J. T. McGRATH.

TUBE CLEANER.

APPLICATION FILED OCT. 27, 1920.

1,405,930.

Patented Feb. 7, 1922.

2 SHEETS—SHEET 1.

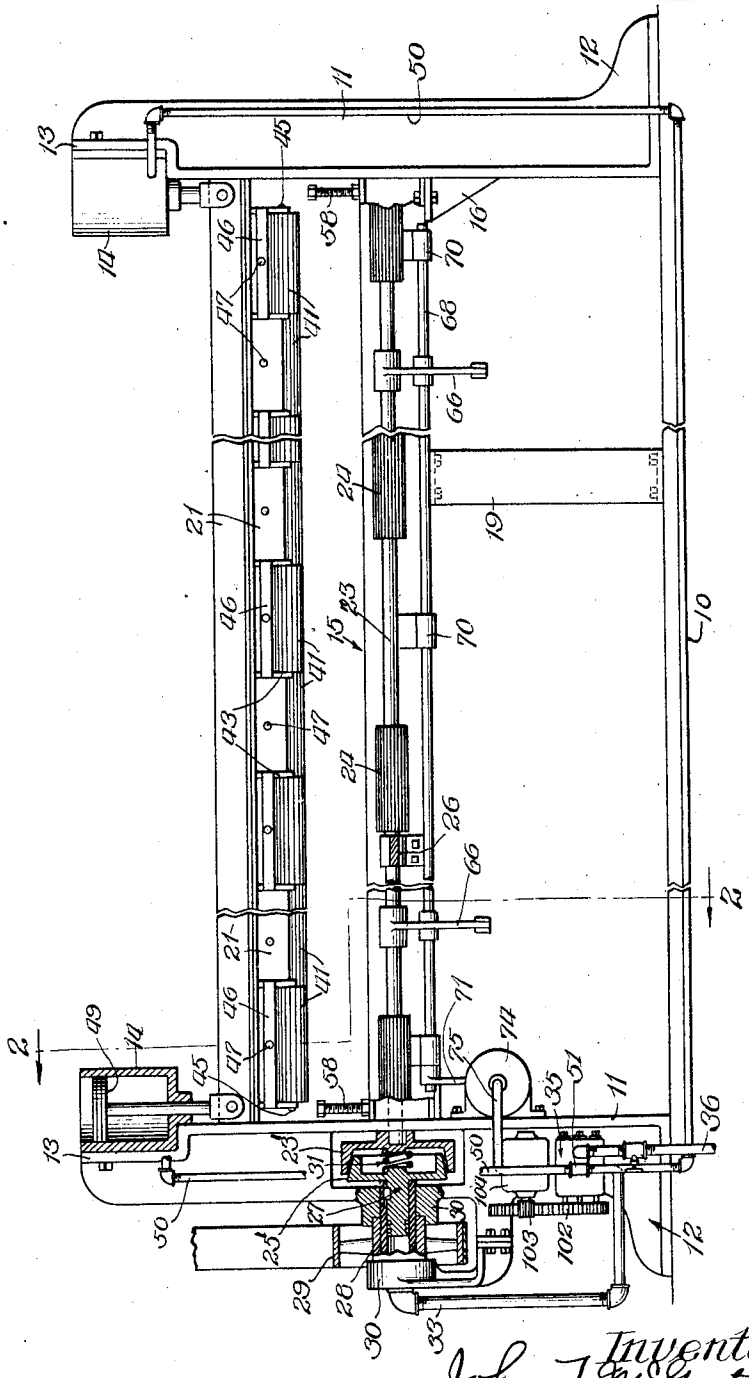


Fig. 1

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2 SHEETS—SHEET 2.

