Jan. 31, 1928.

1,657,779

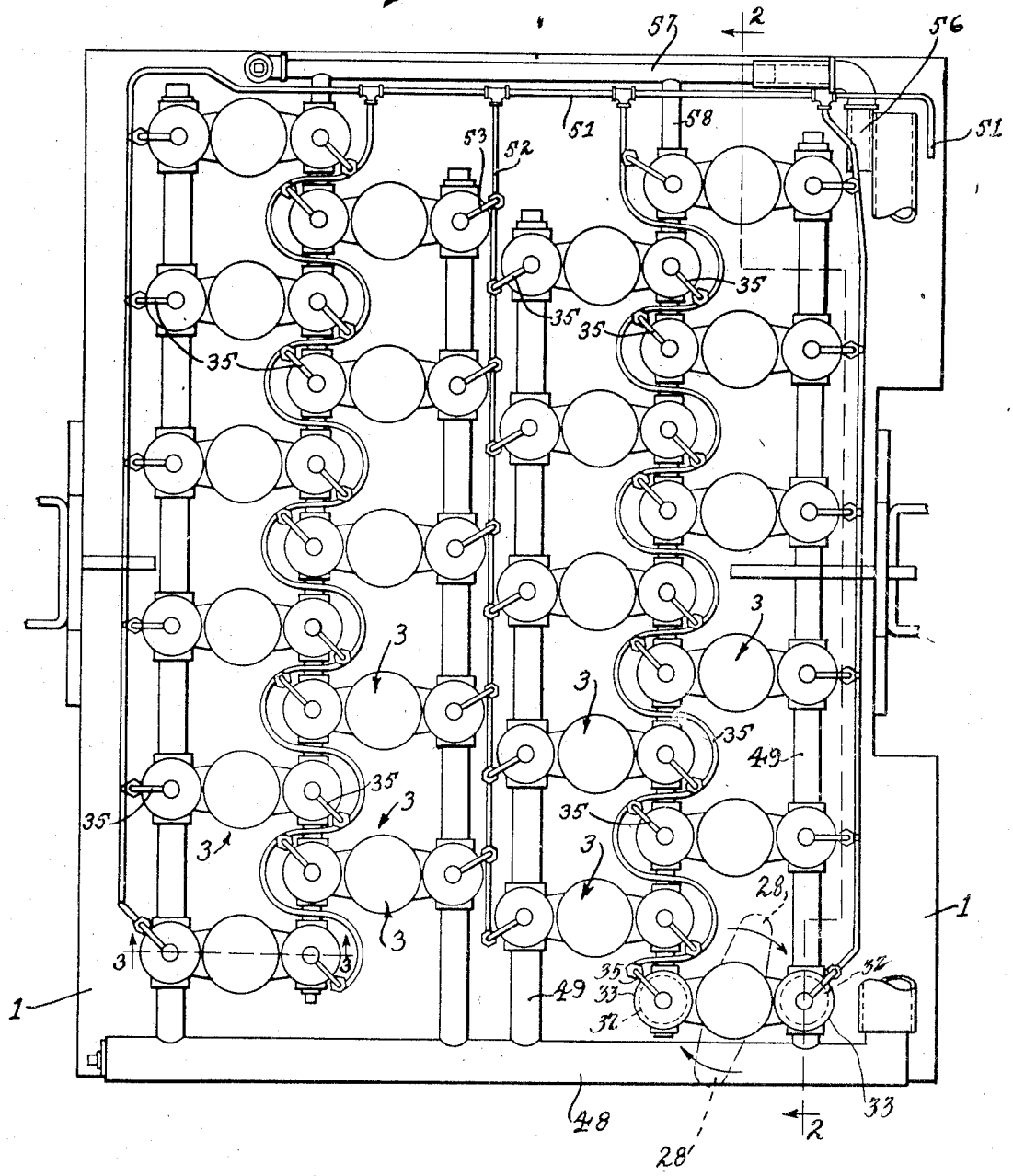
E. P. BLY

PNEUMATIC PIPE CLEANING MACHINE

Filed May 25, 1926

8 Sheets-Sheet 1

Fig. 1.



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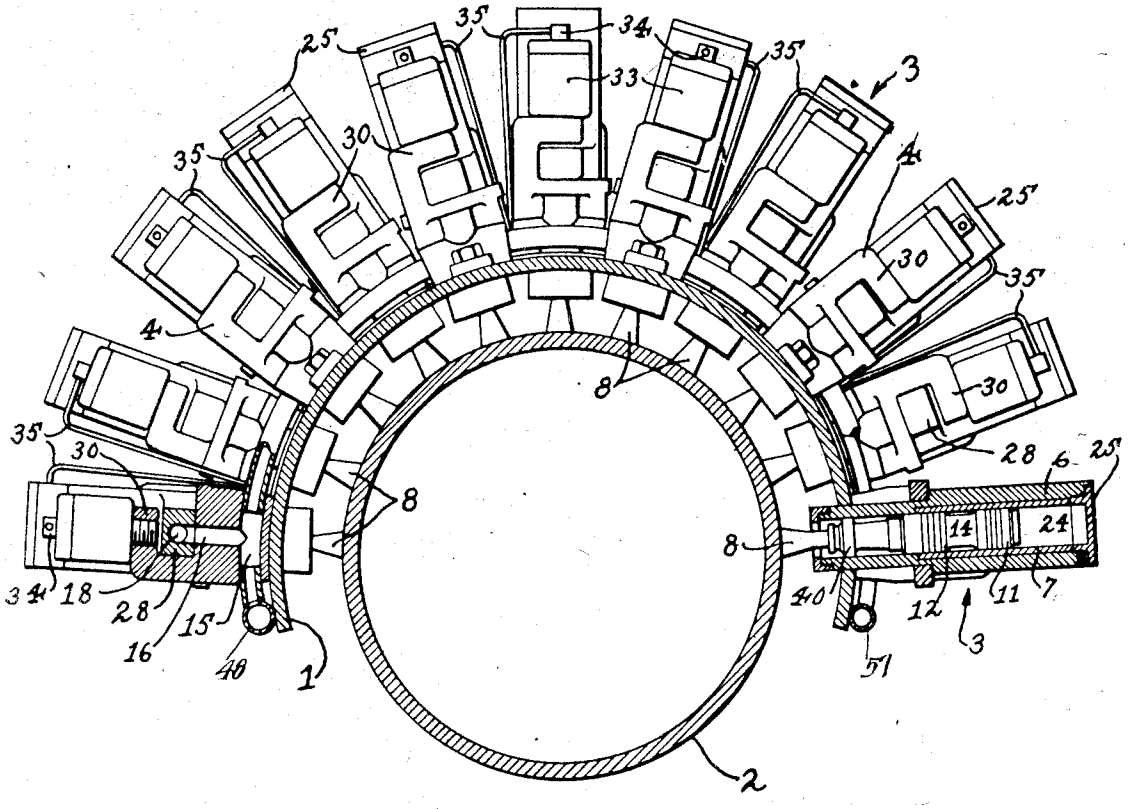
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Fig. 2.



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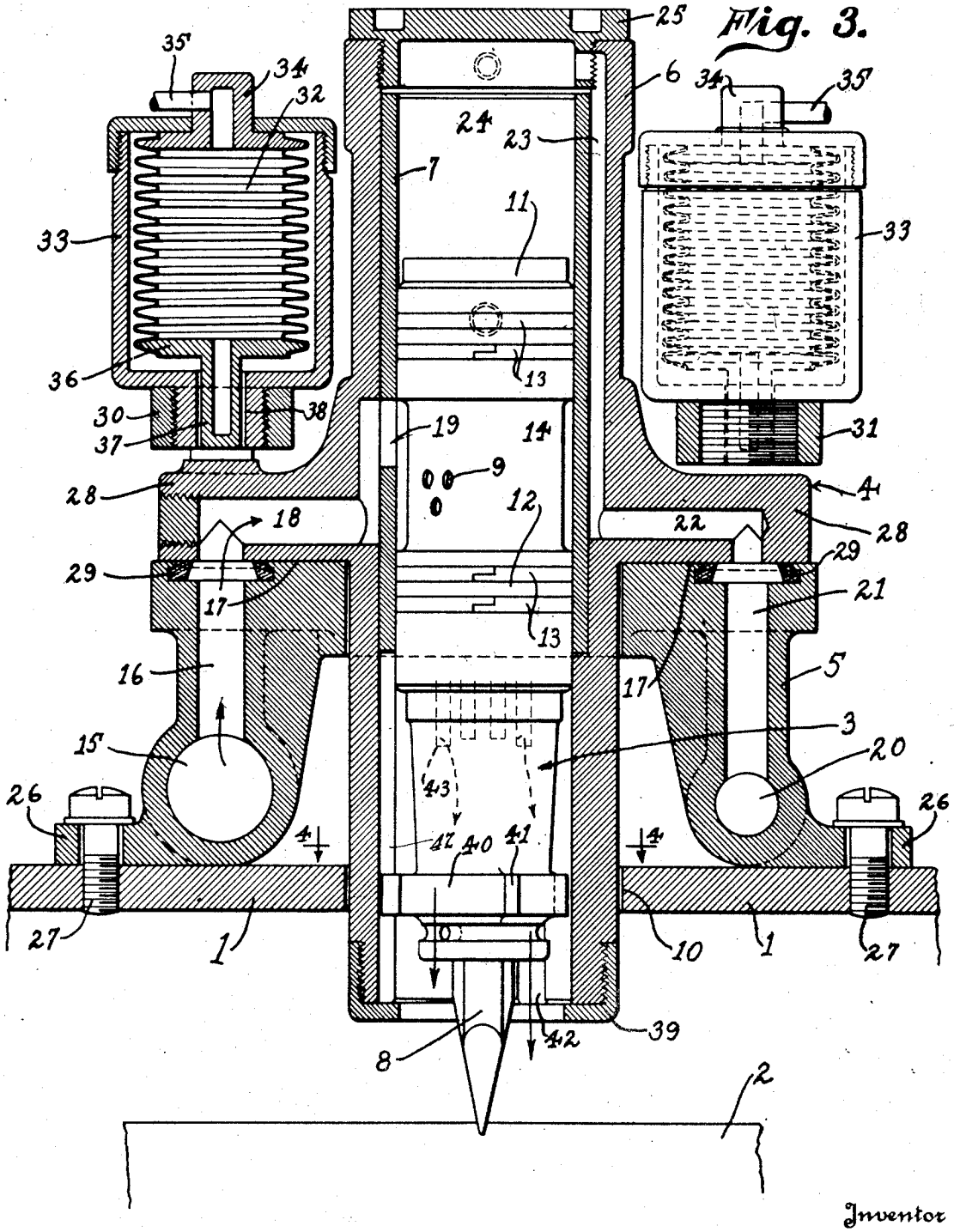
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Fig. 3.



