

No. 638,928.

Patented Dec. 12, 1899.

A. L. HUMPHREY.  
PNEUMATIC RAM.

(Application filed Aug. 31, 1899.)

(No Model.)

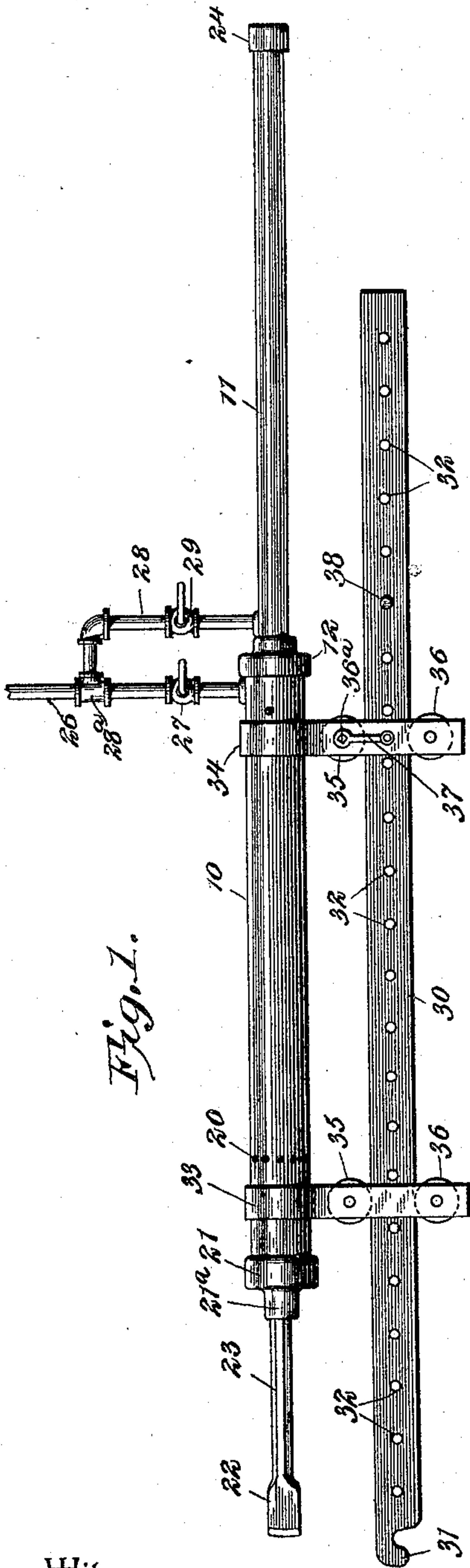


Fig. 1.

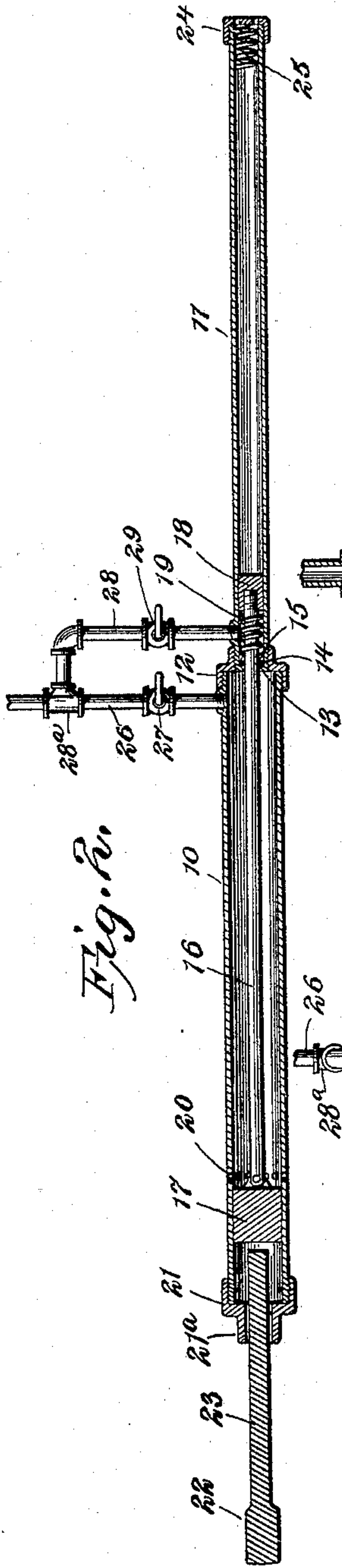


Fig. 2.