FIG. 2

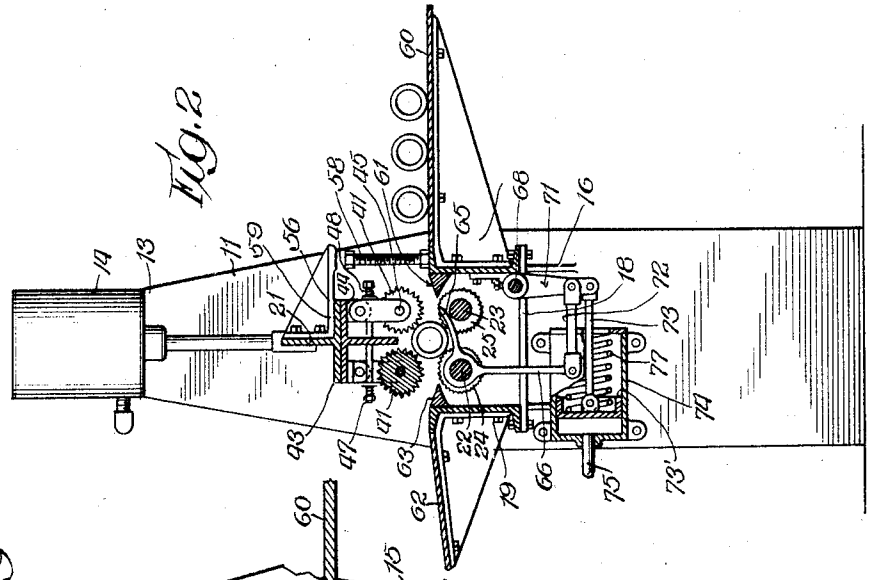


FIG. 3

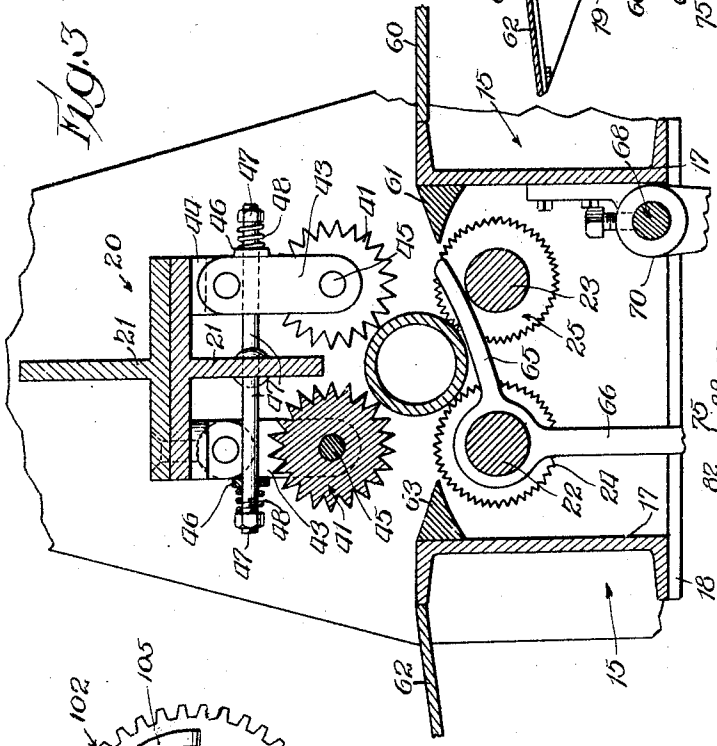


FIG. 4

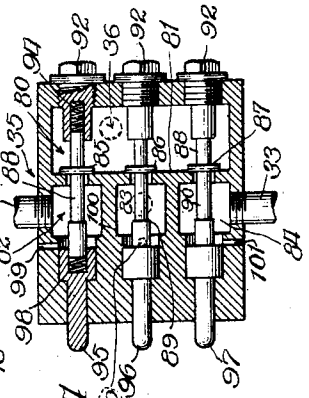
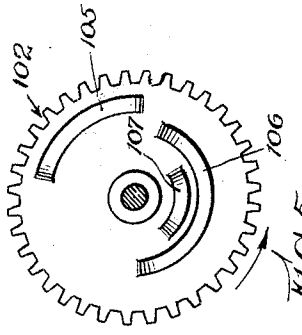


FIG. 5



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UNITED STATES PATENT OFFICE.

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TUBE CLEANER.

1,405,930. Specification of Letters Patent. Patented Feb. 7, 1922.

Application filed October 27, 1920. Serial No. 419,889.

To all whom it may concern:

Be it known that I, JOHN T. McGRATH, a citizen of the United States, and a resident of Bloomington, in the county of McLean and State of Illinois, have invented certain new and useful Improvements in Tube Cleaners; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, and to the characters of reference marked thereon, which form a part of this specification.

This invention relates to improvements in tube cleaners of a type in which the external scale is removed from the tubes by the application of a series of toothed or otherwise roughened hardened steel cutter wheels which are adapted to be disposed symmetrically about the tube to be cleaned, with means for ejecting the tubes from the machine when certain of the cutter wheels are separated from the others and power means for rotating the cutter wheels.

Among the objects of the invention is to provide an exceedingly simple machine for this purpose which can be made in large part automatic in its action, so that the tubes can be delivered to the machine at intervals of time to correspond to the speed of the machine and can be either automatically or manually thrown out of the cleaning zone of the machine.

