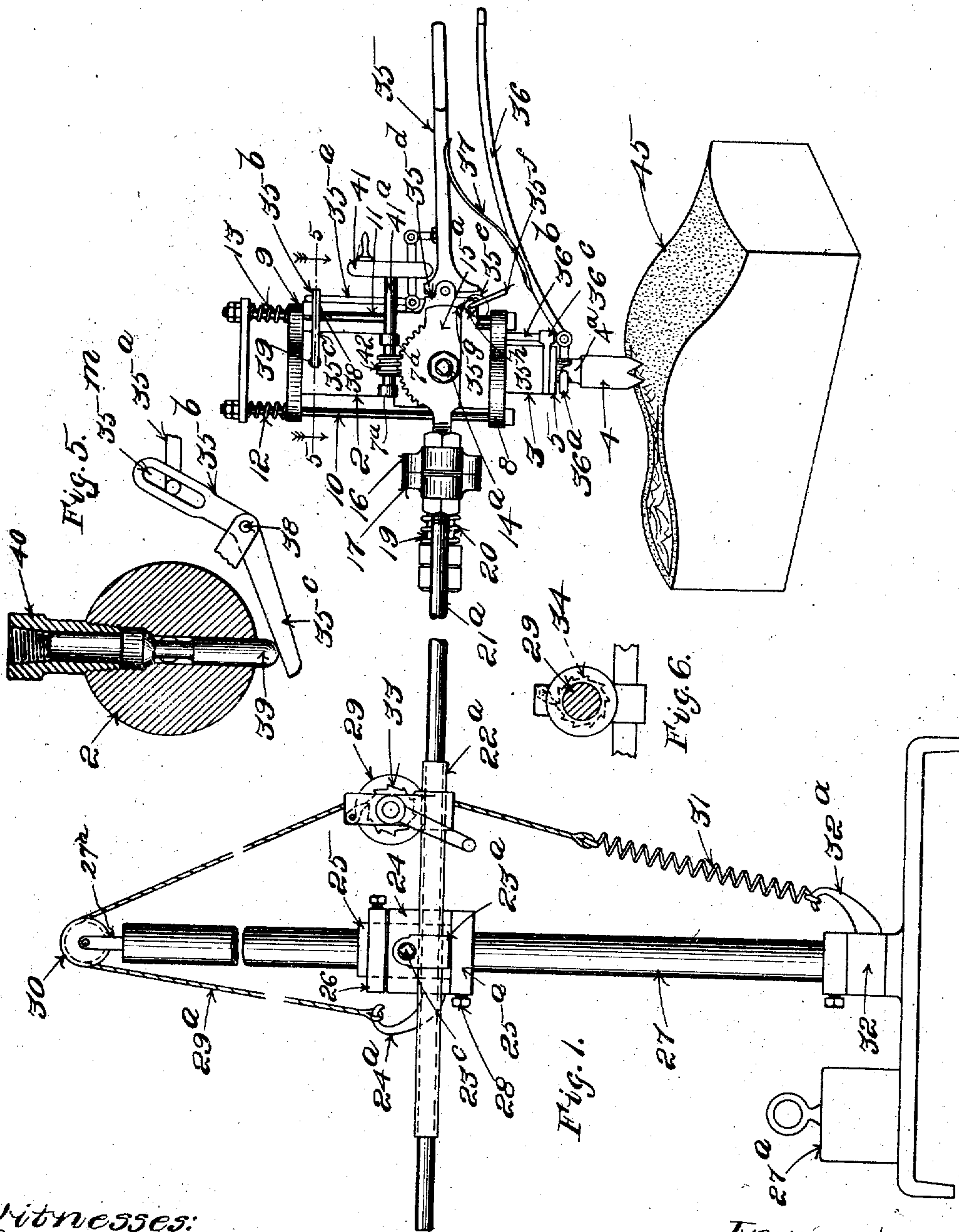


906,850.

G. L. BADGER.
PNEUMATIC SURFACING MACHINE.
APPLICATION FILED APR. 30, 1906.

Patented Dec. 15, 1908.
4 SHEETS—SHEET 1.



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4 SHEETS—SHEET 2.

