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UNITED STATES PATENT OFFICE.

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STEEL-CLEANING MACHINE.

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To all whom it may concern:

Be it known that I, ALBERT CARTER, a citizen of the United States, and a resident of Chicago, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in a Steel-Cleaning Machine, of which the following is a description, reference being had to the accompanying drawings which form a part of my specification.

My invention relates to a machine for cleaning the surface of steel shapes of cylindrical form and more particularly for cleaning the tubes of boilers of the locomotive type; namely a machine for removing the scale from the exterior of the fire tubes or flues of a boiler.

My invention has for its object the provision of a machine for automatically feeding the tubes through a cleaning zone at a predetermined speed, while at the same time causing the tubes to be rotated so as to subject the entire exterior surface, during a single passage, to the action of a suitable abrasive material under pressure.

A further object of my invention is to provide a machine adapted for continuous operation, wherein the tubes may be successively fed through the machine, end to end, and the cleaned tubes carried through and out of the cleaning zone at uniform speed and discharged therefrom.

A further object of the invention is to provide a machine wherein the tube feeding and conveying elements may all be actuated and driven from a single source of power or motor.

Another object of the invention is to provide a machine wherein the cleaning zone comprises a suitable housing or chamber wherein the forcibly ejected abrasive material and the removed scale or foreign substance will be confined, to permit reclamation of the abrasive material, as well as prevent a scattering of the scale removed; in other words, a machine whereby the possibility of injury to the operators is eliminated.

The above enumerated objects as well as other objects and advantages inherent in the construction will all be more fully comprehended from the following detailed description of the drawings, wherein:

Figure 1 is a plan view of my improved machine.

Figure 2 is a side elevation of the intermediate portion of the machine, with portions broken away.

Figure 3 is a view of a portion of the machine taken substantially on the line 3—3 of Figure 4.

Figure 4 is a detail sectional view looking from the right hand end of Figure 3.

As the supporting frame or substructure may be of any suitable construction and arrangment, a more or less schematic illustration of this portion of the machine is shown in the drawings which present an exemplification of the invention having a supporting structure which preferably consists of timbers or beams 15, of suitable length, bolted or otherwise secured together and having suitable supporting standards (not shown).

Mounted on plain wood shims, at a point intermediate of the ends of the timbers or beams 15, is a housing 16, preferably of sheet iron and any suitable cross-sectional configuration, as for example more or less rectangular as shown in the drawings; with the junction between adjacent sides provided with openings to receive nozzles as shown at 17 in Figure 4. The portions or junctures between the sides of the housing provided with the openings are preferably beveled as shown at 18, and provided with bosses or blocks 19, preferably removably secured in place in any convenient manner and adapted to hold the inner nozzle 17 in place, at the desired distance from the axis of the housing and therefore at proper distance from the tube traveling transversely through the housing. The bosses or blocks 19 are also apertured to receive the nozzles of a compressed air line 20 and the nozzle of an abrasive medium supply line 21; both of which nozzles are removably secured to the bosses or blocks 19 and arranged to discharge into the mixing nozzle 17, as shown in Figure 4. While any suitable nozzle construction may be employed, I believe the construction and arrangement shown preferable, because the nozzle holding blocks or bosses and nozzle connections are located to the housing exterior where they are conveniently accessible for adjustment or renewal when required. The air and abrasive medium nozzles and supply lines may be clamped to the bosses or to the housing in any con-

venient manner, as for example by the clips shown at 22. The housing 16 of sheet iron also comprises a light angle frame as shown at 23; and in the exemplification four nozzles 17 are employed, disposed approximately 90° apart, thus causing the entire surface of the tube or other cylindrical steel form to be simultaneously acted upon.

The housing is also preferably provided with a downwardly sloping lower wall as shown in dotted lines at 23ª in Figure 2 in order that the abrasive medium and scale may discharge from the housing into a suitable receptacle or onto a suitable screen or separator whereby the scale and dirt may be separated from the abrasive material and thus enable a reclamation of the abrasive medium; the chute portion 23, if desired, being provided with a closure to prevent escape of dust while the machine is in operation.

The housing 16 is provided with suitable openings in the two side walls thereof as shown at 24 in Figure 4, of size sufficient to permit passage of the tubes or cylindrical steel shapes therethrough.