A further object of the invention is to provide a novel arrangement of the cutter wheels whereby the series of cutter wheels can be arranged in upper and lower pairs, symmetrically disposed about the axis of the tube, some of the wheels constituting driving and supporting wheels, between which the tubes to be cleaned can rest, as in a cradle, and the other being mounted to be freely rotable and to be moved toward and from the operative or cutting positions in timed relation to the ejecting and driving means, so that the different operative elements may be operated in a suitably timed sequence to receive the tubes, clean them, and to eject the cleaned tubes from the machine.

Another object of the invention is to provide a machine of the general character wherein the cutter wheels are arranged in upper and lower series, and provided with loading and discharging platforms parallel with the series of cutter wheels so arranged with respect to said wheels as to permit scaled tubes to be readily rolled into the machine and cleaned tubes readily discharged from the machine.

Another object of the invention is to provide automatic means for operating the different fundamental elements of the machine in a timed relation to permit ample time for the tubes to be delivered to and discharged from the machine.

A further object of the invention is to provide a machine of this character which is adapted to operate on tubes of different diameters and lengths.

A further object of the invention is to provide a novel means for throwing out the cleaned tubes after they have been cleaned and the cutter wheels have been separated, which throw-out device may be either manually or automatically operated.

Other objects of the invention are to improve and simplify machines for this purpose, and the invention consists in the combination and arrangement of the parts shown in the drawings and described in the specification, and is pointed out in the appended claims.

In the drawings;

Figure 1 is a side elevation, with parts in section, of a machine embodying my invention.

Figure 2 is a cross section on the line 2—2 of Figure 1.

Figure 3 is an enlarged transverse section of the cutter wheels shown in Figure 2 and their mountings.

Figure 4 is a sectional view of the air pressure box, showing the valves for controlling the various pneumatically operated parts of the machine, to be hereinafter described.

Figure 5 is a face view of one form of valve controlling cam.

The frame of the machine comprises a base 10 and uprights 11 fixed to the base at the foot portions 12 and provided at their upper ends with inwardly facing pads 13 for the cylinders 14, and an intermediate fixed trust member 15 which extends horizontally between the uprights 11 and is fastened, as by the brackets 16, thereto. Said truss member may consist of channel bars 17 which are connected at their lower flanges by cross bars 18 in any suitable fashion. The

truss may be supported between its ends by one or more intermediate standards or braces 19.

Arranged above the truss member 15 and parallel thereto, and extending from one upright 11 to the other, is a carrier frame 20 for the upper series of cutter wheels, to be herein described. Said frame member can be very simply and at the same time strongly made of a pair of T-bars 21, 21, shown best in Figures 2 and 3, that are arranged with their flanges flatly abutting and bolted together, and with their webs extending upwardly and downwardly, respectively, in the same plane.

22, 23 designate parallel horizontal shafts which are arranged between the side members of the truss 15 and on which are mounted a series of preferably short length peripherally notched supporting and driving wheels 24, 25. Said supporting and driving wheels are arranged laterally a peripheral distance apart less than the diameter of the smallest tube to be cleaned and the peripheries of the rows of wheels constitute a cradle to receive and hold the tube to be cleaned. One of the shafts, the shaft 23, as herein shown, is a driving shaft. The said shafts 22, 23 are rotatively mounted in suitable bearings 26, 26 that are fixed crosswise to the channel bars of the truss member 15. The driving shaft, to which power is applied to rotate the series of driving cutter wheels, extends at one end beyond the adjacent upright or standard 11, and to said extended end of the driving shaft 23 is fixed a clutch member 23′ that is driven by an axially movable clutch member 25′. Said clutch members are normally held out of contact by a release spring, and the axially movable clutch member 25′ can be pneumatically forced against the companion clutch member to drive the latter and the driving series of cutter wheels. As herein shown, the movable member is fixed to a plunger 27 that slides in a cylinder 28, to which the plunger is splined. Said cylinder carries a driving pulley 29 that is rotatively mounted in but held axially fixed relatively to a twin bearing 30 that is carried by the adjacent standard or upright 11. The plunger terminates within the cylinder and reciprocates as a piston that closely fits in said cylinder. Against the end of this plunger air, under pressure, is forced by means to be hereinafter described, against the action of a separating spring 31, to lock the driving pulley to said driving shaft.