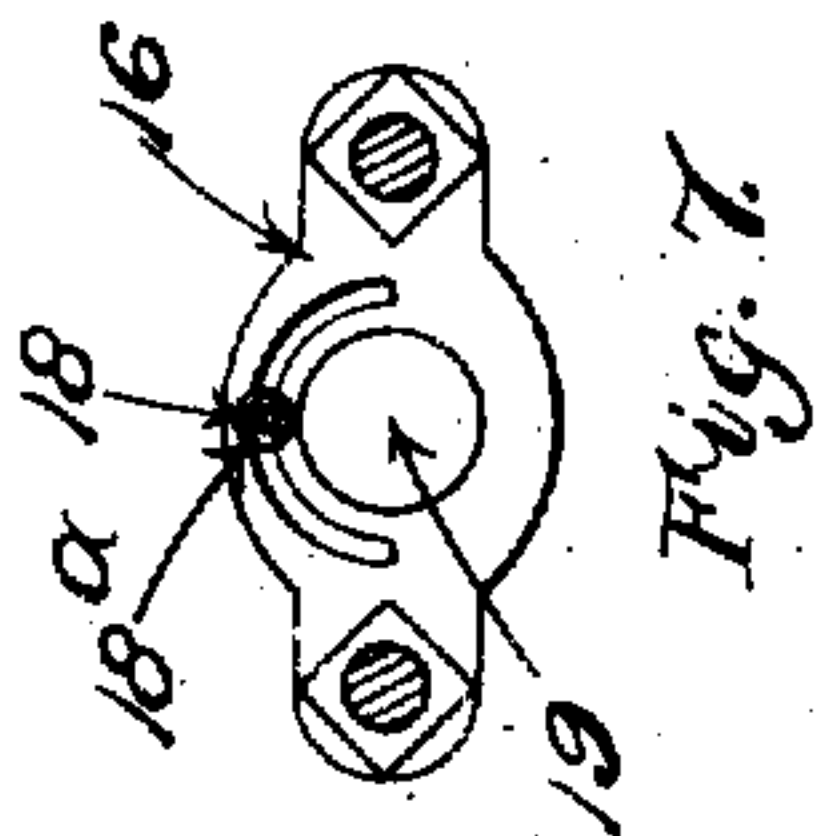


Fig. 7.

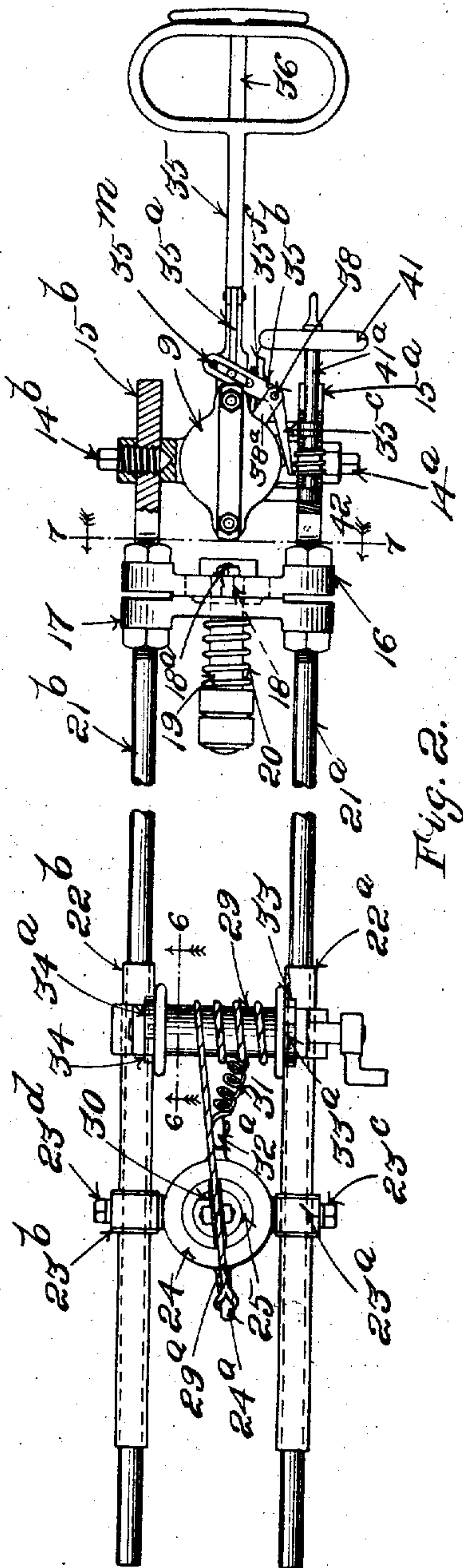


Fig. 2.

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4 SHEETS—SHEET 3.