The upper most beams or timbers 15 are shown provided with blocks 25, which have oppositely sloping or bevelled top surfaces in order to give the desired angularity or inclination to the operating or feeding elements mounted thereon. Each of the blocks 25, (of which a suitable number are employed and spaced desired distances apart lengthwise of the supporting structure) on one of the sloping surfaces, is provided with a bearing bracket 26 for rotatably supporting the end of a stub-shaft or spindle of a roller 27. The other sloping surface of each block 25 is also provided with a bearing bracket 28 in which a shaft 29 is rotatably mounted; the end of the shaft being provided with a suitable roller or enlargement as shown at 30. The idler rollers 27 and the rollers or enlargements 30 of the shafts 29 are preferably provided with a covering of rubber, wood, or other suitable friction providing surface, to induce positive movement of the tubes or cylindrical steel shapes to be cleaned. As seen in Figures 2 and 4, the rollers on the ends of the shafts 29 and the idler rollers 27 are inclined in opposite directions and arranged at an angle to the longitudinal axis of the tube operated on and shown at 31.

The supporting frame or structure of the machine, at a suitable point, is preferably provided with a motor, the outline of which is shown at 32; and the pulley on the armature shaft is provided with a suitable belt 33. The belt 33 also takes about a suitable sized pulley 34 which is keyed on one of the shafts 29, which is supported in suitable bearings 35 mounted on the outwardly jutting and sloping timbers 36; the end of the shaft being disposed through the bearing 35 and provided with a pulley 37 to receive a belt or other suitable driving element 38, which in turn extends about a pulley 39 arranged on the next adjacent shaft 29, in proximity to its upper bearing 28.

Except for the main drive-belt receiving pulley 34, all of the shafts 29, intermediate of the ends of the machine, are provided with similar pulleys receiving the driving belts 38, whereby the shafts are driven from the next preceding shaft, relative to the shaft driven by belt and pulley 33—34. As is apparent from the construction shown in the drawings, the successive shafts 29 at the right hand end of the machine receive their power from pulleys 37 at the lower ends of the preceding shafts, by means of belts 38; while the succeeding shafts 29 at the left hand end of the machine receive their power from the pulleys 39 at the upper ends of the preceding shafts, by means of belts 38; and as a result all of the positively driven rollers 32 are driven in the same direction.

As is apparent from the drawings, the shafts 29 at the ends of the machine, are not provided with pulleys 37 at the right hand end or 39 at the left hand end of the machine.

In the machine, as illustrated in the drawings, the tubes to be cleaned are placed onto the oppositely inclining rollers 27 and 30 at the right hand end of the machine and, when the motor is set in operation, will be fed to the left through the housing 16; the tubes having both rotative and longitudinal movement through the cleaning zone, which ensures the entire surface of the tubes to be subjected to the action of the respective nozzles and therefore to the action of the forcibly discharging abrasive medium issuing from the different nozzles 17.

Any suitable abrasive medium may be employed, such as sand; although I find that a more rapid and superior cleaning effect is obtained by the use of steel grits; it being understood that the lines 20 and 21 are respectively connected with suitable compressed air and sand or steel grit supplies, with a suitable method for inducing flow of the abrasive medium through the lines. With both lines 20 and 21 discharging into the nozzle 17, it is apparent that the abrasive medium will be forcibly ejected onto the tubes passing through the housing 16, the respective nozzles 17 being directed toward the axis of the tubes as clearly shown in Figure 4.

As the nozzles 17, in time, will become worn from the medium passing therethrough, I prefer to removably secure them in place; by preference on the housing exterior as shown.

It is also apparent that where different sized tubes are to be operated on and where

a different speed of movement of the tubes is desired, the sizes of the rollers 27 and 30 may be changed, as may also the sizes of the respective pulleys, or the angularity of the rollers.

The nozzles 17 are preferably mounted in staggered relation, as shown in Figure 2, so as to simultaneously operate at different points lengthwise of the tubes; suitable valves or means (not shown) being employed in the different lines so that any one of the lines may be shut off while the machine is in operation and repair of any one of the nozzles made possible.

As a means for carrying out my improved method of cleaning tubes, I have shown my improved tube cleaning machine provided with four ejecting nozzles 17, as the preferred construction, but it is evident that any suitable number of nozzles may be employed and that the configuration or shape of the housing 16 may be altered; and I have described the preferred form in terms employed merely as terms of description and not as terms of limitation, as structural modifications are possible and may be made without, however, departing from the spirit of my invention.

What I claim is:—

1. A machine of the character described, comprising a housing, jet action producing means secured in the walls of the housing so as to direct jets of an abrasive medium in criss-cross manner toward a common axis, a plurality of oppositely inclined rollers adapted to carry a tube in alignment with said axis, and means whereby the rollers are rotated and the tube given rotative and longitudinal movement along said axis through the housing.