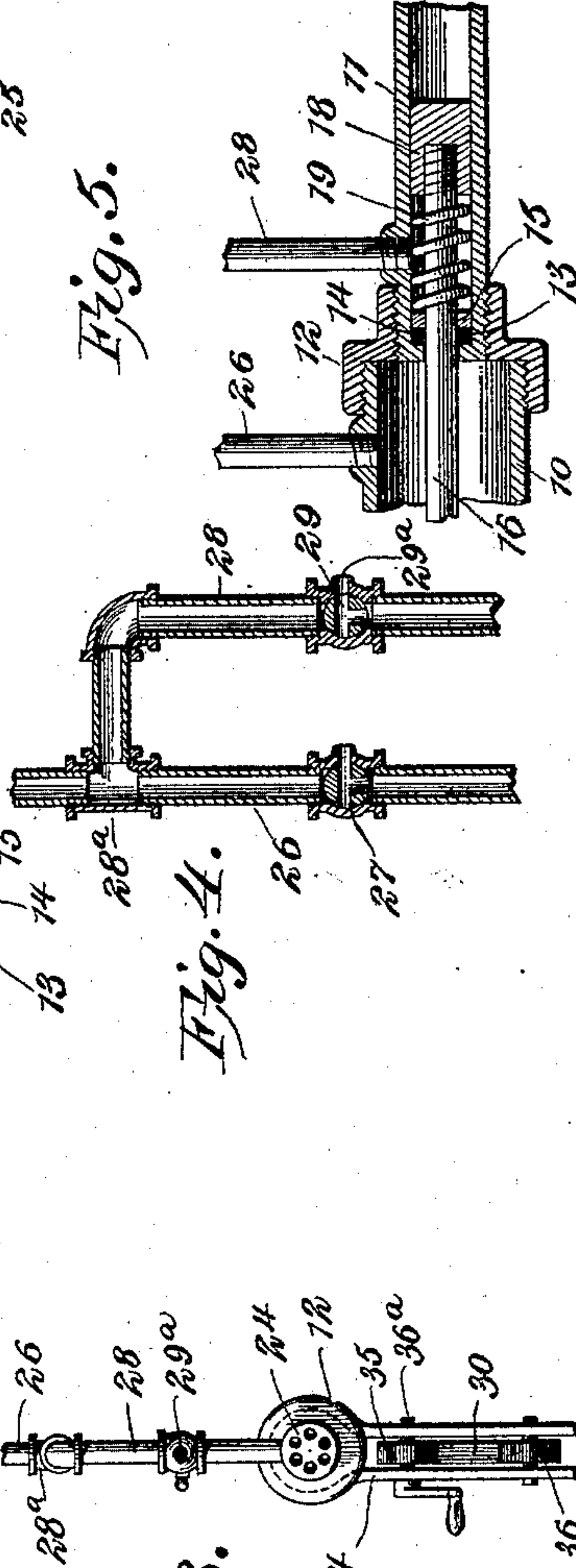


Fig. 3.