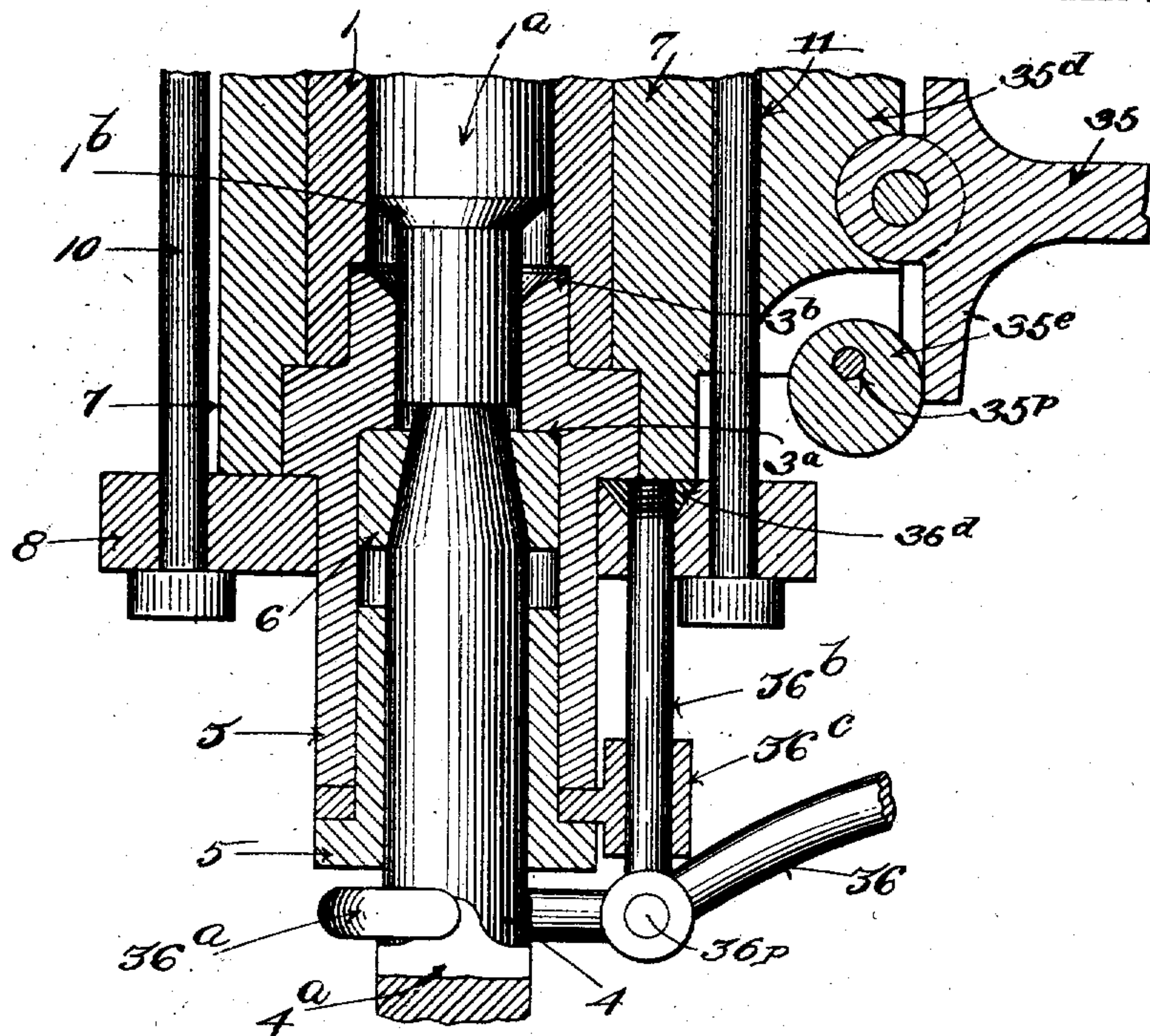


Fig. 3.