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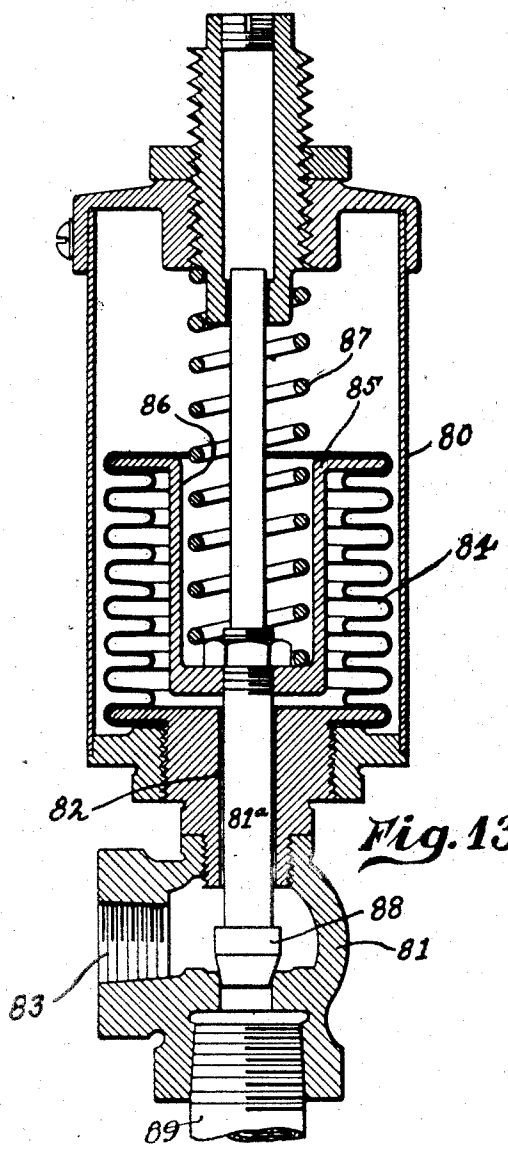


Fig. 13.

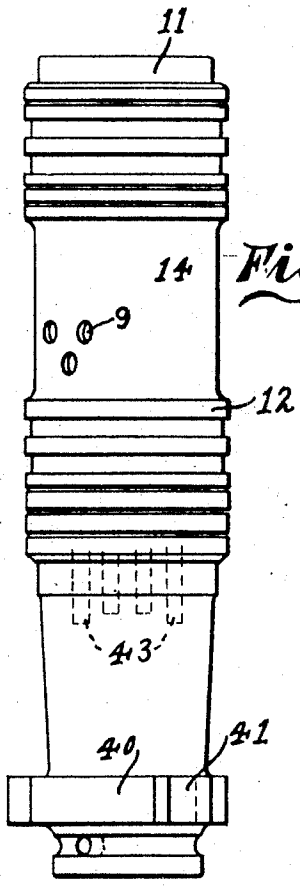


Fig. 5.

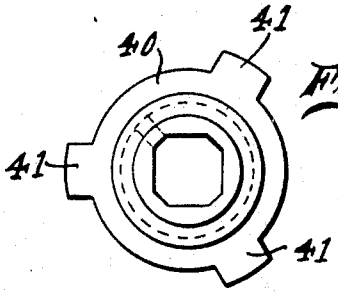


Fig. 6.

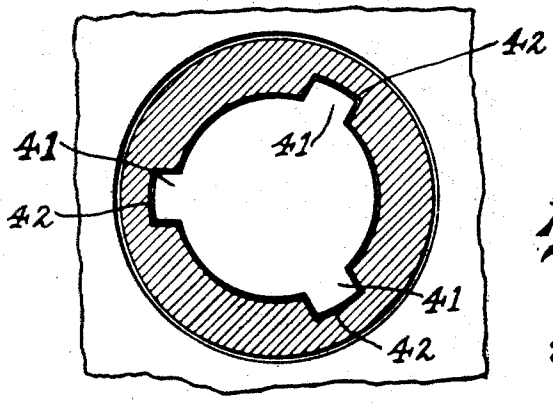


Fig. 4.

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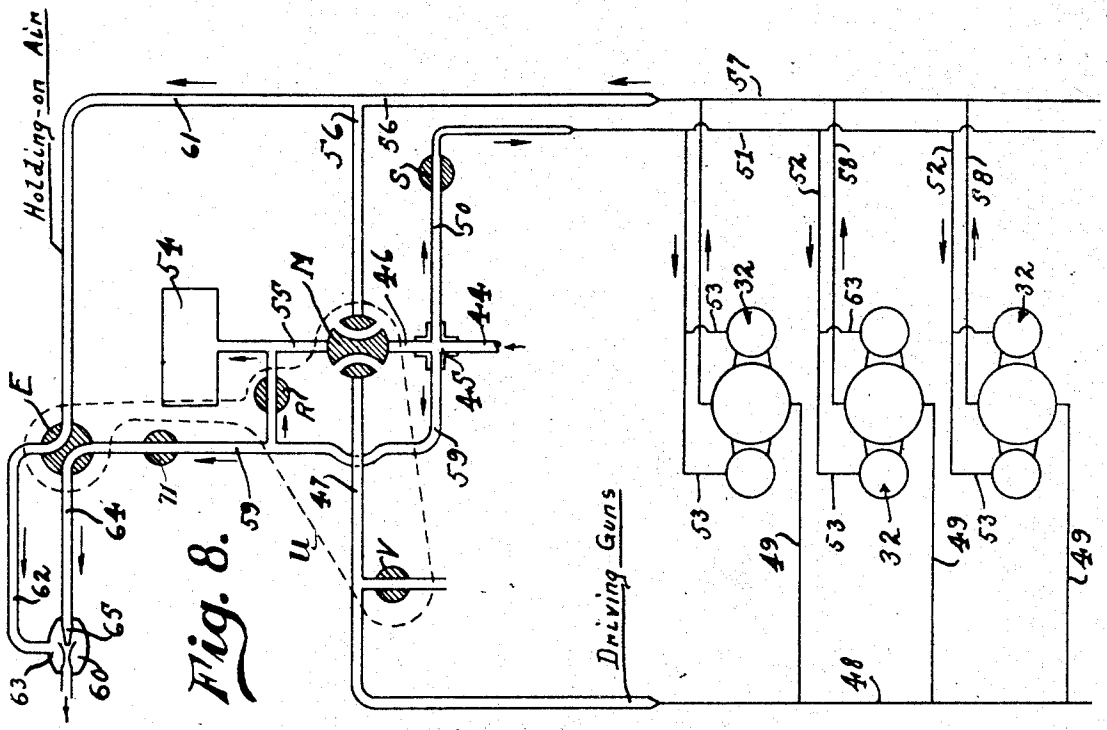


Fig. 8.