It will be understood that the clutch elements are normally spring separated to disconnect driving power from the machine when power is not necessary to be connected to the machine to drive the supporting and driving wheels, and an interposed tube. Air under pressure is controllably admitted to the outer end of the cylinder 28 through a pipe 33 by a suitably timed valve mechanism to be hereinafter mentioned. The belt pulley 29 that is fixed to or made part of the cylinder 28 is normally positively driven and one of the clutch elements is likewise driven by reason of its splined connection to said cylinder. When air under pressure is admitted to the cylinder on the outer face of the plunger, the clutch members are forced into driving contact against the action of their separating spring, and operation of the driving wheels is continued until air is cut off from said cylinder. Driving power is cut off, when air pressure is released, by the spring 31.

The said pipe 33 is connected to a reservoir or pressure box 35 which is connected to a source of air under pressure by a valved pipe 36, and communication between the pipe 33 and the reservoir may be controlled by a valve of any suitable character, such, for instance, as is shown in Figure 4 and described hereinafter in connection with other pneumatically operated parts of the machine.

The upper carrier frame 20 sustains a series of endwise disposed, laterally spaced cutter wheels 41 having deeper cutting teeth than the lower wheels. The said upper cutter wheels are of relatively short lengths, with those on one side of the machine spaced endwise a distance apart substantially equal to the distance of the length of the wheels, and with the wheels on one side of the machine offset with respect to those of the other side of the machine, so as to insure continuous cleaning contact of the upper cleaner or cutter wheels with all parts of the tube lengthwise thereof.

Said wheels 41 are suspended from the frame 20 by links 43 that are hinged at their upper ends to depending lugs 44 of said frame and rotatively receive at their lower ends trunnions 45 at the ends of the wheels formed by the extended ends of shafts that extend through and beyond the wheels. Each pair of links associated with each cutter wheel connected together by a tie bar 46 and tension bolts 47 extend between and through the depending webs of the frame 21 and through apertures in said tie bars and are threaded to receive nuts, whereby the wheels may be made to bear more or less forcibly against the tubes while being cleaned. Springs 48 encircle the bolts and are interposed between the said tie bars and nuts, and permit a yielding cutting pressure of the teeth of the wheels 41 to be imposed on said tubes. Owing to the weight of the tube and owing to the fact that it freely lies in the cradle afforded by the lower wheels 24, 25 and is, therefore, under no restraint, the roughened peripheries of the wheels causes the tube to turn, which, in turn, im-

parts rotational movement to the wheel 24 and cutter wheels 41. The sharp teeth of the latter wheels break or puncture the scale on the tube. Inasmuch as the tube is rolled freely between the upper and lower wheels, different areas of the scale envelope of the tube are successively presented to the wheels, with a result that all parts of the scale envelope are attacked and removed.

The upper cleaning wheels frame is adapted to be pneumatically lifted by compressed air admitted under pistons 49 in the cylinders 14 before referred to, the stems or rods of the pistons being loosely connected to the raising and lowering carrier frame, as by being forked and fitted over the upstanding web of said frame and bolted thereto. The said pistons are connected by pipes 50 with the valved pressure box 35 through a common pipe 51 which is connected at the box.

In order that the carrier frame and the upper cutter wheels shall not descend too low, when no tube is between the cutter and driving and supporting wheels, stops 58, rising from the truss or girder frame member near the ends thereof are provided which are in position to engage brackets 59 on the carrier frame (Figure 2). These stops may be spring stops or buffers, if desired.

In order to facilitate the feeding of the tubes into the machine between the wheels when the latter are separated, said tubes are preferably loaded into the machine from a loading platform 60 at the receiving side of the machine. A short, inclined, longitudinal bridge piece 61 between the inner side of said platform and the lower supporting and driving rollers facilitates the direction of the tubes to the machine. Likewise, a downwardly inclined discharge platform 62 may be arranged at the discharge side of the machine to receive and direct the cleaned tubes when they are discharged from the machine, inclined approaches 63 being located at the receiving side of the discharge platform, as shown in Figures 2 and 3.

The tubes may be rolled into and from the machine in any suitable manner. As herein shown, they are adapted to be rolled manually into the machine, and are adapted to be discharged from the machine by two or more throw-out arms 65. They are pivoted on the shaft 22 of the supporting rollers 24 and are formed with inwardly extending arms, preferably having upper concave surfaces. They are adapted to lie beneath the operative position of the tube in the machine when a tube is supported or being cleaned therein. The said throw-out arms are provided with actuating levers 66 which extend downwardly from the shaft 22. In the present instance the said throw-out arms are power actuated, although they may be hand actuated. When power actuated, the actuating power may be the air under pressure from the pressure box 35.