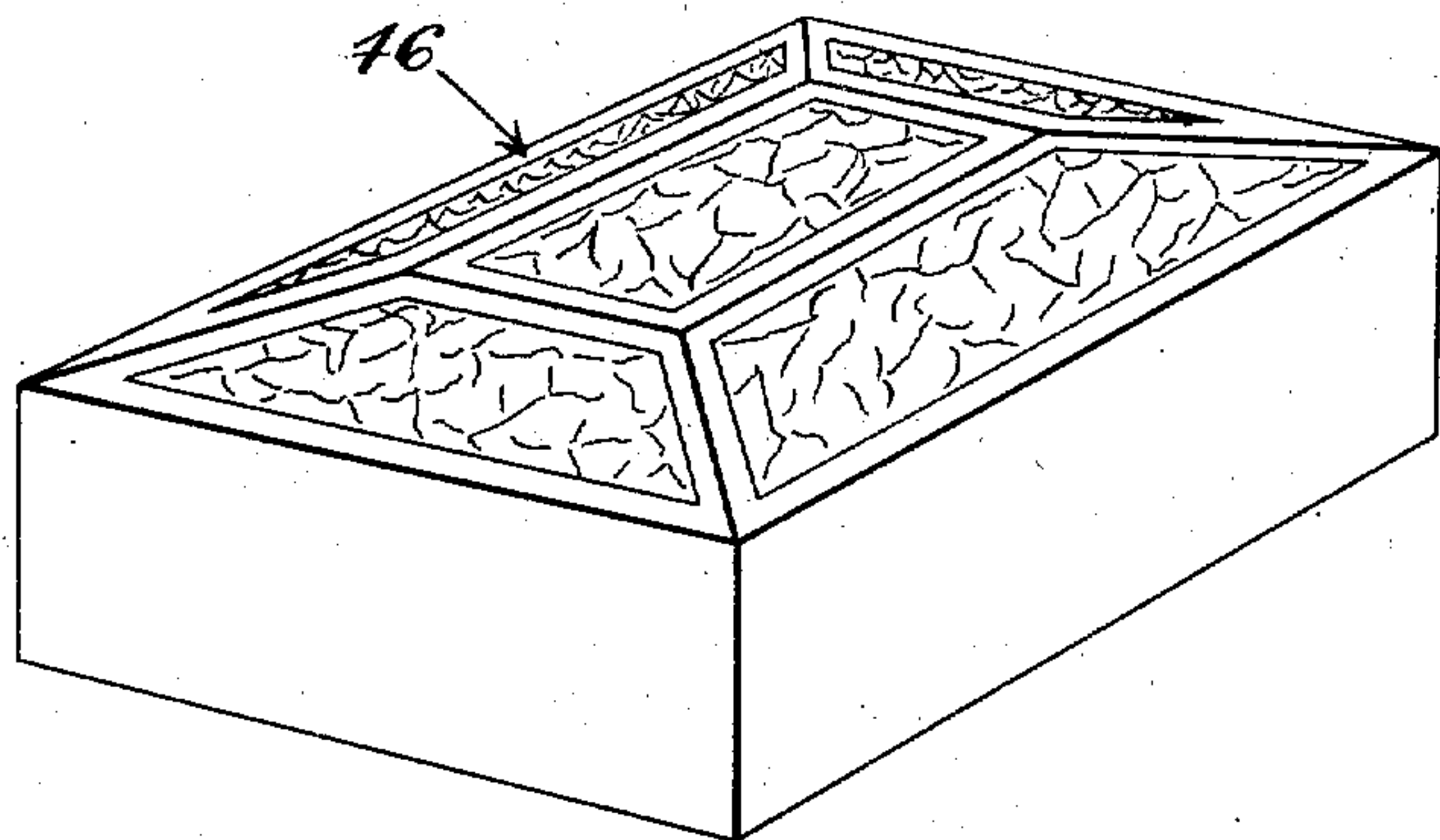


Fig. 4.

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4 SHEETS—SHEET 4.

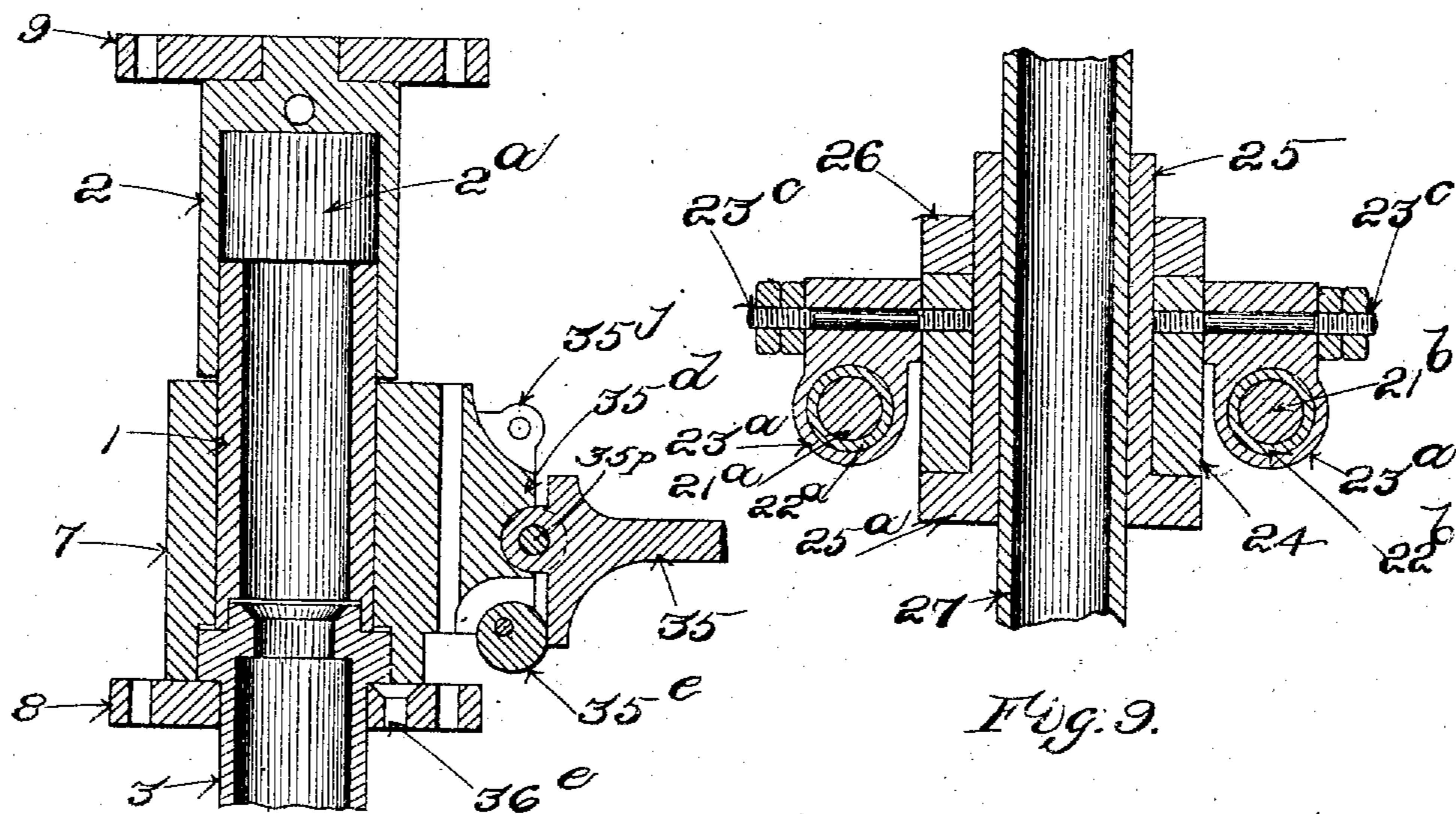


Fig. 8.

Fig. 9.