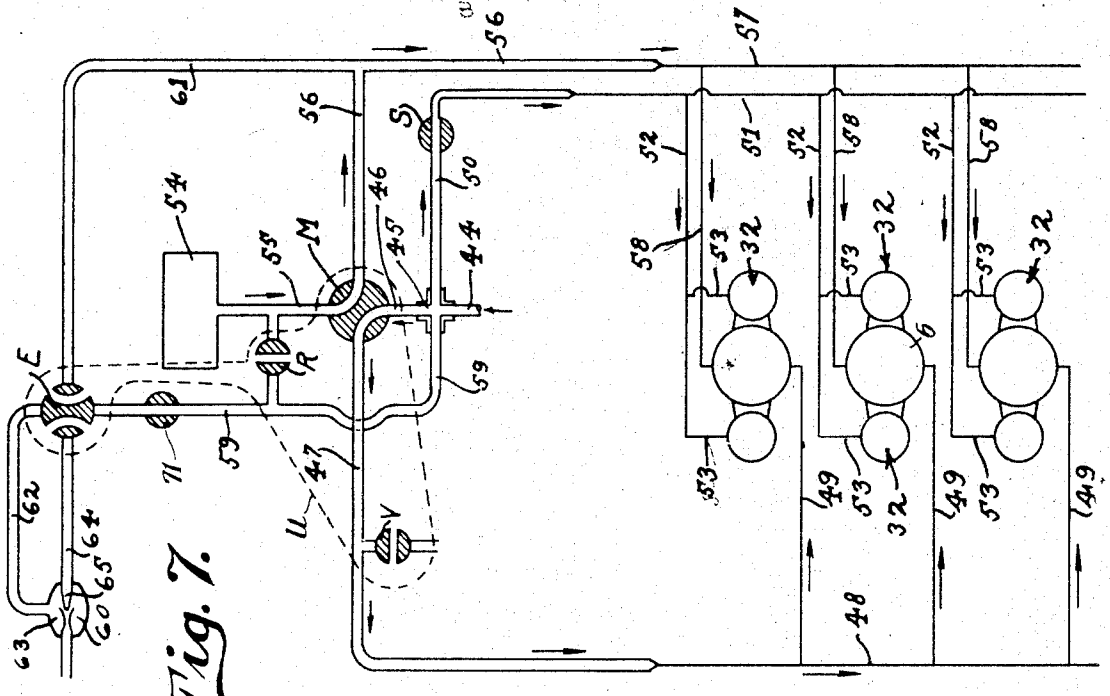


Fig. 7.

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PNEUMATIC PIPE CLEANING MACHINE

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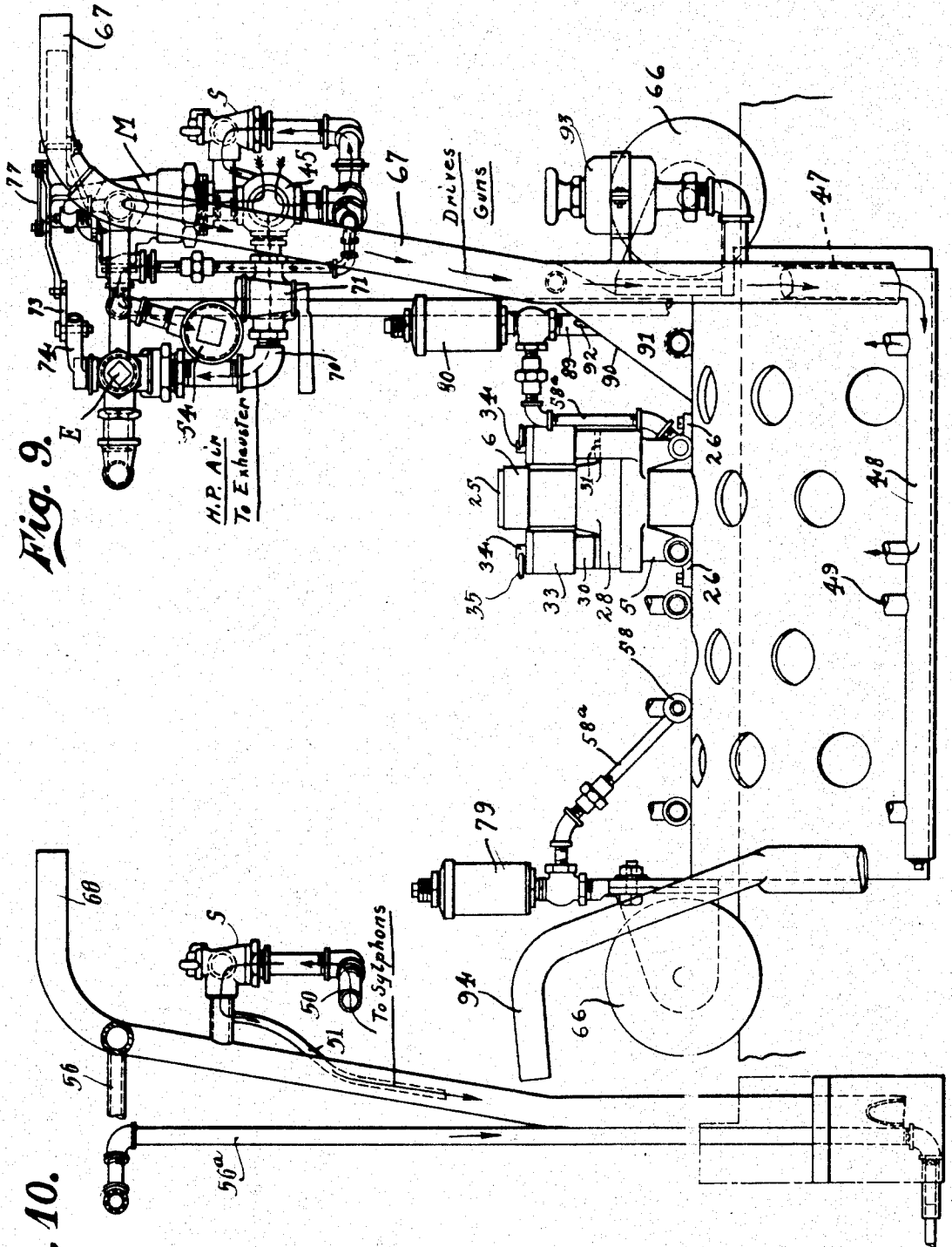


Fig. 9.

Fig. 10.

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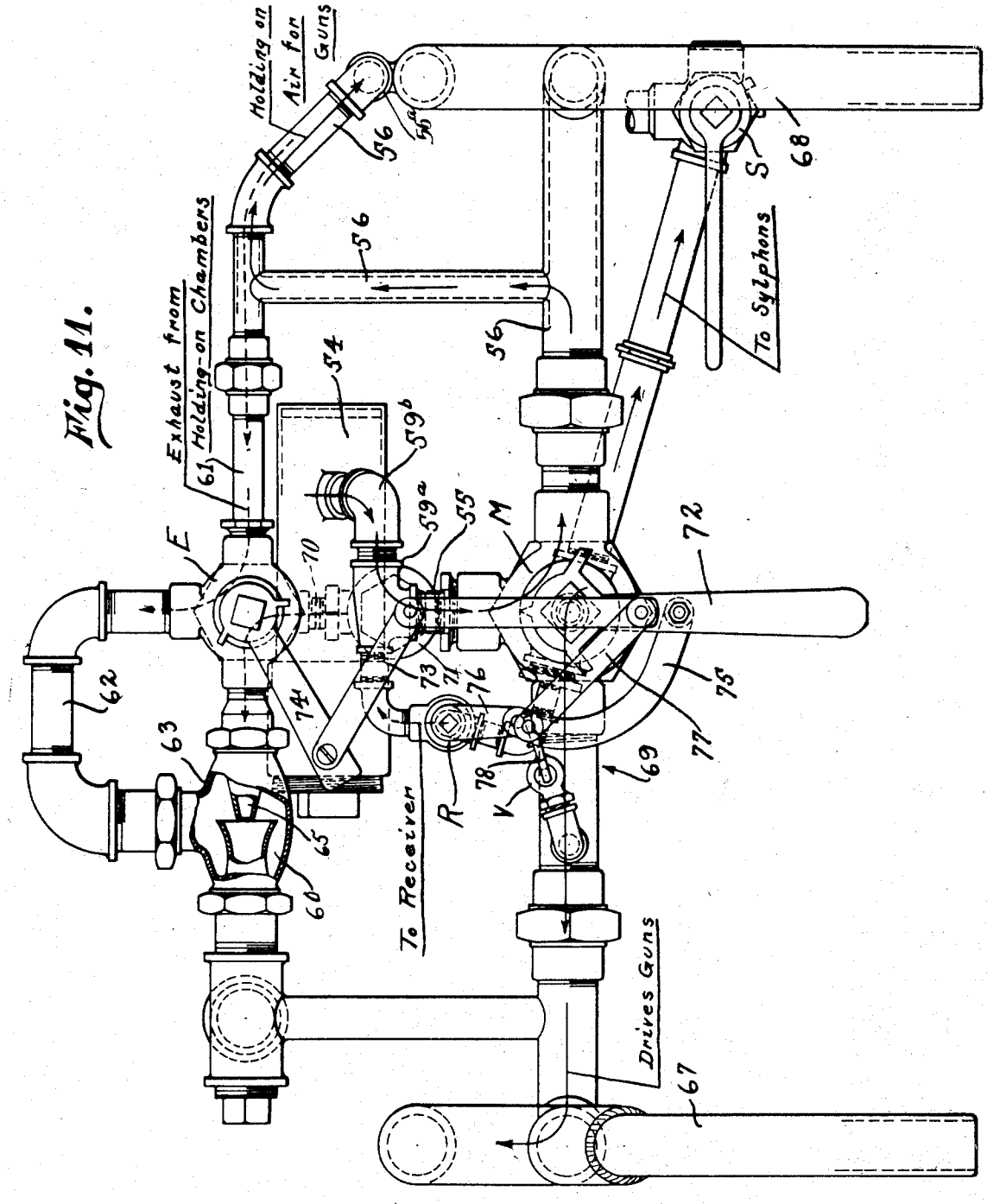
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PNEUMATIC PIPE CLEANING MACHINE

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Fig. 11.