It is desirable that said throw-out arms be adjustable lengthwise of the machine, so that tubes of different lengths may be properly ejected from the machine by symmetrical engagement with said arms. To this end hubs of said arms 65 are slidable on the shaft 22, and the arms are rocked about the shafts 22 by connection with a rock shaft 68 that is disposed parallel to and below the shafts 22 and 23 and mounted in suitable bearings 70 on the machine frame. Said rock shaft is connected to the levers 66 of the throw-out arms by means of crank arms 71 depending from the rock shaft and links 72, as best shown in Figures 1 and 2. The said rock shaft is shown as actuated by connection to the stem 73 of a piston 73′ which reciprocates in a cylinder 74 that is fixed to the upright 11 adjacent to the power end of the machine. The outer end of the cylinder 74 is connected by a pipe 75 with the valve controlled air box 35 in the same manner as are the pipes 50 for raising the upper cutter wheels, as will be hereinafter described. A spring 77 interposed between one head of the cylinder 74 and said piston acts, through the crank link and lever connections, to normally hold the piston 73′ in the back end of the cylinder 74 and to hold the throw-out arms in the position shown in Figures 2 and 3. When air under pressure is admitted to said cylinder 74 in rear of the piston 73′, said piston is forced outwardly against the action of the spring 77 to swing the throw-out arms through an arc of movement that will eject a cleaned tube.

This ejecting movement of the throw-out arms and the return movement thereof to pass into position beneath the next tube to be cleaned occurs at a time when the carrier frame 20 and the cutter wheels 41 are in their elevated positions and at a time when the shaft is unclutched from power.

It will, of course, be understood that the various mechanism, to-wit, the clutch mechanism, the upper cutter wheel elevating mechanism, and the throw-out mechanism may be manually operated or a portion of them so operated. Preferably, however, and as herein shown, all of these various mechanisms are automatically operated by pneumatic means, which embrace the air pressure box 35, shown in Figures 1 and 4. This illustration is diagrammatic in its character, and it will be understood that any suitable form of pressure box, valves, and valve controlling mechanism may be employed, which will enable the parts to be operated in synchronism with each other. A form of pressure box and valve mechanism is shown in Figure 4 and a form of controlling cam for operating the stems of the valves is illustrated in Figure 5. The pressure box 35 embraces a free

rear chamber 80, into which the valve pipe 36 enters, that is connected with a suitable source of constant pressure, preferably air under pressure. A diaphragm 81 separates the chamber 80 from a plurality of independent valve chambers 82, 83, 84. The valve chamber 82 is connected to the pipe 75 which leads to the cylinder 74. The chamber 84 is shown as connected to the clutch operating cylinder 28 through the pipe 33. The intermediate valve chamber 83 is, in like manner, connected to the pipe 51 that is common to the pipes 50 which, in turn, communicate with the operating cylinders 14 of the upper cutter wheel raising and lowering device. This latter connection is indicated by the opening shown in the valve chamber 83. Each of the valve chambers 82 to 84, inclusive, is connected by a port with the pressure chamber 80 and the ports are normally spring closed by valves 85, 86, 87 when the machine is not in operation. Said valves are provided with stems 88, 89, 90, which extend beyond the valves in both directions. The rear ends of the stems enter sockets or recesses in screw threaded plugs 92 that are threaded through the rear wall of the pressure box, the rear ends of said stems slidingly fitting said sockets and bearing against spiral expansion springs 94 which tend to press the valves to their seats. The valve stems 88, 89, 90 extend inwardly through the chambers 82 to 84, inclusive, and their extreme ends enter and are guidingly engaged in sockets in the enlarged inner ends of tappet extensions 95, 96, 97, which latter are also guidingly fitted in suitable openings in the thickened forward wall of the pressure and valve box. Between the outer ends of the stems 88, 89, 90 and the bottoms or sockets of the tappet pieces are light springs 98 which tend to hold the enlarged or valved ends of the tappet extensions outwardly when the main valves 85, 86, 87 are seated. Each of the valve chambers 82 to 84, inclusive, is provided with small exhaust ports 99, 100, 101, respectively, through which air is exhausted from said valve chambers after their respective main valves 85, 86, 87 are closed in the sequence of the operation of the machine, so as to permit mechanisms that are controlled by said valves to be restored to inoperative positions; that is to say, to permit the clutch to be released, the upper cutter wheels to be lowered and the throw-out arms to be restored. These valve ports 99, 100, and 101 are so located with respect to the inner enlarged ends of the tappet extensions 95, 96, 97, that said enlarged ends constitute valves to control the exhaust ports, that when a tappet member is forced inwardly to open its main valve. The enlarged inner end of the tappet extension will first close its associated exhaust port due to the fact that the spring 98 is of less strength than the corresponding valve restoring spring 94. Therefore, when a tappet extension is moved inwardly the first effect of the inward movement is to cut off its associated port 99, 100, 101 and thereafter, through the valve stem 88, 89, 90, move the associated main valve away from its port and thereby permit air to pass from the pressure chamber 80 to that one of the pressure pipes which leads to the associated mechanism to be operated by air pressure.