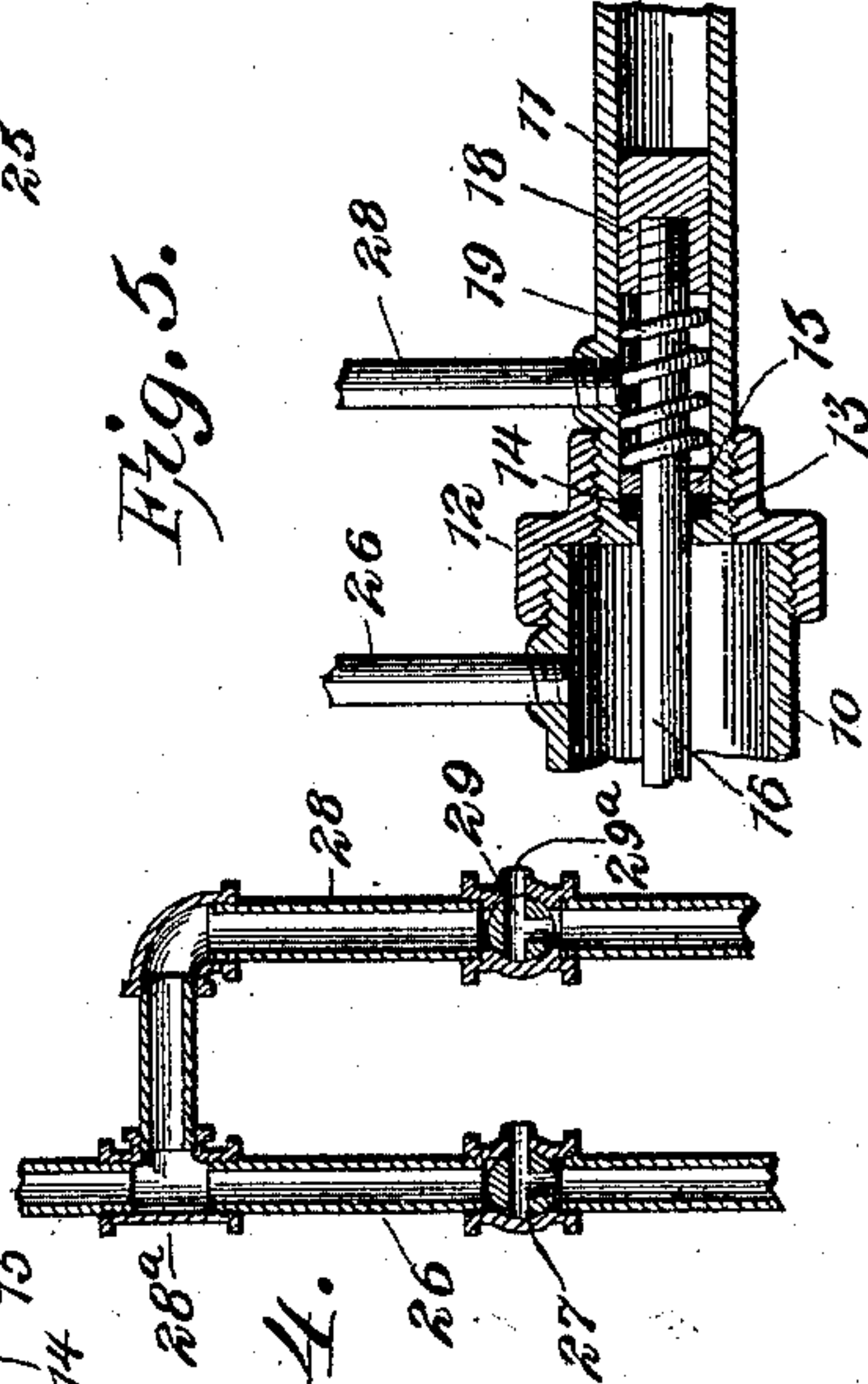


Fig. 4.

Fig. 5.

Witnesses

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# UNITED STATES PATENT OFFICE.

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## PNEUMATIC RAM.

SPECIFICATION forming part of Letters Patent No. 638,928, dated December 12, 1899.

Application filed August 31, 1899. Serial No. 729,058. (No model.)

*To all whom it may concern:*

Be it known that I, ARTHUR L. HUMPHREY, a citizen of the United States, residing at Colorado City, in the county of El Paso and State of Colorado, have invented a new and useful Pneumatic Ram, of which the following is a specification.