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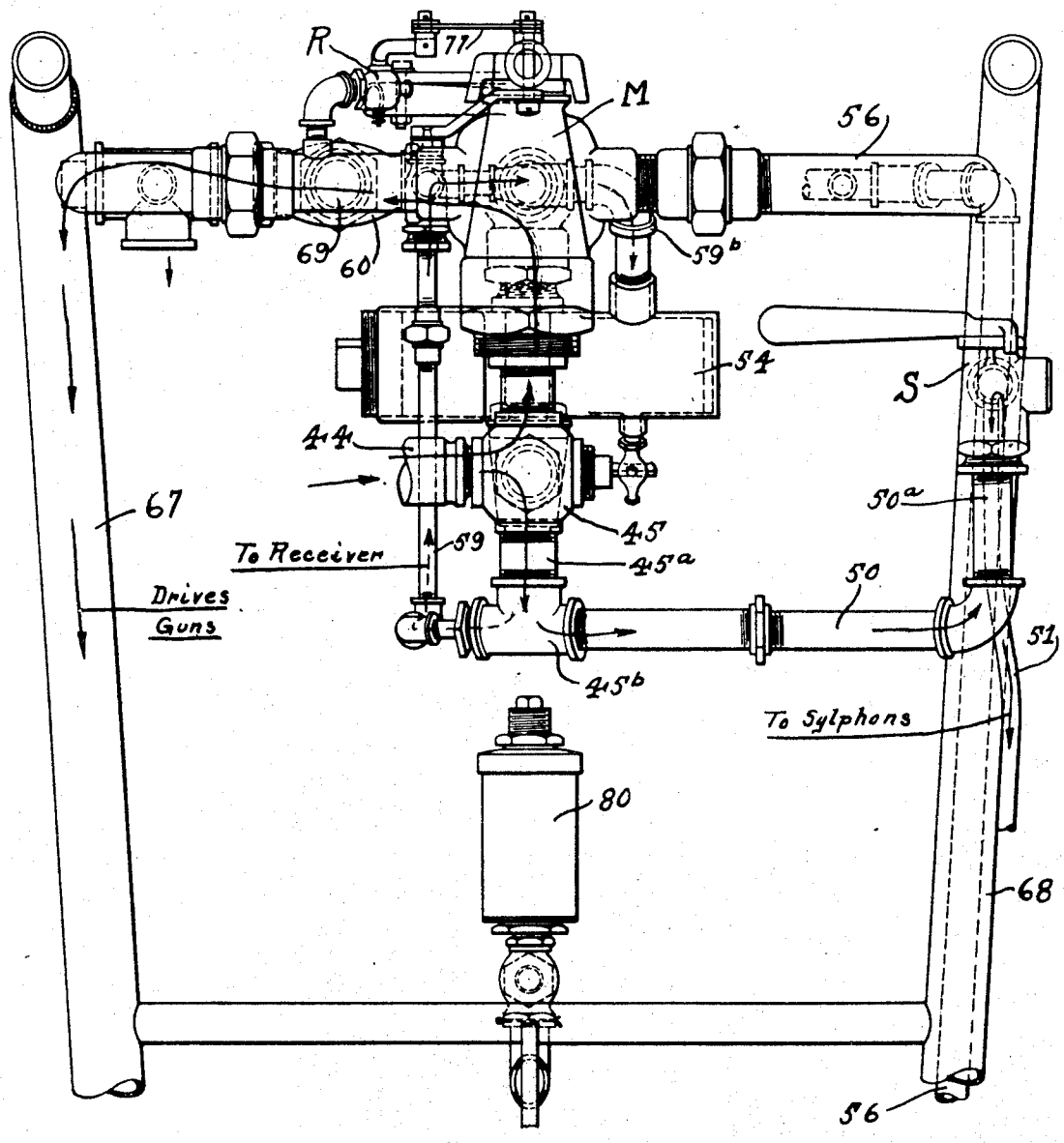


Fig. 12.

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UNITED STATES PATENT OFFICE.

EDWIN P. BLY, OF SAN FRANCISCO, CALIFORNIA, ASSIGNOR, BY MESNE ASSIGNMENTS, TO STANDARD OIL COMPANY OF CALIFORNIA, OF SAN FRANCISCO, CALIFORNIA, A CORPORATION OF DELAWARE.

PNEUMATIC PIPE-CLEANING MACHINE.

Application filed May 25, 1926. Serial No. 111,495.

This invention relates to a machine for performing a chipping or cleaning operation on any article such as pipe tubing or casing, and while the features of the invention may be applicable in various situations, in the present specification the invention is described as embodied in a machine for chipping off scale formed by corrosion; old protective coatings; and/or various objectionable incrustations, from pipes. However, the invention can be applied in any situation where a number of tools are to be actuated and controlled in unison, and while in practice the tools may be actuated by any form of energy, the invention is particularly applicable to the actuation and control of pneumatically operated tools.

The general object of the invention is to provide means for applying a plurality of such tools to the work and for controlling the same in unison so as to enable them at will to operate upon the work and to be withdrawn at will from the work. In the operation of a tool such as a chipping tool which strikes a blow, the reaction of the work to the blow causes a recoil of the tool. One of the objects of the present invention is to provide means for cushioning the recoil of the tool and for maintaining the tool pressed against the work, that is to say in operative contact with the work. The invention contemplates the use of a plurality of holders respectively carrying the working devices, such as chipping devices, and one of the objects is to provide simple means for conveying the operating fluid to the chipping devices and for controlling their position within their holders.

A further object of the invention is to provide simple means for holding and controlling a working device, such as a chipping device, to enable it to be pressed by power against the work and to enable it to be withdrawn and controlled in its operation at will.

In the preferred embodiment of the invention it includes a frame or carriage, carrying a plurality or gang of tools, constructed so as to facilitate setting the carriage over the work, and one of the objects of the invention is to provide an improved general construction for such a machine and to provide simple means for facilitating the conducting of the operating fluid to the operating parts of the machine. In such a machine, where the operating devices are in the form of pneumatic chipping tools, the invention provides simple means for securing the holders on the carriage by a common means or agency operating to insure an air-tight connection in the ducts which carry the compressed air or other operating fluid to the working devices.

The preferred embodiment of the invention involves the use of holders having cylinders in which air guns are mounted to move toward or from the work, and one of the objects of the invention is to provide a simple construction for mounting the air guns in the cylinders in such a way as to enable air pressure to be employed for holding the air guns pressed against the work, and also to provide pneumatic means for effecting the withdrawal of the air guns from the work at will.

A further object of the invention is to provide improved means for excluding dust and dirt from the operating parts of the machine and to provide for lubrication of the operating parts of the air guns.

A further object of the invention is to provide an improved general construction for a machine of this type and to provide the same with an improved organization of valves with a simple controlling apparatus for the same.

Further objects of the invention will appear hereinafter.

The invention consists in the novel parts and combination of parts to be described hereinafter, all of which contribute to produce an efficient pneumatic pipe cleaning machine.

A preferred embodiment of the invention is described in the following specification, while the broad scope of the invention is pointed out in the appended claims.

In the drawings:

Figure 1 is a developed plan of a machine embodying my invention, certain parts being broken away or omitted.

Figure 2 is a vertical cross section through the machine taken in the position of the line 2—2 of Fig. 1.

Figure 3 is a vertical section taken about on the line 3—3 of Fig. 1, but upon an enlarged scale.

Figure 4 is a horizontal cross section taken

about on the line 4—4 of Fig. 3, but showing only the outline of the gun.

Figure 5 is a side elevation of one of the air guns removed from its holder.

Figure 6 is a bottom plan of the air gun shown in Fig. 5.

Figure 7 is a diagrammatic view indicating the general arrangement of the apparatus, and particularly illustrating the pneumatic system and the valves and other apparatus for controlling its operation. This figure shows the valves in the position which they have while the chipping devices are in operation.

Figure 8 is a view similar to Fig. 7 but showing the valves in an opposite position, that is to say, the valves are shown in the relation which they have when the chipping tools are not in operation but are withdrawn from the work.

Figure 9 is a side elevation of the machine, indicating the position of the casing to which it is applied. This view shows the carriage with the holders removed, but indicates one of the holders in position on the carriage. This view also illustrates the piping arrangement with the control valves and indicates the course of the air flowing through the pipe system.

Figure 10 is a detail view and is a vertical section particularly illustrating the course of the air in flowing through the sylphons which secure the holders on the carriage.

Figure 11 is a plan of the piping and valve apparatus illustrated in Fig. 9, but upon a somewhat enlarged scale.

Figure 12 is an end elevation of the upper part of the machine, that is to say, it represents the valves and piping arrangement of Fig. 9, viewed from the right hand end of the machine.

Figure 13 is a vertical section through a relief valve which may be employed in the apparatus which controls the pneumatic means for holding the chipping devices against the work.