The said valves are herein shown as controlled by a controller cam 102, shown in Figures 1 and 5 that may be rotatably mounted on the frame in any suitable manner and is geared to a pinion 103 that is driven by a motor 104. Said controlling cam disc is provided on its inner face or the side towards the pressure and valve box with a plurality of arc-shaped cam ribs 105, 106, 107, which are adapted, respectively, in the rotation of the cam disc to contact with the tappets 95, 96, and 97. The intermediate cam rib 106 controls, by engagement with the tappet 96, the raising and lowering of the upper cutter wheels and is made of a length to hold said cutter wheels and carrier frame upwardly during the time a tube is being ejected from the machine by the throw-out arms and another fed into the machine. The other cams 105, 107 are of such length and are so disposed with respect to the intermediate longer cam as to operate their associated valves to perform the unclutching and throw-out functions in the sequence desired, it being understood that the valve which controls the clutch that connects driving power to the machine will be open at a time when the cutter wheel and throw-out arm valves are closed, so that power is applied to rotate the live shaft 22 when the upper cutter wheels 41 are resting on the tube interposed between the latter cutter wheels and the lower driving and cutter wheels.

The arc-shaped cam ribs will preferably be tapered at their ends, so as to permit the mechanisms of the machine controlled thereby to be brought gradually into working position and brought gradually to rest.

The employment of the rock shaft 68, as described, permits the throw-out mechanism to be operated by a single motor that can be, and is herein shown, as connected to one end of the rock shaft, and at the same time permits the throw-out arms and their connections to be adjusted longitudinally of the shafts 22 and 68 and locked thereto, as will be obvious. This arrangement permits the throw-out mechanism to symmetrically operate on different length tubes, as will be apparent.

When all the various mechanism, to-wit, the pneumatic clutch, the cutter wheel carrier, and the tube throw-out device are thus operated automatically in proper sequence,

the carrier frame, with the upper cutter rollers, is first raised to permit a tube to be placed into the machine on the driving and supporting rollers or wheels, and the said carrier frame and cutter wheels are allowed to descend, which may be effected by gravity, slowed down by the slow closing of the associated controlling valve. Just as, or before, the cutter wheels are brought into contact with the tube, the pneumatic clutch is slowly thrown into operation to effect the clutching of the driving wheels to power and to turn the driving wheel and the tube to effect the rotation of all the wheels. After the wheels have been turned the required number of times to clean the tube, the carrier actuating valve is opened to permit an interval of time for a tube to be discharged from the machine, as by the throw-out arms, and the throw-out arms to be returned and a new tube delivered to the machine, during which time the clutch valve may be operated to cut off driving power from the machine.

Thereafter, the carrier will be allowed to descend to engage the upper cutter wheels with the new tube delivered to the machine. It will be necessary to properly time the cam disc 102 relatively to the control valve stems of different, pneumatically controlled mechanisms to effect these various operations in proper timed relation, and it will also be necessary for the controlling cam to be operated in such relative time movement to allow the operator time for each individual manual operation and also to permit the various parts to return in proper time for sequential operations. So also, the length and relative engagement of the cam ribs may be differently arranged to adjust the machine to different character work, as, for instance, the character of the scale, its thickness, et cetera.

I claim as my invention:

1. A tube cleaning machine comprising driving and supporting elements for a tube, cutter elements movable towards and from the driving and supporting elements, and a throw-out means normally below the working position of the tube in the machine for discharging a cleaned tube from the machine when the cutter elements are out of operative position.

2. A tube cleaning machine comprising driving and supporting elements for a tube, freely rotative cutter elements movable towards and from the driving and supporting elements and adapted for working contact with a tube, and an automatically actuable throw-out device to discharge a cleaned tube from the machine when the cutter elements are out of operative position.

3. A tube cleaning machine comprising rotative driving and supporting elements for a tube, freely rotative cutter elements movable towards and from the driving and supporting elements, and a reversibly movable, pneumatically operable clean tube throw-out device.