My invention relates to improvements in pneumatic rams adapted for use as metal-working machines in breaking bolts or rivets on steam-boilers and in demolishing iron structures, such as bridges or the shells of steamships, and for a variety of other purposes.

The primary object of the invention is to provide a compact portable apparatus adapted to be easily adjusted in place and shifted quickly from one place to another by hand and embodying appliances by which the pressure of a motive fluid, such as compressed air, may be utilized to forcibly and rapidly actuate a breaking implement or tool, such as a bolt or rivet tearing implement.

A further object of the invention is to provide means for sustaining or suspending the pneumatic ram in operative relation to the work, such means affording to the ram a limited amount of travel under the recoil of the bolt-tearing chisel from the work, so as to minimize the liability of injury to the apparatus.

With these ends in view the invention consists in the novel combination of elements and in the construction and arrangement of the parts for service, as will be hereinafter fully described and claimed.

To enable others to understand the invention, I have illustrated a preferred embodiment thereof in the accompanying drawings, forming a part of this specification, and in which—

Figure 1 is a side elevation of a pneumatic ram constructed in accordance with my invention. Fig. 2 is a longitudinal sectional elevation through the ram, omitting the track-bar and the carriage by which the ram is supported in relation to the work. Fig. 3 is an end elevation viewing the apparatus from the rear. Fig. 4 is a fragmentary sectional view of the means for supplying the compressed motive fluid to the main and auxiliary piston-cylinders of the ram. Fig. 5 is another sec-

tional view illustrating the stuffing-box between the working and auxiliary cylinders, together with a portion of such cylinders and the piston-rod.

The same numerals of reference are used to indicate like and corresponding parts in each of the several figures of the drawings.

10 designates the working or pressure cylinder of my pneumatic ram, and 11 is the auxiliary cylinder. This auxiliary cylinder is smaller in diameter than the working cylinder 10, and the two cylinders are arranged in alinement with each other for the purpose of having a single piston-rod with two piston-heads operating in said cylinders. The aligned cylinders of different diameters are coupled end for end through the medium of a coupling 12, which is shown by Figs. 2 and 5 as having screw-threaded connection with the contiguous ends of the two cylinders. This coupling contains a stuffing-box 13, which serves to cut off direct communication of the larger with the smaller cylinder; but the stuffing-box permits the piston-rod to play therethrough. The stuffing-box is made fast with the inner end of the smaller or auxiliary cylinder, said stuffing-box having a suitable packing 14 and a metallic washer 15.

The piston-rod 16 is arranged within the working and auxiliary cylinders in the plane of the axes thereof, so as to reciprocate longitudinally in both of the cylinders, and said piston-rod passes through the stuffing-box 13 and the packing 14 and washer 15, associated therewith. One end of the piston-rod is connected in a suitable way with a ram-head 17, which is of such diameter as to fit snugly in the working cylinder 10, while the other end of this piston-rod is made fast with a piston-head 18, the latter being of smaller diameter than the ram-head and fitted tightly in the auxiliary cylinder 11, as clearly shown by Fig. 2. The coiled cushion-spring 19 fits loosely around the piston-rod, so as to find a seat at one end against the metallic washer 15, associated with the packing of the stuffing-box, said washer thus relieving the packing 14 from the wear incidental to the seating of the cushion-spring upon a part of the stuffing-box. This cushion-spring 19 is disposed in the path of the piston-head 18, that is arranged for operation in the auxiliary cylinder.



der 11, said spring being thus adapted to partially cushion the forward stroke of the ram-head and prevent the piston-head 18 from impinging too forcibly against the stuffing-box.