Referring especially to Figs. 1 and 2, in the present embodiment of the invention I provide a carriage 1 which is in the form of a curved plate or saddle of half-round form which may be set over the work, for example, a pipe-casing or tubing 2 which is to be cleaned. On this carriage I mount a plurality or gang of working devices, which in the present instance are chipping devices for chipping off scale, old protective coverings, and/or various objectionable incrustations from the outer surface of pipes. These chipping devices are preferably in the form of air guns 3 (see Figs. 3 and 5), each air gun being mounted in a holder 4. These holders are mounted in transverse rows on the carriage and each holder preferably comprises a base 5 and a body 6 in the form of a cylinder, which, if desired, may be provided with a liner or bushing 7 in which the air gun 3 fits neatly.

The interior of the air guns 3 may be of any of the well known constructions which enable the same to reciprocate a chipping tool 8 which projects from the lower or inner end of the air gun, the operating fluid under pressure, such as compressed air, being admitted to the interior of the gun through admission ports 9 (see Fig. 3). In order to hold and guide the inner end of the air gun, the inner end of the cylinder 6 is mounted in a corresponding opening 10 in the carriage 1. The openings 10 are preferably arranged in rows (see Fig. 9) and the openings in adjacent transverse rows are staggered with relation to each other. In order to provide for delivering compressed air to the admission ports 9 and also to provide means for yieldingly pressing the air guns toward the work to maintain the chipping tools 8 in operative contact with the work, I prefer to construct the bodies of the air guns of piston form and provide them with two piston heads 11 and 12 which may be provided with piston rings 13 which make them substantially air-tight when the air gun slides to and fro in the bushing or liner 7. Between the heads 11 and 12, the air gun body is formed with a waist 14 of reduced diameter and in this waist the admission ports 9 are formed.

Each holder base 5 is provided with a cross duct 15 and a vertical duct 16 communicating with it, and this vertical duct passes up through a horizontal seat 17 on the upper face of the base. This duct 16 communicates with an admission port or duct 18 which extends horizontally from the side of the cylinder 6 and is in communication with a port 19 in the liner 7. This enables compressed air to flow in through the port 19 into the annular space in the cylinder surrounding the waist 14. The waist 14 is longer than the port 19 so that, during any movements of the air gun longitudinally in the barrel, communication with the admission ports 9 is always maintained.

At the other side of each holder base 5, a cross duct 20 is provided similar to the duct 15, and this duct communicates with a vertical duct or passage 21 which also passes through the seat 17 on the other side of the cylinder. On that side the cylinder 6 is provided with a port 22 to communicate with the port 21 through the seat, and this port 22 extends radially inward toward the axis of the cylinder and communicates with a longitudinal admission port or passage 23 which is formed in the wall of the cylinder 6 on the outer side of the liner 7. This port arrangement enables compressed air to be delivered into an air chamber 24 which is formed in the outer end of the cylinder, that is to say, I provide an air chamber

located in such a way that the pressure of the compressed air in it will force the air gun toward the work. The outer end of the cylinder 6 may be closed by a removable screw cap 25.

The holder bases 5 may be provided with feet 26 which may be secured to the carriage 1 by suitable machine screws 27.

It will be evident that the construction described enables driving air for the air guns to be delivered to the admission ports 9. It also enables "holding on" air to be delivered to the air chambers 24 to hold the air guns against the work, that is to say, to force the air guns yieldingly inwardly to hold the chipping tools 8 in operative contact with the casing being cleaned.

Of course, if desired, any suitable means, such as bolts and nuts, could be provided for clamping the cylinders or barrels 6 on the bases 5. However, in order to render the air guns easily accessible without the necessity for detaching bolts or nuts, I prefer to provide pneumatic means for pressing the barrels down onto their seats 5. In order to accomplish this I prefer to provide each barrel 6 with a pair of oppositely projecting feet 28. The foot at one side carries the port 18 and the foot at the other side carries the port 22. The seat 17 is counterbored or undercut at each side so as to receive a removable gasket 29. When the cylinders are pressed down on the seats, these gaskets 29 are compressed and enable an air-tight connection to be made between the ports in the bases and in the cylinders.

Over the seats 17, two extensions or arms 30 and 31 are provided. These arms are formed integrally with the bases 5 and are oppositely located (see Figs. 2 and 3) so as to enable the barrels 6 to be rotated on their longitudinal axes so as to bring the feet 28 into position under the arms 30, 31. In Fig. 1 the mode of operation of setting the cylinders in position is illustrated by the dotted lines at the lower right-hand portion of the figure. On these extensions 30 and 31, pneumatic devices, such as sylphons 32, are respectively mounted, each sylphon being enclosed in a suitable housing or cup 33. The upper end of each sylphon is formed by a head having a tubular neck 34 which projects through the end of the housing 33 to connect with an air connection 35. The lower head 36 of each sylphon has an elongated neck 37 which extends down through a guide opening 38 in the lower end of the housing, the arrangement being such that when compressed air is admitted to the sylphon, the sylphon extends itself in a downward direction and presses the lower end of the neck 37 against the upper side of the foot 28. In this way, the air pressure may be utilized to clamp the cylinders onto their bases.

The air guns may be introduced into the cylinders or barrels 6 from the inner ends of the barrels and are held in the barrels by any suitable means attached to the inner ends of the barrels which project through the openings 10. In the present instance I provide a screw cap or collar 39 (see Fig. 3). The opening through this cap is too small to permit the air gun to pass out of the barrel. In order to prevent rotation of the air guns in the barrels, I prefer to provide the inner end of each air gun with a special collar 40 having a plurality of equidistant radial fins 41, and these fins run in longitudinal guide grooves 42 formed in the inner end of the barrel (see Figs. 4 and 6).

The air gun is provided with exhaust ports indicated by the dotted lines 43 which permit the air to pass outwardly, as indicated by the arrows in Fig. 3, and this exhaust air passes down through the interior of the body and passes out around the tool 8. In this way the exhaust air is directed as a blast passing out through the cap 39 and this blows out the chips and prevents them from finding a way up into the working parts of the air gun.

I shall now describe the general arrangement of the air pipe system for conducting the air to the holders for the chipping devices, but before doing so it will facilitate the disclosure to refer to Figs. 7 and 8, which indicate diagrammatically the arrangement of the apparatus. Compressed air from a hose is admitted to the pipe system at the point 44, where it pases into a T-connection 45. From the T-45 a branch 46 passes to a main valve M which is in the form of a four-way cock. When the air guns are operating, this four-way cock M is open so as to connect the branch 46 with a duct or pipe line 47 which connects to a header pipe 48 with lateral connections 49 which lead the air to the cross ducts 15 in the bases 5, and this is the air which drives the air guns by passing into their admission ports 9 (see Fig. 3).

The T-connection 45 connects with another branch pipe 50 which connects to a header pipe 51 with branch headers 52 with lateral connections 53 which carry air to the sylphons 32.

The "holding on" air which is supplied to the air chambers 24 should be at a substantially constant pressure and for this purpose, I provide a receiver 54. In the open position of the valve M, air from this receiver flows through the pipe 55 and through the valve M to a pipe 56 which connects with a down-pipe 56[a] and to a header pipe 57 with lateral branches 58 which carry the "holding on" air to the cross ports 20 in the holder bases.

From the T-45, a branch pipe 59 extends over to an exhauster valve E which is in the form of a four-way cock, and this branch

pipe 59 is connected through a receiver valve R with the pipe 55 to the receiver 54. When the main valve M is open, as indicated in Fig. 7, the exhauster valve E and the receiver valve R are both closed. Connected to the pipe 47, I provide a vent valve V which is simply a valve which, in its open position, enables the interior of the pipe 47 to communicate with the atmosphere. I prefer to connect the valves M, V, R and E so that they are all controlled in unison by a single lever, and in such a way that when the valve M is closed, as indicated in Fig. 8, all of the other valves will be open, and vice versa. The exhauster valve E has a special function and enables me to admit compressed air to an exhauster device 60 from the pipe 59 to develop a partial vacuum at will in the air chambers 24, the effect of which will be to withdraw the air guns from the work. In order to accomplish this, I provide a pipe 61 leading from the pipe 56, and the flow of air through this pipe 61 is directed through the exhauster valve E and through a pipe 62 to the exhaust chamber 63 of the exhauster device 60. The exhauster valve E also controls flow through the pipe 59 and the pipe 64 so that when the valve E is open, compressed air can be delivered through the high pressure nozzle 65 of the exhauster device. In other words, when the valve M is closed, as indicated in Fig. 8, compressed air admitted at the point 44 flows through the pipe 59 and through the valve E to the high pressure nozzle 65, creating a suction in the pipe 61 and the pipe 56 which withdraws the "holding on" air from the air chambers 24. Furthermore, in this position of the valves, the valve V is open to the atmosphere so as to permit exhaust of the air in the air chest of the air guns around the waist 14. This prevents escape of the air into the air chambers 24 in such a way as might interfere with the efficiency of the evacuation of the air from the air chambers. Furthermore, while the valve M is closed, the receiver valve R is open so that when the exhauster device 60 is operating, the receiver 54 will be recharged with compressed air.