4. A tube cleaning machine comprising driving and supporting elements for a tube, freely rotative cutter elements for contact with the tubes, raisable and lowerable relatively to the driving and supporting elements, automatically operable means to connect power to the driving elements, other automatic means to raise the cutter elements permitting them to lower for contact with a tube, and automatic means to throw a cleaned tube from the machine and to return to normal position below the tube position, operative when the said cutter elements are raised.

5. A tube cleaning machine comprising a frame embracing a raisable and lowerable carrier, a series of cutter, supporting, and driving elements arranged to encircle a tube in its cleaning position, some of which elements are rotatively mounted on the raisable and lowerable carrier, and others of which are fixed on shafts rotatively mounted in the machine, means for raising said carrier to permit a tube to be lodged into its cleaning position and to be removed therefrom, one of the tube supporting series of elements being roughened for contact with the tube, means for mounting other of the series to permit yielding lateral adjustment thereof to adapt them to different tube diameters; and means for rotating the roughened series to thereby rotate the tube and cutter elements when in contact with the cutter elements.

6. A tube cleaning machine comprising a frame embracing a raisable and lowerable carrier, a series of cutter, supporting, and driving wheels arranged to encircle a tube in its cleaning position in the machine, some of which are mounted on the raisable and the lowerable carrier and others of which are fixed on shafts rotatively mounted in the machine, means for raising said carrier and its wheels to permit a tube to be lodged into and ejected from its cleaning position, one of the series of lower wheels being roughened for contact with the tube, with means to rotate the latter elements, and throw-out means operative when the upper cutter wheels are raised.

7. A tube cleaning machine comprising a frame embracing a raisable and lowerable cutter element carrier, a series of rotative cutter, driving, and supporting elements, all adapted for simultaneous contact with a tube, some of which are mounted on the carrier, and others on shafts mounted in the machine, one of which is a driving shaft, and automatic means operative separately to raise said carrier to connect power to said driving elements and to eject a cleaned tube from the machine.

8. A tube cleaning machine comprising a frame, embracing a raisable and lowerable

cutter element carrier, a series of cutter, driving, and supporting elements adapted for simultaneous contact with a tube, some of which are rotatively mounted on the carrier, shafts on which the other elements are fixed, one of which is a driving shaft, means for discharging cleaned tubes from the machine, and pneumatically controlled means operative separately to raise said carrier, to operate said tube discharging device, and to connect and disconnect the driving shaft to power.

9. A tube cleaning machine comprising a frame, embracing a raisable and lowerable cutter element carrier, a series of cutter, driving, and supporting elements adapted for simultaneous contact with a tube, some of which are rotatively mounted on the carrier, shafts on which the other elements are fixed, one of which is a driving shaft, means for discharging cleaned tubes from the machine, and pneumatically controlled means operative separately to raise said carrier, to operate said tube discharging means, and to connect and disconnect the driving shaft to power, said pneumatic means embracing cylinders at the respective operation stations, with pistons therein respectively connected to the operative elements, a series of valve controlled chambers communicating respectively with said cylinders, and a controller element having a series of cams respectively to operate the valves of said chambers.

10. A tube cleaning machine comprising a frame, embracing a raisable and lowerable cutter element carrier, a series of cutter, driving, and supporting elements adapted for simultaneous contact with a tube, some of which are rotatively mounted on the carrier, shafts on which the other elements are fixed, one of which is a driving shaft, means for discharging cleaned tubes from the machine, pneumatic means to raise said carrier, and means to operate the tube discharging device and to connect the driving shaft to power, embracing a constant pressure box, valve controlled chambers communicating with said box through ports controlled by valves, and communicating with said several operating elements, and a rotative power driven element having cams to separately actuate said valves.

11. A machine for cleaning tubes comprising a frame, lower driving and supporting elements mounted therein on which a tube to be cleaned is supported, as in a cradle, upper cutter elements adapted to engage the periphery of the tube simultaneously with said lower elements, a carrier supported on the frame in which said upper cutter elements are rotatively mounted, means for raising said carrier to permit a tube to be fed into and discharged from the machine, and means for driving one of said lower elements, acting through said tube to rotate it and to rotate the upper cutter elements when in contact with the tube.

12. A machine for cleaning tubes comprising a lower series of driving and supporting elements, an upper series of cutter elements adapted with the driving and supporting elements for encircling contact with a tube, means to raise said cutter elements away from the supporting and driving elements, a tube throw-out element with its active portion beneath the cleaning position of the tube in the machine and pivoted to the support for the driving elements, and means operative when the cutter elements are raised to actuate said throw-out element.