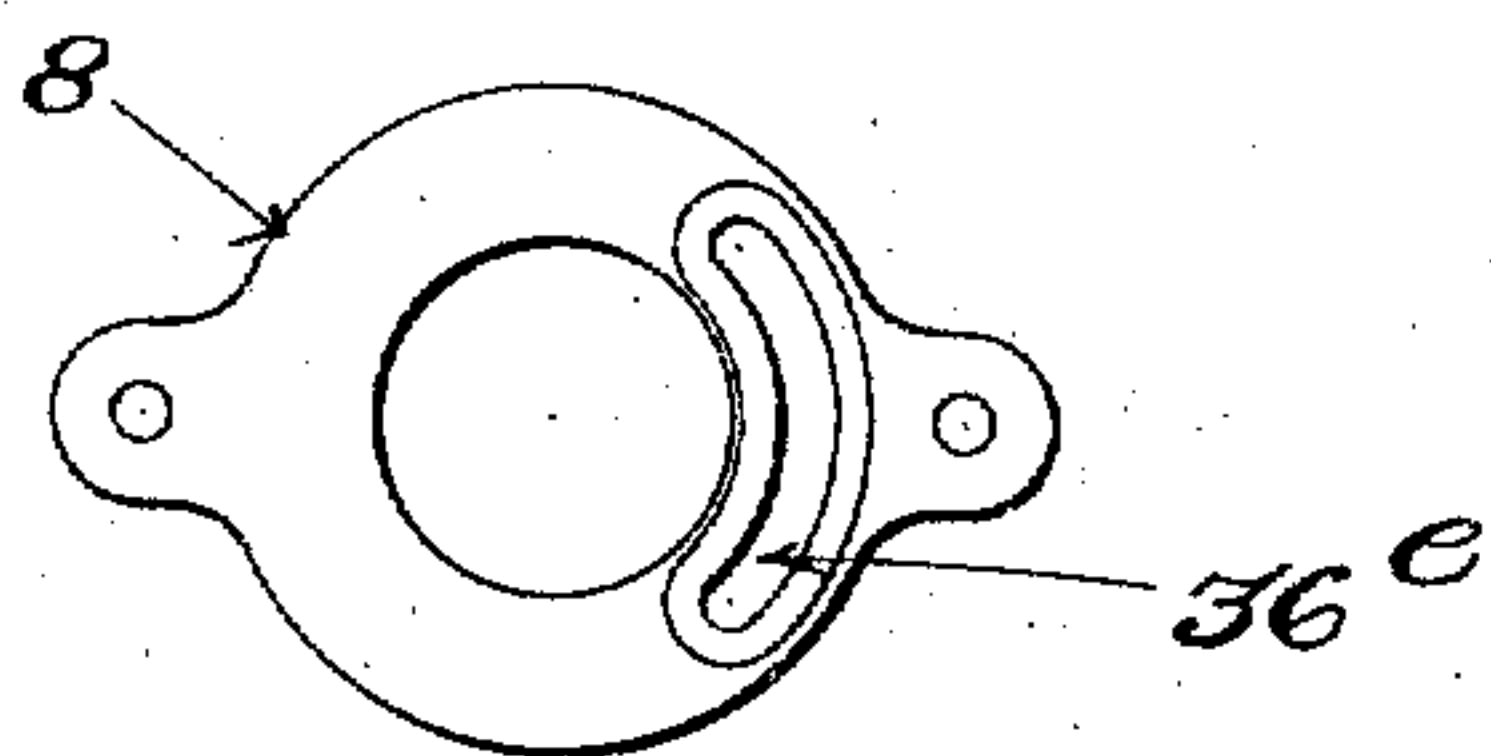


Fig. 12.