In order to simplify the piping arrangement, the pipe 48 which supplies driving air to drive the air guns extends along one side of the carriage 1, and the air guns are placed in transverse rows with a staggered relation with respect to each other, and the holders in two adjacent rows are in a reversed arrangement with respect to each other, for example, in the extreme right-hand row of holders, as shown in Fig. 1, the branch pipe 49 which connects the ducts 15 to supply driving air to the guns is located on the right-hand side, while in the next row to the left, the corresponding air pipe 49 is on the left of the row of holders. This enables an alternate arrangement of branch pipes to be used, that is to say, the branch pipes projecting in from one of the air pipes 48 alternate with the branch pipes 58 which extend in from the opposite air pipe 57. It will be noted that in the arrangement shown in Fig. 1, the branch pipes 58 connect the "holding on" air ducts 20 in succession. In the diagrams, each one of the holders 4 therefore corresponds to one of the transverse rows in the actual arrangement of the holders.

In order to enable the carriage to be set over the work and moved along the same, the carriage is provided with a pair of wheels 66 at each end, which roll along on the upper side of the casing, and in order to facilitate moving the carriage along, it is provided at one end with two upwardly extending handles 67 and 68. The controlling valves and the levers for controlling the same are preferably supported between these handles 67 and 68 in a convenient position to be reached by the operator of the machine.

Referring to Fig. 12, the air hose 44 is attached to one side of the T-connection 45 and from the T compressed air passes downwardly through a short connection 45^a to a second T 45^b, from which the pipe 50 extends over to the right side of the machine and terminates in a riser pipe 50^a connecting to a sylphon valve S which connects with the pipe 51 that supplies compressed air to the sylphons and from which the branch pipes 52 carry the air to the individual sylphons. This pipe 51 extends down the right-hand handle 68 (see Figs. 1 and 12).

From the T 45^b the pipe 59 extends upwardly and passes through a T-connection 59^a, beyond which there is an elbow connection 59^b leading into the receiver 54 (see Fig. 11). From the T-connection 59^a, the short pipe connection 55 connects the receiver to the valve M. The valve M is mounted in a horizontal cross pipe or brace 69, the right-hand end of which is tubular and constitutes the branch pipe 56 of the diagram, which leads from this valve and includes a connection leading to the right in Fig. 11, and extending down the right-hand handle 68 (see Fig. 12), the lower end of this pipe 56 connecting with the header pipe 57 already described.

The air to supply the exhauster device 63 passes to the valve E through a pipe connection 70 at the rear of the T 45 (see Fig. 9), and passes through a special valve 71 before it reaches the exhauster valve E. From the valve E the high pressure air is conducted toward the left and through the high pressure nozzle 65 of the exhauster 60. From the pipe 56, already referred to, the branch pipe 61 leads to the valve E from which there is a short return bend pipe 62

which leads to the exhaust chamber of the exhauster 63 (see Fig. 11). In the diagrams of Figs. 7 and 8, dotted lines U are employed to indicate that the valves E, R, M and V are all operated in unison. In order to accomplish this I provide the main valve M with a lever 72 which extends across the axis of the valve M, the forward end of this lever being connected by a link 73 with the handle 74 of the valve E.

In addition to this the curved link 75 is provided, attached to the lever 72 near its handle, and this curved link is attached to the lever 76 of the receiver valve R. In addition to this, there is another link 77 which connects the lever 72 with the handle 78 of the vent valve V.

In order to control the pressure of air in the receiver and maintain it at any pressure desired, the pipes 58 which carry the "holding on" air to the air chambers 24 are connected by a suitable pipe connection 58^a to relief valves 79 and 80, the former of which is mounted on the left end of the machine as viewed in Fig. 9, and the latter of which is mounted on the right-hand end of the machine. The relief valve 80 with its T-connection 81 is illustrated in Fig. 13. The stem 81^a of this valve is smaller than the guide opening 82 through the lower head of the relief valve so that air flowing in through the inlet connection 83 of the T 81 flows up into the interior of a sylphon 84 within the valve body. The upper end of this sylphon 84 is provided with a head 85 with a tubular neck 86 to receive a coil spring 87 which presses down on the head and normally holds the valve plug 88 on its seat. If the air pressure within the sylphon 84 should rise beyond a predetermined point, the spring 87 will be compressed and the plug 88 will lift off its seat and permit the air to escape through the tubular mounting 89 for the valve which is secured on an inclined face 90 of a bracket 91. At the base of this standard or fitting 89, ports 92 are provided through which the air escapes. A similar or corresponding arrangement is used for mounting the valve 79 at the other end. (See Fig. 9).

The air which passes to the pipe 48 passes down the left-hand handle 67, the lower portion of which is tubular so as to enable it to act as a duct for this air. The lower end of this handle connects to the end of the pipe 48 (see Fig. 9).

At a suitable point on the tubular portion of the handle 67, the lubricator 93 is provided, by means of which oil may be introduced into the air which goes into the holders to drive the air guns. This oil is carried in by the compressed air, and lubricates the mechanism on the interior of the air guns and also, as the air exhausts, lubricates the inner face of the wall of the barrel or cylinder. If desired, a similar lubricator can be used on any of the other air lines for the same general purpose. At the left end of the machine two short handles 94 may be provided which enable the machine to be moved along from the left end.

I shall now describe the general mode of operation of the machine. The operator stands at the right end of the machine as viewed in Fig. 9 and by means of the handles 67 and 68 he can move the carriage 1 of the machine along the casing 2. By placing the hand lever 72 in a position to open the main valve M, the air will be admitted through the hose 44, T 45 and through the valve M and connections, as indicated by the full line arrows in Fig. 12, so as to permit the air to pass down the left hand tubular handles 67 and connect with the pipe 47 and the header pipe 48 which supplies the branch pipes 49 with air; these branch pipes 49 supply the driving air to the air chests of the holders around the waists 12 of the air guns. This air enters the admission ports 9 of the air guns and reciprocates the chipping tools 8. When the air exhausts from the air guns, it passes down through the ports 43 and outwardly through the end of the gun past the chipping tool 8 and through the annular cap 39. This blast of exhaust air blows the chips out of the end of the cylinder and prevents them or dirt passing up into the interior of the guns.

The "holding on" air passes from the receiver 54 through the pipe connections 59^b, 59^a and 55, through the valve M and thence through the pipe 56, as indicated by the arrows in Fig. 11; this air passes down along the right-hand handles 68, its lower end being connected to the pipe 57 which serves the lateral branch pipes 58 which connect with the ducts 20 to supply "holding on" air to the air chambers 24. The relief valves 79 maintain this air at the desired pressure.

When it is desired to withdraw all of the tools from the work, the lever 72 of the main valve is operated so as to throw the valve M to its closed position indicated in the diagram of Fig. 8. Throwing the lever into this position opens the other interconnected valves, namely, the vent valve V, the receiver valve R and the exhauster valve E. This cuts off the connection of the receiver to the air chambers 24 and opens the receiver valve R so as to permit air in the pipe connection 59 to flow into the receiver. When the exhauster valve E is open, it connects the pipe 61 (see Fig. 11), (which connects with the pipe 56), to the exhaust chamber 63 of the exhauster through the pipe 62. This position of the valve E also permits high pressure air from the line 59 to flow through the high pressure nozzle 65 and this produces a partial vacuum in the pipe connections 56 which withdraws the air from the air cham-

bers 24. The atmospheric air pressure at the lower ends of the air guns then forces them up into the upper ends of the cylinders and in this way withdraws the tools from the casing or from the "work".

The cylinders of the holders are all held down on their bases by air supplied through the pipe 51 and through the sylphon valve S. The air in these pipe lines 50 and 51 is not controlled by the valve M but when it is desired to remove any cylinder 6 from its base, the sylphon valve S should be closed.

In the operation of the chipping devices, as each blow is struck by a tool, the body of the air gun of course recoils and moves up or outwardly in its holder, thereby compressing the air in the air chamber 24. This air of course acts as an air cushion and, being compressed by the recoil, exerts the higher pressure developed by its compression to force the body of the air gun back toward the casing. In this way, these air chambers operate as air cushions for yieldingly pressing the chipping devices toward the work, as well as performing the function of enabling the air guns to be withdrawn from the casing at will and in unison through the operation of a single lever

The term "carriage" as used in this specification and claims means a frame of suitable construction for carrying the pneumatically operated tools and this term is not restricted in its meaning to a movable carriage.

It is understood that the embodiment of the invention described herein is only one of the many embodiments this invention may take, and I do not wish to be limited in the practice of the invention, nor in the claims, to the particular embodiment set forth.

What I claim is:

1. In apparatus of the kind described, the combination of a carriage to lie over the work, a plurality of holders with cylindrical interiors mounted on the carriage, a plurality of chipping devices having cylinders with fluid-actuated pistons held in the holders, and means for controlling in unison the distance of the chipping devices from the work.

2. In apparatus of the kind described, the combination of a holder, a chipping-device mounted in the holder to move toward and from the work and having a reciprocating chipping tool moving to and fro on the longitudinal axis of the holder said holder having an air chamber operating to take the recoil of the chipping device when the tool strikes the work.

3. In apparatus of the kind described, the combination of a holder, a chipping-device mounted in the holder to move toward and from the work and carrying a chipping tool to engage the work, said holder having an air chamber for carrying compressed air, operating to press the chipping-device against the work and to take the recoil of the chipping-device when the tool strikes the work.

4. In apparatus of the kind described, the combination of a holder, a pneumatic chipping device mounted to move in the holder to and from the work, means for supplying compressed air to the chipping device to actuate the same, and means for introducing a lubricant into the compressed air before it flows into the chipping-device.