2. A machine of the character described, comprising a supporting structure, a housing, nozzles mounted on different sides of the housing and disposed in criss-cross manner toward a common axis, a pressure medium line and an abrasive medium line connected with each nozzle, a set of roller carrying shafts rotatably mounted on the supporting structure at an inclination to the axis of the housing, a second set of rollers mounted on the supporting structure at an inclination to said axis and disposed in a direction opposite to that of the rollers on said shafts, and means whereby all of said shafts may be rotated at uniform speed and the tube to be cleaned given rotative and longitudinal movement along said axis through said housing.

3. A machine of the character described, comprising a supporting structure, a housing, a plurality of radially arranged nozzles in the walls of the housing all directed toward a common axis, a plurality of rollers mounted on the supporting structure on opposite sides of the housing, one set of said rollers being disposed in one direction at an inclination and angle to said axis, while the other set of rollers is disposed in the opposite direction at an inclination and angle to said axis, and power imparting means whereby all of the rollers may be rotated at uniform speed.

4. A machine of the character described, comprising stationarily mounted means for providing a plurality of circumferentially staggered jets of an abrasive medium under pressure, with all of the jets directed toward a common axis, and means whereby the material to be cleaned is rotated and progressively moved in one direction along said axis.

5. A machine of the character described, comprising a housing provided with aligned openings in opposite walls, means secured in opposite walls of the housing at points above and below the axis of the aligned openings whereby a plurality of jets of an abrasive medium are directed in opposite directions toward said axis, and tube feeding means arranged on opposite sides of the housing adapted to simultaneously rotate and move the tube longitudinally through the aligned openings of the housing.

6. A machine of the character described, comprising a housing the opposite side walls whereof are provided with aligned openings, the lower side whereof is provided with a discharge opening, nozzles removably secured to the housing exterior and projecting into the housing in a radial manner relative to the axis of the aligned openings, a pressure medium line and an abrasive medium line removably secured to the outer ends of each of said nozzles, and means located on opposite sides of the housing whereby the tubular material to be cleaned is given rotative movement and progressively forced through the aligned openings in the side walls of the housing.

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STEEL CLEANING MACHINE

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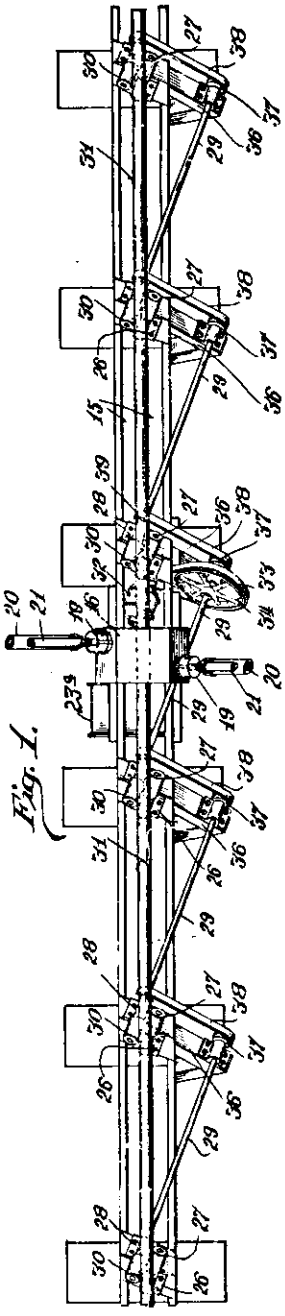

Fig. 1.