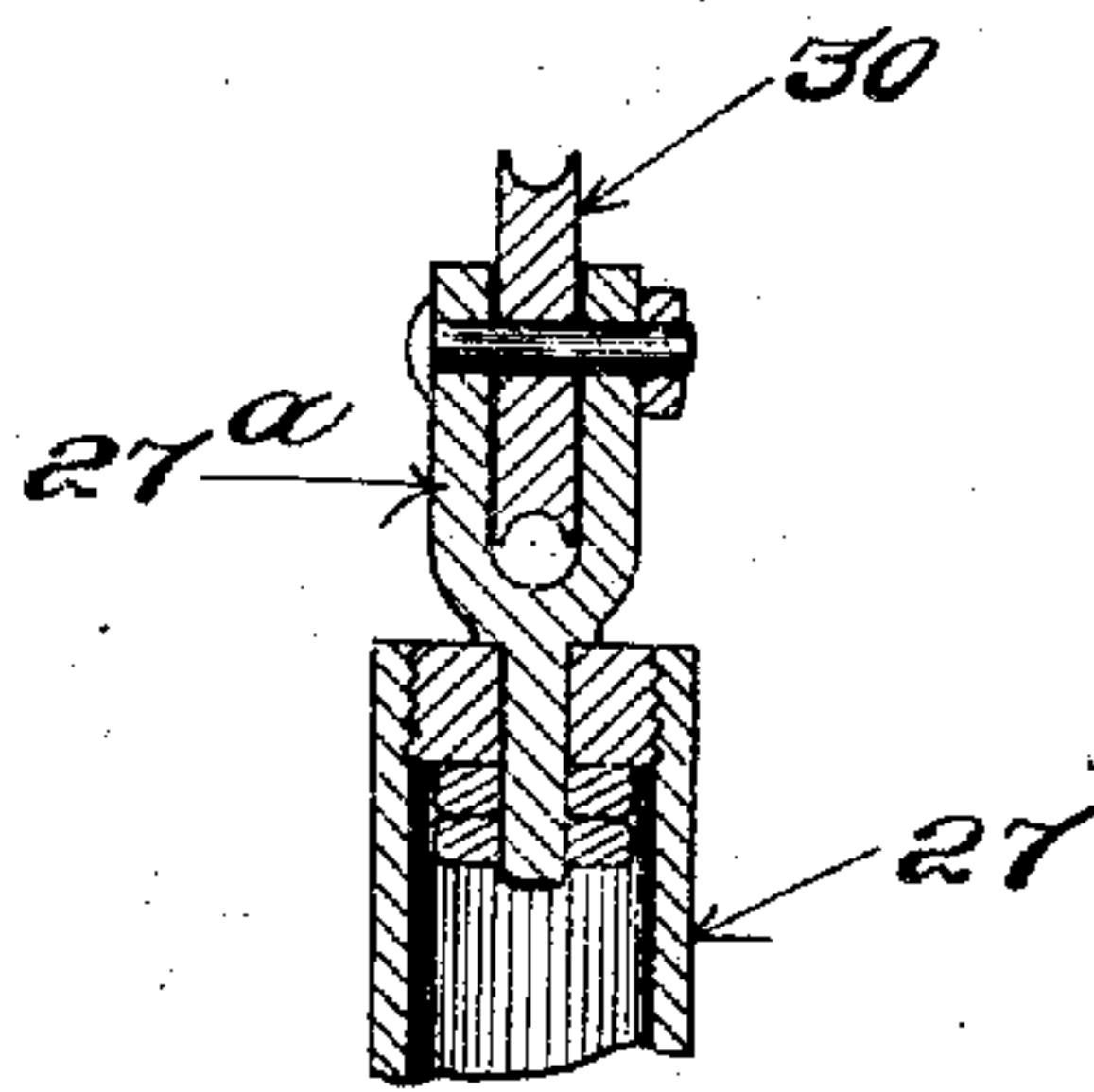


Fig. 10.