5 The working cylinder 10 of the ram is provided with an annular series of radial exhaust-ports 20, which are formed in the cylinder at a point in rear of the guide-head 21, the ram-head 17, which works in said larger  
10 cylinder 10, being adapted to travel therein to a point in advance of the exhaust-ports on the forward stroke of the piston-rod, whereby the movement of the ram-head to the position indicated will release the pressure of the  
15 motive fluid in the working cylinder and permit the motive fluid to rush suddenly out of said cylinder, so that the ram-head will not travel clear up to the guide-head 21. Said guide-head has screw-threaded connection  
20 with the open front end of the working cylinder for the purpose of disconnecting the head from said cylinder, said guide-head being formed with an elongated or extended portion in which is produced a guide-opening  
25 21<sup>a</sup>, preferably rectangular or polygonal in form.

One of the essential features of a pneumatic ram embodying this invention is a tool or implement 22, adapted to sever or fracture the  
30 rivet or bolt in a metallic structure on which the ram is adapted to operate for the purpose of demolishing the structure or removing bolts or rivets therefrom. This tool 22 (shown by Figs. 1 and 2) is in the form of a chisel  
35 having a polygonal shank 23, which is slidably fitted in the guide-opening of the head 21. This tool is thus slidably fitted or confined in the guide-head for a limited movement within the front end of the pneumatic  
40 ram, the inner end of said tool being disposed in the path of the ram-head 17 for the purpose of having the ram on the forward stroke of its piston-rod act forcibly against the implement, so as to impel the tool with consid-  
45 erable energy against the bolt, rivet, or other part of the work.

A perforated head 24 is screwed on the open rear end of the smaller auxiliary cylinder, said head having a plurality of ports, as  
50 shown by Figs. 1 and 2, for the free escape of air confined in the auxiliary cylinder on the rearward stroke of the piston-rod and the piston-head 18. Against this perforated head 24 is seated one end of a coiled cushion-spring  
55 25, the latter being disposed in the path of the piston-head 18 for the purpose of cushioning the piston when on its rearward stroke under the pressure of air admitted to the auxiliary cylinder.

60 To the main working cylinder 10 is connected one end of a main pressure-pipe 26, the motive fluid being supplied to the pressure-pipe through a line of hose (not shown) from a suitable compressor or other source of  
65 supply. This main pressure-pipe has a controlling cock or valve 27, which may be a three-way cock adapted in one position to

cut off communication between the working cylinder and said main pressure-pipe, in another position to establish communication be- 70  
tween said parts for the admission of the motive fluid to the working cylinder in rear of the ram-head 17, and in its third position to establish a vent from the working cylinder to the outer atmosphere while cutting off the 75  
flow of the pressure fluid from the pipe 26 to said cylinder. A branch or auxiliary pressure-pipe 28 has one end coupled to the auxiliary cylinder 11 at a point between the stuffing-box 13 and the innermost position 80  
occupied by the piston-head 18, the other end of said branch pipe being united by a T-coupling 28<sup>a</sup> to the main pressure-pipe at a point above the valve or cock 27 therein. This  
85 branch pipe is provided with a three-way cock 29, the shell of which has an exhaust-port 29<sup>a</sup> to the outer atmosphere, and the plug of this cock is constructed as shown by Fig. 4, or in any equivalent way, to establish  
90 or cut off communication between the main pressure-pipe 26 and the auxiliary cylinder or to establish a vent from the auxiliary cylinder through the port 29<sup>a</sup> to the outer air for the purpose of exhausting the motive fluid  
95 admitted to the auxiliary cylinder 11.

