam supposedly to increase the efficiency of the operation of the steam on the soot, &c., and such expansion brings the air into such forced and intimate association with the steam-jet that they combine, the result being that the blast is a wet blast and obviously causes the soot and other deposits to adhere or smear over the inner surface of the tubing, thereby retarding to a very great extent quick, and practically prevents perfect, cleaning of the same.

The above-mentioned objectionable expansion of the air and intermingling of the same with the steam attendant upon the use of the devices heretofore known I overcome by heating and expanding to approximately its maximum capacity the air before its introduction into the tubing, which is centrally thereof, and surrounding the same by the steam-jet, the latter cutting the soot and other accumulated particles from the tubing and the former operating in what might be called a separate and distinct current as a ve-

hicle for carrying off the detached particles. The improved method may therefore be defined as a method of cleaning tubing which consists in subjecting the interior surface thereof to the action of a hollow jet of steam, subjecting a quantity of air to heat to expand the same to approximately its maximum capacity, and introducing said expanded air into the hollow steam-jet and passing the same through the tubing in a substantially separate and distinct current to act as a vehicle for carrying off the particles removed by the action of the steam-jet.

The device for carrying the method into practical effect comprises a tubular nozzle adapted to be inserted in one end of the tubing and to emit a hollow jet of steam and a complementary valve for adjusting the degree of fineness of said jet, the valve being hollow for the passage of air and having a relatively contracted inlet and an enlarged chamber near its outlet affording room for ample expansion of the air previous to its passage into the tubing, suitable means being provided for the introduction of the steam between the valve and the nozzle to form the jet.

The novel details in the construction and arrangement of the several parts will be apparent from the detailed description hereinafter contained when read in connection with the accompanying drawings, forming part hereof, and wherein a convenient embodiment of the invention is illustrated.

In the drawings, Figure 1 represents a side elevation of the device. Fig. 2 is a longitudinal vertical sectional view of Fig. 1, showing its application to a tube and by dotted lines the circular jet of steam and a column of air therewithin. Fig. 3 is an end elevation, and Fig. 4 is a sectional view, showing a coupling employed on what I may term my "standard size valve" to accommodate a nozzle of greater diameter than that shown in the preceding figures.

Referring more specifically to the drawings, wherein like reference characters designate corresponding parts in the several views, A represents a nozzle, conveniently shown as of cylindrical formation, the forward end of which is adapted to be inserted into the tubing to be cleaned and having intermediate its ends a collar or flange *a*, adapted to abut the end of said tube. This nozzle is made as thin as possible at its forward end, so as to bring the bore thereof as closely as possible

into alinement with that of the tubing, said bore of the nozzle being smooth and of substantially uniform diameter throughout save at its connection with the valve, where it is internally screw-threaded, as at *a'*.

B represents the valve, which is of approximately conical formation, having a threaded boss *b* adapted to adjustably engage the thread *a'* on the nozzle to adjust the degree of fineness of the jet discharged therefrom, said boss having transverse apertures *c*, opening to the space between the exterior of the valve and the nozzle A at one end and at the other end opening to channels *c'* in the forked end C of the steam-inlet pipe E. The space intermediate the sections or arms of the forked inlet-pipe just referred to affords the inlet for the air into the hollow interior of the valve B, this inlet being quite restricted in size relative to the chamber within and discharge-opening from said valve, it being noted that said chamber, which is represented at E, tapers from the discharge end of the valve to the inlet thereinto to offer a gradually-increasing area toward the discharge end of the nozzle, as will be obvious upon an inspection of Fig. 2.

The operation may now be followed. The valve having been properly adjusted within the nozzle to provide a thin or coarse jet, depending upon the use to which the device is to be put, and the device having been introduced into one end of the tube or flue to be cleaned, steam from any suitable source is supplied to the nozzle through the steam-inlet pipe E and passing out of the nozzle creates a hollow circular jet entirely surrounding and engaging the inner surface of the tube with such force as to cut and wipe therefrom the soot or other foreign matter adhering thereto, which will either be carried on by the steam or fall into the space on the interior of such circular jet, this action of the steam creating a vacuum which draws in a current of air through the hollow valve and into said space within the hollow jet, whence it takes up and serves as a vehicle for carrying off the detached particles from the tube. However, immediately upon the admission of air into the hollow valve, it being observed that said valve has been heated by the steam, said air in turn takes up the said heat and gradually expands from said inlet and in the chamber within the valve until it has expanded to approximately its full capacity as it leaves the chamber and passes through the tubing, whereby any substantial expansion within the tubing is prevented and the air passes through the tubing in substantially a separate and distinct current from that followed by the enveloping steam-jet, thus overcoming objections incident to an intimate contact or intermingling of the air and steam, as where the air is introduced in unexpanded condition.