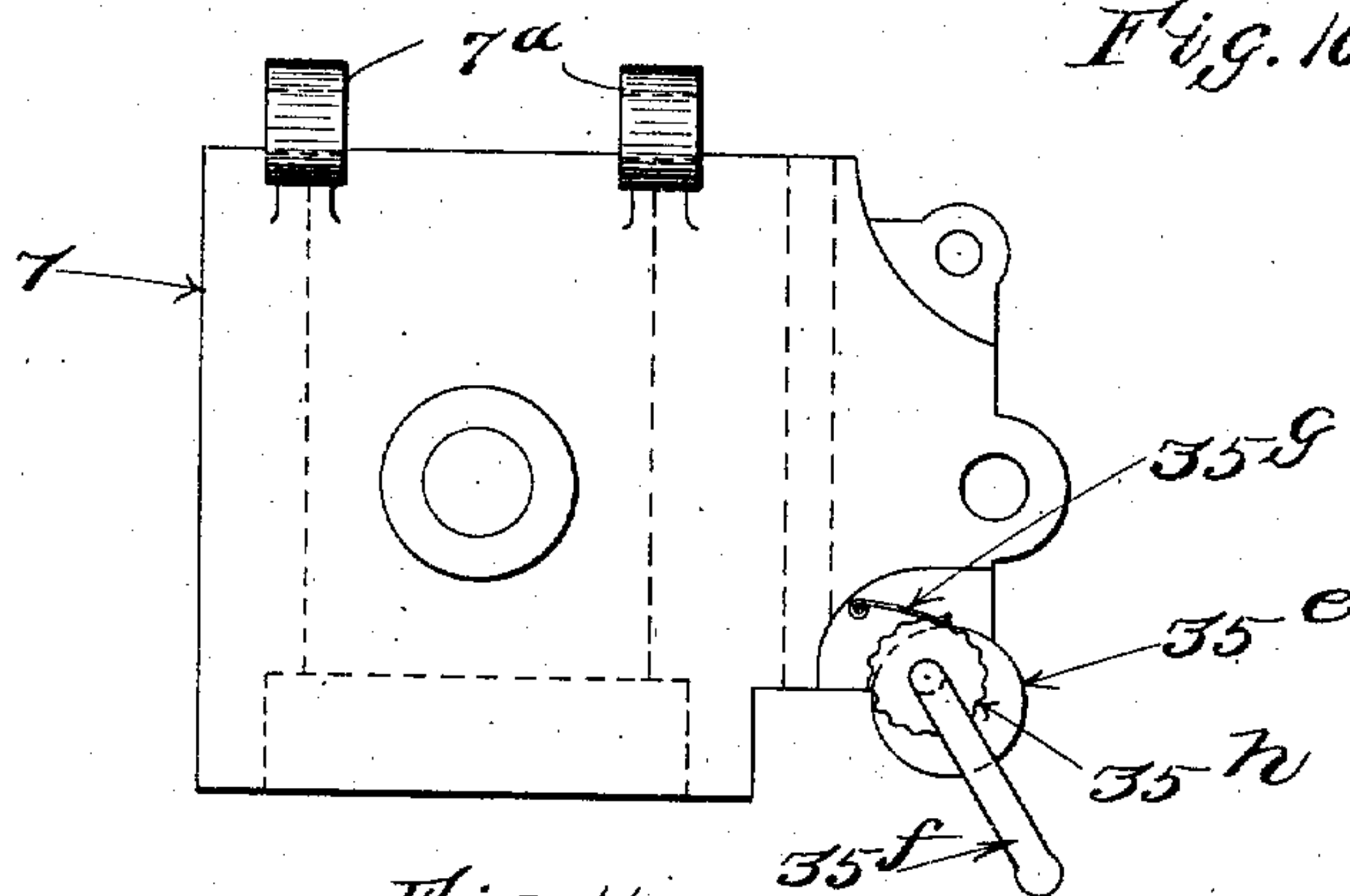


Fig. 11.

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UNITED STATES PATENT OFFICE.

GEORGE L. BADGER, OF QUINCY, MASSACHUSETTS.

PNEUMATIC SURFACING-MACHINE.

No. 906,850.

Specification of Letters Patent.

Patented Dec. 15, 1908.

Application filed April 30, 1906. Serial No. 314,467.

To all whom it may concern:

Be it known that I, GEORGE L. BADGER, citizen of the United States, residing at Quincy, in the county of Norfolk and State of Massachusetts, have invented a certain new and useful Improvement in Pneumatic Surfacing-Machines, of which the following is a specification, reference being had therein to the accompanying drawings.

10 This invention relates to machines for dressing stone by a pneumatic impact tool which is held in a movable arm or frame that may be guided on the surface of the stone.

15 The objects of the invention are to provide a light portable machine which may be easily moved to different stones; to combine a light powerful impact tool to dress stone quickly, with a light frame on which it is mounted, and which may readily be moved
20 over the surface of a stone; to furnish means for dressing stone of irregular shape, curved surfaces and varying planes, without resetting the stone or changing the adjustment of the machine for the different surfaces; to
25 maintain the working tool perpendicular to the surface of the work when desired; to maintain a constant pressure on the working tool when in contact with the work; to retain the working tool in a position to receive the
30 most effective piston impact; to raise the machine to different levels when in operation without displacement of the working-tool, and other novel features which will hereinafter be set forth.

35 In surfacing machines commonly used, it is the custom to provide a traveling tool holder or carrier which is free to move horizontally parallel to the plane of the desired surface, toward and away from a standard or
40 support, and to rotate about the same. The weight of the traveling arm or the carrier and tool being sustained by the support, there is no weight on the working tool. The tool carrier is raised and lowered with relation to
45 the standard and the surface of the work by a windlass, or winch, which also determines the rearward position of the working tool in the cylinder with relation to the desired plane.

50 The working tool is free to move longitudinally with relation to the cylinder, and when said working tool is moved to cut on the higher portions of the rough surface, it projects further into the cylinder, and is not in position to receive the most effective im-
55 pact blow, unless the vertical adjustment of the tool carrier is changed; and the efficiency

of the machine depends largely on the judgment of the operator in maintaining the adjustment of the tool carrier with relation to the work.

60 When the adjustment is fixed to allow the machine to work to the best advantage on the higher portions of the rough surface, the variation of the surface often permits the working tool to drop so far that the piston
65 strikes the head of the cylinder instead of striking the working tool, and this is a source of frequent breakage of parts despite their being made heavy and strong to withstand this frequent concussion. It has heretofore
70 been deemed necessary to allow the working tool to rebound freely from the work, in order that the cutting face of the work tool might mount the high places or projections from
75 the lower plane on the rough surface of the stone.

In some cases the working tool is provided with a shoulder to prevent it projecting too far into the cylinder, but when the machine is in operation, the weight of the tool and
80 tool carrier is not on the working tool, the weight being counterbalanced, so that the tool can move rearward with relation to the working tool to allow the latter to rebound freely from the work. If the weight of the
85 tool and tool carrier bears on the shoulder of the working tool, the body of the latter must be made larger than would otherwise be necessary to provide a shoulder of sufficient projection, and in order to prevent rapid wear
90 the shoulder should be hardened and is very apt to break off at this point.

The use of surfacing machines is generally limited to plane surfaces, and in order to dress stone such as bases, which have the
95 bed and washers lying in different planes, it is necessary to set such stone to five different levels to dress the same.

A large proportion of the stone manufactured are surfaced by hand, and might advantageously be dressed by a portable machine
100 that could be brought to the stone, having its movements under the immediate control of the operator to dress a variety of plane and curved surfaces and moldings and widen the
105 range of machine work.