5. In apparatus of the kind described, the combination of a carriage to lie over the work, a gang of pneumatic chipping devices mounted thereon, means for yieldingly pressing the chipping devices toward the work, and means for supplying operating fluid to the chipping devices.

6. In apparatus of the kind described, the combination of a carriage to lie over the work, a gang of chipping devices mounted thereon, pneumatic means for yieldingly pressing the chipping devices toward the work, and means for supplying operating fluid to the chipping devices to actuate them.

7. In apparatus of the kind described, the combination of a carriage to lie over the work, a gang of chipping devices mounted thereon, pneumatic means for yieldingly pressing the chipping devices toward the work, means for supplying operating fluid to the chipping devices to actuate them, and pneumatic controlling means for withdrawing the chipping devices from the work.

8. In apparatus of the kind described, the combination of a carriage to lie over the work, a gang of chipping devices with chipping tools mounted on the carriage, said devices having pneumatic chambers respectively for holding the chipping devices with the tools pressed against the work, means for supplying fluid under pressure to the said chambers, and means for inducing a partial vacuum in the chambers at will to withdraw the chipping devices from the work.

9. In apparatus of the kind described, the combination of a carriage, a gang of chipping devices mounted thereon, means for yieldingly pressing the chipping devices to hold them against the work, and pneumatic means operatable at will for withdrawing the chipping devices from the work.

10. In apparatus of the kind described, the combination of a carriage, a gang of chipping devices mounted thereon and having pneumatic chambers respectively for controlling the chipping devices, and means for inducing a partial vacuum in the pneumatic chambers to effect the withdrawal of the chipping devices from the work.

11. In apparatus of the kind described, the combination of a carriage, a gang of holders mounted thereon, a plurality of chipping devices carried in the holders,

means for yieldingly pressing the chipping devices toward the work, and means controlled at will to withdraw the chipping devices from the work.

12. In apparatus of the kind described, the combination of a carriage, a plurality of holders mounted on the carriage, a plurality of pneumatic chipping devices mounted in the holders, means controllable at will for holding the chipping devices pressed toward the work, and means controlled at will for effecting the withdrawal of the chipping devices from the work.

13. In apparatus of the kind described, the combination of a carriage, a plurality of holders mounted thereon, said holders having cylinders respectively, chipping devices in the form of air-guns mounted respectively in said cylinders and movable therein toward and from the work, and means controllable at will for withdrawing the air guns from the work.

14. In apparatus of the kind described, the combination of a carriage, a plurality of holders mounted thereon, said holders including cylinders respectively, chipping devices in the form of air-guns mounted in the cylinders respectively and carrying chipping tools, said cylinders having chambers respectively back of the air-guns, means for supplying fluid under pressure to the chambers to hold the chipping tools on the work, means for supplying operating fluid to the air-guns to actuate them, and means controllable at will to induce a partial vacuum in the chambers to withdraw the air guns from the work.

15. In apparatus of the kind described, the combination of a carriage, a plurality of holders mounted thereon, said holders including bases with seats and bodies removably mounted on the seats, pneumatic chipping devices carried respectively in the bodies, said bases and bodies having ducts passing through the seats for supplying operating fluid to the chipping devices, and means for clamping the bodies on the seats.

16. In apparatus of the kind described, the combination of a carriage, a plurality of holders mounted thereon, said holders including bases with seats and bodies removably mounted on the seats, pneumatic chipping devices carried respectively in the bodies, said bases and bodies having ducts passing through the seats for supplying operating fluid to the chipping devices, pneumatic means associated with the holders for clamping the bodies on the seats, and means for controlling the chipping devices in unison.

17. In apparatus of the kind described, the combination of a carriage, a plurality of holders mounted thereon, said holders including bases with seats and bodies removably mounted on the seats, pneumatic chipping devices carried respectively in the bodies, said bases and bodies having ducts passing through the seats for supplying operating fluid to the chipping devices, sylphons associated with the holders for forcing the bodies onto the seats, and means for controlling the operation of said sylphons.

18. In apparatus of the kind described, the combination of a carriage, a plurality of holders mounted thereon, said holders including bases with seats and bodies removably mounted on the seats, pneumatic chipping devices carried respectively in the bodies, said bases and bodies having ducts passing through the seats for supplying operating fluid to the chipping devices, said bases having extensions projecting over the seats, sylphons associated with the holders for forcing the bodies onto the seats, and pneumatic means for controlling the operation of said sylphons.

19. In apparatus of the kind described, the combination of a carriage, a plurality of holders mounted thereon, said holders including bases with seats and bodies removable from said bases, said bases having arms extending over said seats and said bodies having feet projecting under said arms and resting on said seats, said holders having ducts passing up from the bases through said seats into the bodies, and pneumatic devices carried by the arms for pressing the same down onto the seats.

20. In apparatus of the kind described, the combination of a carriage having an opening therein, a holder including a base secured to the carriage, a body projecting through said opening, a pneumatic chipping device carried in the body, and means for supplying operating fluid under pressure to the chipping device.

21. In apparatus of the kind described, the combination of a holder, a pneumatic chipping device mounted in the holder, said holder having a chamber at one end of the chipping device, means for supplying fluid under pressure to said chamber to hold the chipping device against the work, and means for supplying fluid under pressure to the chipping device to actuate the same.

22. In apparatus of the kind described, the combination of a holder including a cylinder, a chipping-device guided in the cylinder to move toward and from the work, said cylinder having a chamber at the end remote from the work, means for supplying fluid under pressure to said chamber to press the chipping device toward the work, and means for supplying fluid under pressure to the chipping device to actuate the same.

23. In apparatus of the kind described, the combination of a holder including a cylinder, a chipping device having a casing in the form of a piston guided in said cylinder and having two separated heads with a waist

between the same, said waist having admission ports for supplying operating fluid to the chipping device to actuate the same, said holder having ports for supplying operating fluid to the last named ports, said cylinder having a chamber at the outer end thereof, means for supplying fluid under pressure to said chamber to press the chipping device toward the work, and means for inducing a partial vacuum at will in the chamber to withdraw the chipping device from the work.

24. In apparatus of the kind described, the combination of a carriage, a holder including a base secured to the carriage and a cylinder mounted on the base and capable of being rotated on its longitudinal axis when seated on the base, said base having seats thereon and said cylinder having feet, said seats and said feet having passages which may communicate to conduct operating fluid into the cylinder, said base having extensions projecting over said seats and cooperating with the cylinder to enable the feet to be moved onto the seats by rotation of the cylinder on its longitudinal axis, and pneumatic means carried by the extensions over the seats for pressing the feet down onto the seats.

25. In apparatus of the kind described, the combination of a holder including a cylinder, a chipping-device guided in the cylinder to move toward and from the work, said cylinder having a chamber at the end remote from the work, means for supplying fluid under pressure to said chamber to press the chipping device toward the work, and means for holding the chipping device against rotation in the cylinder.

26. In apparatus of the kind described, the combination of a carriage having an opening therein, a holder including a base secured to the carriage and a cylinder seating on the base and projecting through said opening, an air-gun mounted in the cylinder and carrying a chipping tool at its inner end, means for supplying operating fluid to the air-gun, and means at the inner end of the cylinder for retaining the air gun within the same.

27. In apparatus of the kind described, the combination of a carriage having an opening therein, a holder including a base secured to the carriage and a cylinder mounted on the base and projecting through the opening, an air-gun received in the cylinder from its lower end, means secured to the inner end of the cylinder to retain the air gun, and means for supplying air under pressure to the air-gun through said base and cylinder.

28. In apparatus of the kind described, the combination of a plurality of holders, chipping devices mounted in the holders, said holders having air chambers to receive air under pressure to press the chipping devices against the work, a receiver with means connecting the same to the chambers to supply them with compressed air, means for opening and cutting off communication from the receiver to the chambers, and means for exhausting the air from the chambers to withdraw the chipping devices from the work.

29. In apparatus of the kind described, the combination of a holder having a cylinder, a chipping device with a piston-form body mounted in the cylinder, said cylinder having an air chamber at the outer end of the chipping device, a receiver for compressed air with means connecting the same with the air-chamber to hold the chipping device against the work, means for opening and cutting off communication from the receiver to the chamber, means for exhausting the air from the chamber to withdraw the chipping device from the work, and means for charging the receiver while connection from it to the chamber is cut off.

30. In apparatus of the kind described, the combination of a holder including a cylinder, a chipping device in the form of a piston mounted in said cylinder, said cylinder having an air-chamber at the outer end of the chipping device to press the same against the work, a receiver with connections for conducting compressed air from it to the said chamber, means for opening and cutting off communication between the receiver and the air-chamber, an exhauster device operated by compressed-air and connected with the chamber for producing a partial vacuum therein when the communication with the receiver is cut off, and means for effecting the recharging of the receiver with compressed air.

31. In apparatus of the kind described, the combination of a plurality of pneumatic chipping devices with air-chambers back of them for holding them against the work, a receiver for compressed air, means including a valve for admitting compressed air from the receiver to the air chambers, a second valve operated in unison with the first named valve for admitting compressed air to the receiver when the first named valve cuts off communication between the receiver and the air-chambers, and an exhaust device operating to produce a partial vacuum in the air chambers to withdraw the chipping devices from the work when the receiver is cut off from communication with the same.