13. A machine for cleaning tubes comprising a lower series of driving and supporting elements, an upper series of cutter elements adapted with the driving and supporting elements for encircling contact with a tube, means to raise said cutter elements away from the supporting and driving elements, tube throw-out elements with their active portions beneath the cleaning position of the tube in the machine and pivoted to the support for the driving elements, means operative, when the cutter elements are raised, to actuate said throw-out elements, and said throw-out elements being adjustable along their pivot support.

14. A machine for cleaning tubes comprising a lower series of driving and supporting elements, an upper series of cutter elements adapted with the driving and supporting elements for encircling contact with a tube, means to raise said cutter elements away from the supporting and driving elements, tube throw-out elements with their active portions beneath the cleaning position of the tube in the machine and pivoted to the support for the driving elements, and means to actuate said throw-out elements, comprising a rock shaft parallel to the pivot support of the throw-out elements, means connected to one end of said rock shaft to rock it, and lever and link connections between said rock shaft and said throw-out elements.

15. A machine for cleaning tubes comprising a frame, lower rotative driving and supporting elements rotatively mounted therein on which a tube to be cleaned is supported, upper cutter elements adapted to engage the periphery of a tube, a carrier supported on the frame on which said cutter elements are rotatively mounted, means for driving one of said lower elements, means for throwing out a clean tube from the machine when said carrier is raised, and pneumatic means severally to actuate said driving elements, the carrier, and the throw-out means, each having valve controlling means, and a rotative element provided with cams for separately actuating the controlling valves.

16. A tube cleaning machine comprising a lower pair of series of driving and supporting notched wheels adapted to form a cradle for a tube, an upper pair of series of cutter wheels having means to move them towards and from the tube and adapted to be rotated through the tube from the driving wheels, a pivotal throw-out device normally below the cleaning position of the tube in the machine, and means operative, when the upper series of wheels are raised, to swing said throw-out device to eject a clean tube from the machine and to permit the throw-out device to be returned to its normal receiving position.

17. A tube cleaner comprising a lower pair of driving and supporting notched elements adapted to form a cradle to support a tube, an upper pair of series of cutter elements having means to move them towards and from the tube and adapted to be rotated through the tube from the driving elements, means to eject a clean tube when the cutter elements are raised, a feed platform at one side and above the plane of the tube position in the machine from which the tubes may be rolled into the machine, and an incline discharge platform at the other side of the machine to receive the tubes discharged by the throw-out device.

18. A tube cleaning machine comprising a frame, a tube support, with means for rotating a tube supported thereon, an upper pair of series of cutter elements having means to raise and lower them from the tube position in the machine, said upper cutter elements being arranged in two lateral, endwise disposed series, each with the elements of one series disposed in staggered relation to the elements of the other upper series of elements.

19. A tube cleaning machine comprising a frame, a tube support with means for rotating a tube supported thereon, an upper pair of series of cutter elements having means to raise and lower them from the tube position in the machine, said upper cutter elements being arranged in two lateral, endwise disposed series, and spring means associated with the upper series of elements to permit them to yieldingly separate to adapt them to tubes of different diameters.

20. A tube cleaning machine comprising a frame, a lower series of parallel driving and supporting elements forming a cradle to receive a tube, a pair of upper, laterally spaced series of cutter elements, a carrier for said cutter elements, with means for raising and lowering said carrier, and means to support the cutter elements from said carrier comprising links pivoted to the carrier in which the cutter elements are rotatively mounted.

21. In a tube cleaning machine, a frame, a pair of laterally spaced upper series of cutter elements, a carrier in which said cutter elements are mounted by means permitting the upper series of cutter elements to adjust themselves to tubes of different diameters, and means to support the tube in cleaning position in the machine.

22. A tube cleaning machine comprising a frame, a support for a tube, embracing means to rotate the tube, an upper series of cutter elements adapted for contact with the tube when sustained on said support, and swinging means to support said cutter elements.

23. A tube cleaning machine comprising a frame, a support for a tube, embracing means to rotate the tube, an upper series of cutter elements adapted for contact with the tube when sustained on said support, swinging means to support said cutter elements, and spring means acting against the swinging means to support the cutter elements to adapt the latter to different diameter tubes.

24. A tube cleaning machine comprising a frame, a support for a tube, embracing means to rotate the tube, an upper series of cutter elements adapted for contact with the tube when sustained on said support, and yielding means acting on the cutter elements to yieldingly adapt said cutter elements to tubes of different diameters.

In witness whereof I claim the foregoing as my invention, I hereunto append my signature this 25th day of August, 1920.

JOHN THOMAS McGRATH.