In the construction just described I have had particular reference to the first three views of the drawings, wherein the usual sized nozzle is shown; but to afford provision for pipes and nozzles of somewhat greater diameter I make a ring F, adapted to thread upon the valve and to receive the nozzle G, the forward end of the valve being provided with an enlarging ring H, whereby the same will be accommodated to the increased size of the exit end of the nozzle.

Where I have herein referred to the expansion of the steam to its "maximum capacity" I mean thereby its susceptibility to expand under the heat of the steam constituting the jet.

I claim—

1. A tube-cleaner comprising a nozzle provided with means whereby the same will emit a hollow steam-jet, means for conducting steam thereto, and said nozzle having a chamber therewithin having a restricted inlet for air, an enlarged expanding-chamber for said air, and an exit for the expanded air arranged to discharge the same into said hollow jet.

2. A tube-cleaner comprising a nozzle provided with means whereby the same will emit a hollow steam-jet, means for conducting steam thereto, and said nozzle having a chamber therewithin having a restricted inlet for air, a gradually-enlarging expanding-chamber for said air, and an exit for the expanded air arranged to discharge the same into said hollow jet.

3. In a tube-cleaner, means for receiving steam and discharging the same in a hollow jet, means for receiving and discharging air into the hollow of said jet, said means having an expanding-chamber enlarged relative to its inlet arranged whereby said air is substantially expanded previous to its discharge into said jet.

4. A tube-cleaner comprising a nozzle, a hollow valve therein arranged in conjunction with the nozzle to create a hollow jet, means adjustably connecting the casing to the valve, means for supplying steam for said jet comprising a pipe having a forked extension formed with the valve and opening to apertures therein which in turn open to the space between the valve and nozzle, the space between the arms of said forked extension constituting an air-inlet to the hollow interior of said valve.

5. A tube-cleaner comprising a nozzle, a hollow valve therein arranged in conjunction with the nozzle to create a hollow jet, means for supplying steam for said jet comprising a pipe having a forked extension opening to apertures in the valve which in turn open to the space between the valve and nozzle, the space between the arms of said forked extension constituting an air-inlet to the hollow interior of said valve, the hollow interior of the

valve and discharge therefrom being enlarged to a substantial extent as compared to said inlet.

5 6. A tube-cleaner comprising a nozzle, a hollow valve therein arranged in conjunction with the nozzle to create a hollow jet, means for supplying steam for said jet comprising a pipe having a forked extension opening to apertures in the valve which in turn open to  
10 the space between the valve and nozzle, the space between the arms of said forked extension constituting an air-inlet to the hollow interior of said valve, the hollow interior of the valve gradually enlarging from said inlet to  
15 the discharge end thereof.

7. A tube-cleaner comprising a nozzle, a valve therein, and a detachable ring intermediate the valve and nozzle for securing them in operative association.

20 8. A tube-cleaner comprising a nozzle, a valve therein, and a detachable ring intermediate the valve and nozzle for securing them in operative association, in combination with a detachable enlarging ring at the end of the  
25 valve whereby it approximates the interior diameter of the discharge end of the nozzle.

9. A tube-cleaner comprising a nozzle, a valve therein, in combination with a detachable enlarging ring at the end of the valve

whereby it approximates the interior diameter of the discharge end of the nozzle. 30

10. A tube-cleaner, comprising a nozzle, a hollow valve therein arranged in conjunction with the nozzle to create a hollow jet, means adjustably connecting the casing to the  
35 valve, and means for supplying steam for said jet comprising a pipe extension formed with the valve and discharging into the space between the valve and nozzle, said valve also having an inlet for air leading to the hollow  
40 interior thereof.

11. A tube-cleaner comprising a nozzle, a hollow valve therein, arranged in conjunction with the nozzle to create a hollow jet, means adjustably connecting the casing to  
45 the valve whereby the size of the jet may be regulated, and means for supplying steam for said jet discharging into the space between the valve and nozzle, said valve having an inlet for air leading to the hollow interior thereof. 50

In testimony whereof I affix my signature in presence of two witnesses.

ADELBERT HENRY COLCORD.

Witnesses:

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HUGH J. STACK.