32. In apparatus of the kind described, the combination of a plurality of holders having cylinders, a plurality of chipping-devices having piston-bodies mounted in said cylinders with a pressure chamber at the end of each cylinder remote from the work, a receiver for compressed air, an air pipe for conducting compressed air to said chipping devices for actuating the same, an air pipe for conducting air to said pressure

chambers from the receiver to hold said chipping devices against the work, and a valve through which the air may flow from said receiver to the said air chambers for holding the chipping devices against the work and through which the air flows for operating said chipping devices.

33. In apparatus of the kind described, the combination of a plurality of holders having cylinders, a plurality of chipping-devices having piston-bodies mounted in said cylinders with a pressure chamber at the end of each cylinder remote from the work, a receiver for compressed air, an air pipe for conducting compressed air to said chipping devices for actuating the same, an air pipe for conducting air to said pressure chambers from the receiver to hold said chipping devices against the work, and a valve through which the air may flow from said receiver to the said air chambers for holding the chipping devices against the work and through which the air flows for operating said chipping devices, and a receiver-valve with means for moving the same in unison with the first named valve for recharging the receiver.

34. In apparatus of the kind described, the combination of a plurality of holders having cylinders, a plurality of chipping-devices having piston-form bodies received in the cylinders respectively with an air chamber in the outer end of the cylinder, an air pipe connecting the cylinders to supply compressed air to the chipping devices to actuate the same, an air-pipe connected with the air chambers to hold the chipping devices against the work, valve-means for shutting off the flow of air from both of said pipes, and automatic means for exhausting the air from the second pipe and the air chambers to withdraw the chipping devices from the work.

35. In apparatus of the kind described, the combination of a plurality of holders having cylinders, a plurality of chipping devices having piston-bodies received in said cylinders respectively, with air chambers at the outer ends of the cylinders for holding the chipping-devices against the work, a compressed air supply pipe having a branch for leading air to the chipping devices for actuating the same and having a branch leading air to the air chambers for holding the chipping devices against the work, and a valve for controlling the flow of air through said branches.

36. In apparatus of the kind described, the combination of a plurality of holders having cylinders, a plurality of chipping devices having piston-bodies received in said cylinders respectively, with air chambers at the outer ends of the cylinders for holding the chipping-devices against the work, a compressed air supply pipe having a branch for leading air to the chipping devices for actuating the same and having a branch leading air to the air chambers for holding the chipping devices against the work, and a valve for controlling the flow of air through said branches, an air operated exhaust device connected with the branch pipe leading to the air chambers with a valve, and means for controlling the same in unison with the first named valve to exhaust the air from the pressure chambers and withdraw the chipping devices from the work.

37. In apparatus of the kind described, the combination of a plurality of holders including cylinders, a plurality of chipping-devices having piston-bodies mounted in said cylinders respectively, with an air chamber at the end of each cylinder remote from the work, a main valve with a port for admitting compressed air to the cylinders to actuate the chipping-devices and a port for admitting compressed air to the air chambers to hold the chipping devices against the work, a receiver for compressed air with a receiver valve, said valve operating in its open position to supply compressed air to the cylinders for operating the chipping devices and also operating to connect the receiver with the air chambers, and means for operating the two valves in unison so that when the first named valve is closed, the receiver valve is open and operates to effect a recharging of the receiver.

38. In apparatus of the kind described, the combination of a plurality of holders having cylinders, a plurality of chipping devices with piston-bodies received respectively in the cylinders with an air chamber in each cylinder at the end thereof remote from the work, an air supply pipe, a receiver with its valve, a main valve operating in its open position to connect the air supply pipe with the cylinders for supplying air to actuate the chipping devices and also operating to connect the receiver with the pressure chambers to hold the chipping devices against the work, an exhauster device operated by compressed air, an exhauster valve operating in its open position to admit compressed air to the exhauster device and to open communication from the exhauster device to the air chambers for withdrawing air therefrom to withdraw the chipping devices from the work, and means for operating the main valve, the receiver valve and the exhauster valve in unison.

39. In apparatus of the kind described, the combination of a holder including a cylinder, chipping devices guided in the cylinder to move toward and from the work, said cylinder having an air chamber at the end remote from the work, an air duct for supplying air under pressure to the air chamber to press the chipping devices toward the work, a second air-duct for supplying high pres-

sure air to the cylinder for actuating the chipping devices, means for exhausting the air from the air chamber to withdraw the chipping devices from the work, and means for venting the second named air-duct to prevent leakage of high pressure air into the air-chamber.

40. In apparatus of the kind described, the combination of a holder including a cylinder, a chipping-device having a casing in the form of a piston guided in said cylinder and having two separated heads with a waist between them, said waist having admission ports for supplying compressed air to the chipping-device to actuate the same, said cylinder having an air-chamber in the end thereof remote from the work to press the chipping device against the work, means for exhausting the air from the air-chamber at will to withdraw the chipping device from the work, and means for venting the interior of said cylinder in the vicinity of said waist to prevent leakage of air into the air-chamber.

41. In apparatus of the kind described, the combination of a holder, a pneumatic chipping device mounted in the holder and carrying a chipping tool at its inner end to engage the work, means for supplying air to the holder to operate the chipping device, means for directing the discharged air from the chipping device outwardly past the tool to prevent chips from the tool passing up into the holder.

42. In apparatus of the kind described, the combination of a holder having a cylinder, an air-gun mounted in the cylinder and carrying a chipping tool at its inner end to engage the work, means for supplying compressed air to the cylinder to actuate the air-gun, a collar for retaining the air-gun in the cylinder and means for directing the discharged air from the air-gun downwardly through the lower end of the cylinder and past the tool to prevent chips from the tool passing into the cylinder.

43. In apparatus of the kind described, the combination of a carriage, a plurality of holders mounted on the carriage including bases and cylinders seating on the bases respectively, air-guns mounted in the cylinders and carrying chipping tools to engage the work, said bases and cylinders having ducts formed therein for conducting compressed air to the air-guns to actuate the same and also having ducts formed therein for conducting "holding-on" air into the cylinders to hold the chipping devices against the work, pneumatic clamping devices for securing the cylinders on their bases, and valves for controlling flow of air through said ducts and to said pneumatic clamping devices.

44. In apparatus of the kind described, the combination of a carriage, a plurality of holders mounted on the carriage including bases and cylinders seating on the bases respectively, air-guns mounted in the cylinders and carrying chipping tools to engage the work, said bases and cylinders having ducts formed therein for conducting compressed air to the air-guns to actuate the same and also having ducts formed therein for conducting "holding-on" air into the cylinders to hold the chipping devices against the work, pneumatic clamping devices for securing the cylinders on their bases, and valves for controlling flow of air through said ducts and to said pneumatic clamping devices, and an air-operated exhaust device with a valve for controlling the same enabling the "holding on" air to be exhausted to effect the withdrawal of the chipping devices from the work.

45. In apparatus of the kind described, the combination of a carriage capable of being set over the work, a plurality of fluid controlled chipping devices mounted on the carriage, handle means attached to the carriage for controlling the same, said chipping devices having means for withdrawing the same from the work at will, and controlling levers for the chipping devices mounted near the handle means.

46. In apparatus of the kind described, the combination of a carriage capable of being set over the work, a plurality of pneumatic chipping-devices mounted on the carriage, handle-means attached to the carriage and extending upwardly therefrom, valves with control-levers supported adjacent the upper part of said handle-means, and means for conducting the air from the valves down said handle means to the chipping devices for controlling their operation.

47. In apparatus of the kind described, the combination of a carriage capable of being set over the work, a plurality of holders mounted on the carriage, a plurality of chipping devices mounted respectively in the holders, said holders having air-chambers for holding the chipping devices againt the work and having ports for directing air into the holders for actuating the chipping-devices, an air pipe extending along one side of the carriage and connected with the last named ports to supply operating air for the chipping devices, an air pipe extending along the other side of the carriage and connected with the said air-chambers, and valves for controlling the flow of air into the said pipes.

48. In apparatus of the kind described, the combination of a carriage capable of being set over the work, a plurality of holders mounted on the carriage, a plurality of pneumatic chipping-devices held in the holders respectively, a pair of handles extending upwardly from the carriage, said holders having air-chambers for pressing the chipping-devices against the work and having ports

for conducting air to the chipping devices to actuate the same, and valves with controlling levers supported between said handles for controlling the supply of air to the holders.

49. In apparatus of the kind described, the combination of a carriage capable of being set over the work, a plurality of holders mounted on said carriage in transverse rows, pneumatic chipping devices mounted in said holders respectively, an air-pipe extending along the carriage at one side and crossing said rows, connections from said air-pipes to said holders for controlling the operation of the chipping tools, and valves with controlling levers, connected with said pipes.

50. In apparatus for chipping or cleaning a pipe or casing or tubing, the combination of a carriage in the from of a curved plate with means for supporting the same over the pipe, a plurality of holders mounted on the carriage, a plurality of pneumatic chipping devices carried in the holders, handles attached to the carriage and extending upwardly therefrom, a plurality of valves with controlling levers mounted between the handles, and pipes connecting the valves with the holders for actuating and controlling the chipping devices:

Signed at San Francisco, Calif., this 17th day of May, 1926.

EDWIN P. BLY.