The ram of my invention is slidably mounted upon a track-bar 30, which serves to support the entire pneumatic ram in removable relation to the work, so as to admit of a slight traveling motion of the ram under the recoil 100  
of the tool from the work. This track-bar is shown by Figs. 1 and 3 as consisting of an elongated flat bar rectangular in cross-section, said bar being provided at its front end with a hook 31 and with a plurality of transverse 105  
perforations 32, said perforations extending throughout the entire length of the track-bar. The pneumatic ram is movably mounted on the track-bar by the employment of a roller-carriage, so that while the track-bar 110  
occupies a relatively stationary relation to the work the ram may be adjusted lengthwise along the bar and be free to travel a limited distance thereon. In the embodiment of the roller-carriage shown by Figs. 1 and 3 I 115  
employ a pair of straps 33 34, which are bent or doubled around and firmly united to the working cylinder 10, said straps embracing the sides of the track-bar. In the straps are journaled the shafts or arbors of the rollers 120  
35 36, said rollers being arranged for the rollers 35 to ride upon the upper edge of the track-bar, while the rollers 36 are mounted below the track-bar to ride against the under edge thereof. The shaft 36<sup>a</sup> of one of the rollers 125  
35 is provided with a hand-crank 37, which may be rotated by hand, for the purpose of making the carriage and the ram travel lengthwise of the track-bar to assume a proper position thereon with relation to the work. It 130  
is evident that one or more stop-pins 38 may be placed in an opening or openings 32 of the track-bar, so as to lie in the path of one or both of the carriage-straps, said stop-pins



adapted to arrest the travel of the carriage on the track-bar under the recoil of the chisel or tool from the work.

It should be noted that the front carriage-strap 33 must be secured to the working cylinder 10 at a point to one side of the annular series of exhaust-ports 20 in said cylinder, thus making the carriage avoid interference with the proper venting of the working cylinder.

The hook 31 on the front end of the track-bar is of a radius proper to fit a stay-bolt or rivet on the steam-boiler, so as to support one end of the apparatus in proper relation to the work. The other end of the apparatus may be sustained or suspended in place by means of a cable reeved through differential pulleys and having connection by means of a bail with the track-bar or the auxiliary cylinder; but as this suspending means forms no part of the present invention and as the same may be modified within wide limits by a skilled mechanic I have not considered it necessary to illustrate such suspension means or more particularly describe the same.

The operation may be described briefly as follows: The pressure-supply pipe 26 having been coupled with a hose leading from a compressor or other source of motive-fluid supply and the track-bar 30 having been properly fitted to a bolt or other part of a metallic structure in order to support the chisel or tool 22 in proper relation to a bolt or rivet which it is desired to sever, the cock 29 in the branch pipe 28 is opened for the purpose of admitting the motive fluid to the auxiliary cylinder 11, said fluid acting against the piston-head 18 to move the piston-rod 16 and the ram-head 17 in a rearward direction. On this back stroke of the piston the air is free to escape from the auxiliary cylinder through the ports in the back of the head 24, and the smaller piston-head 18 strikes against the coiled spring 25, which cushions the back stroke of the piston. The valve 29 is now turned to the position shown by Fig. 4 for the venting of the cylinder 11, and the valve 27 is opened to admit the motive fluid from the pipe 26 to the working cylinder 10. The motive fluid acts expansively in the cylinder 10 and against the ram-head 17 to forcibly impel the piston and ram-head in a forward direction, said ram-head striking against the shank of the chisel or tool and impelling the latter with considerable energy against the rivet or bolt. On the forward stroke of the ram-head the air in the front part of the cylinder 10 is free to escape through the ports 20, thereby minimizing air resistance to the forward travel of the ram-head, and this ram-head is propelled under the energy of the motive fluid to a point in front of the exhaust-ports 20, which are opened automatically on the forward travel of the ram-head for the motive fluid to rush suddenly out of the working cylinder. Of

course the valve 27 is manipulated at the proper period to cut off communication between the pressure-supply pipe and the cylinder, and if a three-way valve 27 is used in the main pressure-pipe the valve may be manipulated to permit the motive fluid remaining in the cylinder to be exhausted therefrom on the back stroke of the piston. Any suitable mechanism may be adopted and combined with the two valves for opening and closing them in the order hereinbefore recited. The operator may rotate the crank 37 to move the pneumatic ram to different positions on the track-bar, and a stop pin or pins 38 may be employed in the apertured track-bar to limit the travel of the ram under the recoil of the tool, thus preventing the ram from being accidentally displaced on the track-bar.