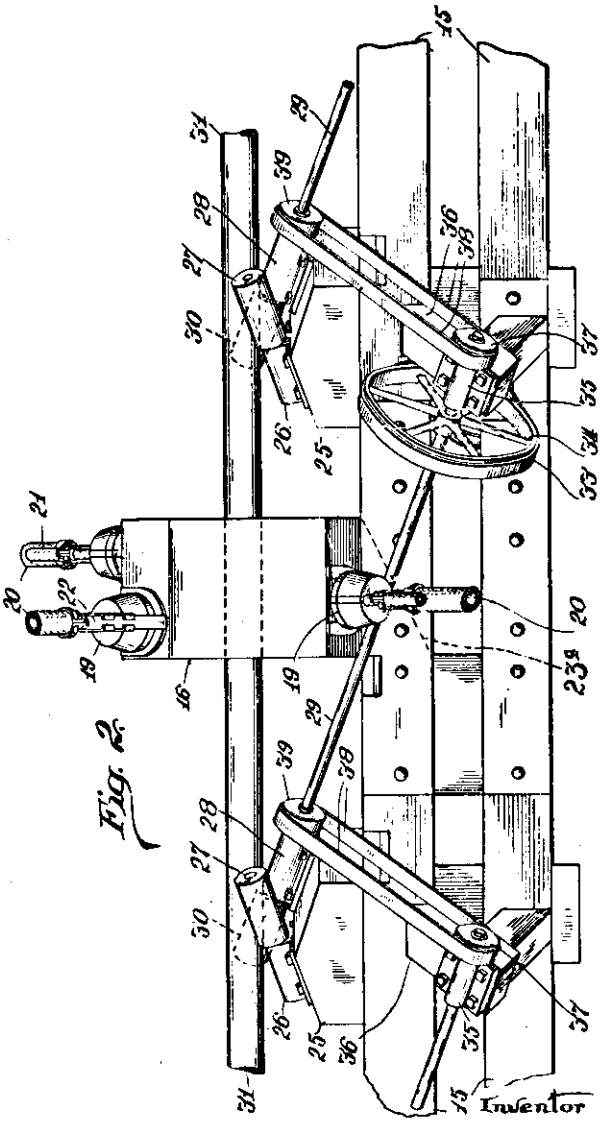

Fig. 2.

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STEEL CLEANING MACHINE

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Fig. 3.

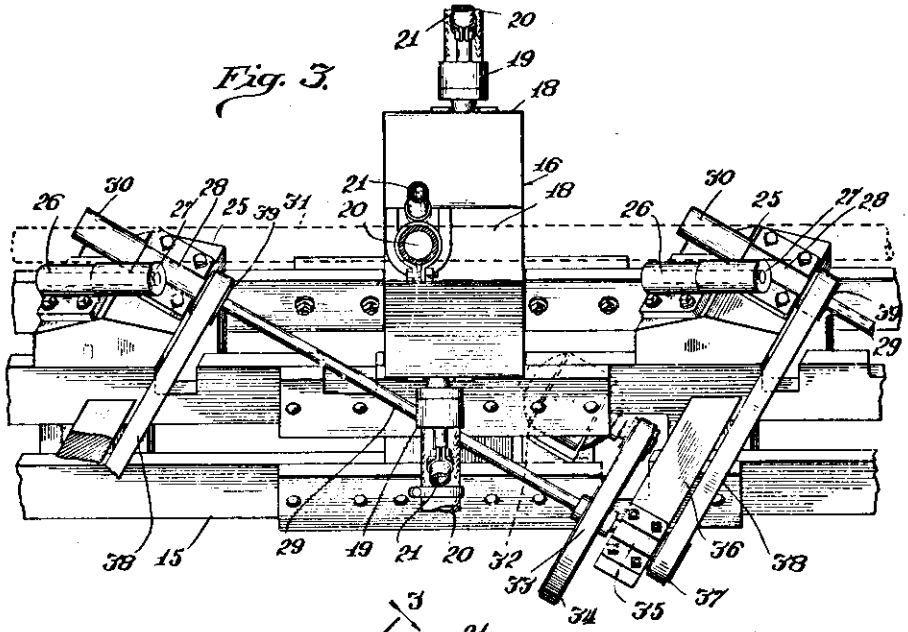
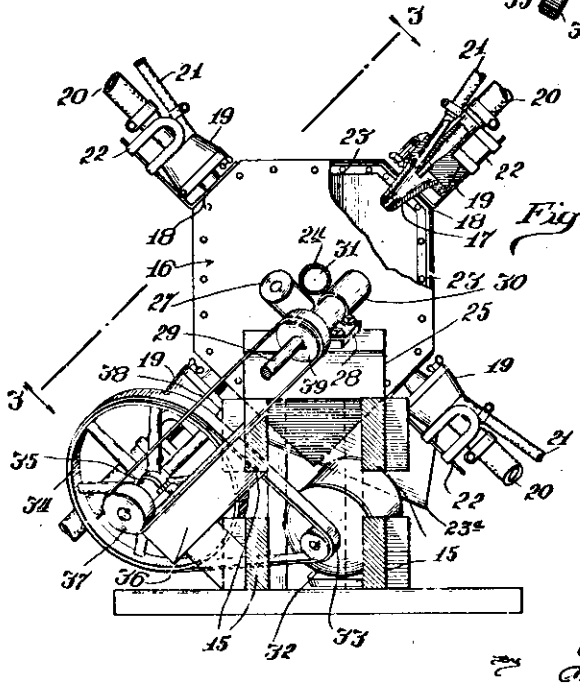


Fig. 4.



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