Changes may be made in the form and proportion of some of the parts while their essential features are retained and the spirit of the invention embodied. Hence I do not desire to be limited to the precise form of all the parts as shown, reserving the right to vary therefrom.

Having thus described the invention, what I claim is—

1. In an apparatus of the character described, a pneumatic ram comprising aligned working and return cylinders of different cross-sectional area, a double piston having its heads of different areas fitted in the respective cylinders, a breaking tool or implement supported independently of the piston and in the path of one of the piston-heads, and a valve mechanism for admitting motive fluid directly and alternately to said cylinders, whereby the piston is actuated by pressure of the motive fluid in both directions, substantially as described.

2. In an apparatus of the character described, a pneumatic ram comprising aligned working and return cylinders of different cross-sectional area, a stuffing-box between the contiguous inner ends of said cylinders and cutting off direct communication therebetween, a piston-rod slidably fitted in the stuffing-box and provided at its respective ends with a ram-head and a piston-head, the ram-head being of larger area than the piston-head, a tool or implement mounted in the larger working cylinder separately from the piston-rod and in the path of the ram-head, and a valve mechanism for admitting a motive fluid directly and alternately to said cylinders, substantially as described.

3. In an apparatus of the character described, a pneumatic ram comprising the aligned working and return cylinders of different cross-sectional area and coupled together at their contiguous ends, a double piston reciprocally fitted in said cylinders, a tool or implement supported independently of the piston and in the path of one head thereof, recoil-springs disposed at opposite ends of



the return-cylinder for cushioning the stroke of the piston in either direction, and a valve mechanism for admitting a motive fluid directly and alternately to said cylinders, substantially as described.

4. In an apparatus of the character described, a pneumatic ram comprising the connected non-communicating working and return cylinders, a guide-head mounted in the working cylinder, a tool or implement slidably confined in the guide-head, a piston-rod having the ram-head and the piston-head of different areas and fitted in the work and return cylinders respectively for the ram-head to act against the tool or implement, a vent-port in the working cylinder adjacent to the guide-head and adapted to be opened by the travel of the ram-head, and a valve mechanism for admitting motive fluid directly and alternately to said cylinders, substantially as described.

5. In an apparatus of the character described, a pneumatic ram comprising aligned non-communicating cylinders of different cross-sectional area and coupled together at their contiguous ends, a piston-rod working in said cylinders and provided with the ram-head and the piston-head, the ram-head being of greater area than the piston-head, a tool or implement mounted slidably in the working cylinder and in the path of the ram-head therein, a valved pressure-pipe connected to the working cylinder, and a valved branch pipe coupled to the pressure-pipe and to the smaller cylinder, the two pipes communicating with the respective cylinders at points contiguous to each other and on oppo-

site sides of the division between the cylinders, substantially as described.

6. In an apparatus of the character described, the combination of a track-bar, a pneumatic ram, and a roller-carriage supporting the ram and freely mounted on said track-bar to have unrestrained travel thereon under the recoil of the ram, substantially as described.

7. In an apparatus of the character described, the combination of a track-bar, a roller-carriage arranged to have unrestrained free traveling play, a pneumatic ram mounted on the carriage to move therewith on the track-bar, and a cutter-tool supported by an element of the ram and in the path of a fluid-actuated member of the ram mechanism, for the purpose described, substantially as set forth.

8. In an apparatus of the character described, the combination of a track-bar having means for supporting the same in place, a roller-carriage adapted to the track-bar to travel freely thereon, a ram mechanism mounted on the carriage to travel and recoil therewith, said carriage having means whereby it may be adjusted manually on the track-bar, and a stop on the track-bar to limit the recoil of the ram and the carriage, substantially as described.

In testimony that I claim the foregoing as my own I have hereto affixed my signature in the presence of two witnesses.

ARTHUR L. HUMPHREY.

Witnesses:

F. F. SCHREIBER,  
CHAS. L. CUNNINGHAM.