This invention provides means whereby, when the machine is in operation, the weight of the tool and the outer end of the tool
110 carrying arm, and any additional tension desired, may bear upon the working tool to keep it in contact with the work; and to

maintain the rear end of the working tool at the proper distance with relation to the cylinder to receive the most effective blow of the piston. The working-tool does not
 5 require a shoulder and may be formed from square or round stock of practically the same size as the shank with a slight allowance for turning the shank, the end of which is tapered and hardened to form a stop, so
 10 that the body of the shank has no tendency to break or jump off.

The construction of the standard or support may be light, since it is not required to support the weight of the tool carrying arm, except when the machine is not in use, and
 15 then the arm and tool can be moved close to the support, and the weight will be practically balanced on the support.

The arm is pivoted on the support, permitting a wide range of vertical movement without changing the vertical adjustment on the support, and the arm is free to move towards and away from and to rotate about the support, thus having a universal motion
 20 adapted for surfacing a variety of stone, without strain or inconvenience to the operator. The end of the arm to which the impact tool is fastened is also provided with universal joints, which are directly under the
 25 control of the operator, permitting the working tool to be maintained perpendicular to surfaces of irregular form and different levels and planes, without stopping the operation of the machine, or changing the
 30 adjustment of the arm on the support or the setting of the stone.

A pressure on the guiding handle towards the work starts the machine and when the handle is released the air supply is shut off.
 40 A pivoted lifting handle serves to grip the working tool so that the arm may be lifted without displacing the working tool, and the lifting handle also serves to maintain the working tool for bushing the stone in alignment with any desired face.
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The heads of the impact tool are flexibly secured to the cylinder by bolts under spring tension, so that when the piston strikes the heads the springs relieve the concussion and
 50 prevent injury to the tool.

When the shank of the working tool is gripped by the lifting handle, and clamped to the head to permit the working tool to be moved to a higher level while the machine is
 55 in operation, the blow of the piston on the working tool is cushioned by the springs on the clamp bolts and greatly relieves the jar to the operator.

The invention will now be fully described, reference being had to the accompanying drawings, and the novel features will be particularly pointed out in the claims at the end of the specification.

In the drawings,—Figure 1 is an elevation
 65 of the apparatus embodying the invention.

Fig. 2 is a plan view partly in section. Fig. 3 is a sectional detail showing the work tool in its rearward position. Fig. 4 is a view of a stone as prepared to be dressed by the machine. Fig. 5 is a sectional detail on line 5—5 of Fig. 1, to show the throttle valve. Fig. 6 is a sectional detail on line 6—6 of Fig. 2 showing the ratchet on the opposite end of the winch from that shown in Fig. 1. Fig. 7 is a detail elevation of one of the swivel heads showing the curved swivels lot. Fig. 8 is an elevation partly in section of the impact tool with piston and other parts removed. Fig. 9 is a section through the standard and pivoted arms. Fig. 10 is a sectional view of the swivel sheave. Fig. 11 is an elevation of the sleeve or saddle showing the eccentric stop, pinion and lever. Fig. 12 is a plan view of the lower clamp plate for the impact tool, showing the curved swivel slot.
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The apparatus comprises a pneumatic impact tool which is mounted on an arm that is free to move in all directions. The impact tool has a cylinder 1, Fig. 3, and Fig. 8, a piston 1^a, an upper head 2, a valve casing 2^a, a lower head 3, a working tool 4, a bushing 5, a stop ring 6, a sleeve 7, clamp plates 8 and 9, clamp bolts 10 and 11, and springs 12, 13. The sleeve 7 is located between the upper head 2 of the cylinder 1 and the clamp plate 8, which bears against the lower head 3. The bolt 11 passes through the sleeve 7. The heads 2 and 3 are clamped by the bolts 10, 11, under spring tension to the cylinder 1, a slight clearance being provided to prevent
 90 gripping the sleeve 7. If the working tool is not in position against the work and the piston strikes the lower head 3, the springs 12, 13, permit the head 3 to move, and relieve the strain on the heads and clamp bolts 10, 11.
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The sleeve 7, supporting the impact tool, is held in pivoted bearings by screws 14^a, 14^b in the arms 15^a, 15^b, of the swivel plate 16. The plate 16 is recessed into and may turn in the head 17. A stud 18 fastened to the head 17 passes through a circular or arc-shaped slot (see Fig. 7) in the plate 16 having a nut 18^a which may be screwed against plate 16 to clamp the swivel in any desired position. When the plate 16 is not clamped to the head 17, it is held against the head 17 by means of the bolt 19 and spring 20 under spring tension but free to swivel. The head 17 is provided with two guide arms 21^a, 21^b, which slide freely in the guide tubes 22^a, 22^b, and the whole forms a swiveling tool carrying arm, which by means of the swivel guide supports 23^a, 23^b and bearing studs 23^c, 23^d, is secured to the saddle 24. The saddle 24 is rotatably mounted on the sleeve 25, between the shoulder 25^a of the sleeve 25 and the retaining collar 26. The set screw 28 serves to clamp the sleeve 25 to the support 27. The hoisting winch 29 is secured to the guide tubes 22^a, 22^b. The hoisting rope 29^a is fas-
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tened at one end to the saddle 24 as by a hook 24^a; thence passing over the swivel sheave 30 at the top of the support 27 having a swivel sheave support 27^a, thence passes down and is wound several turns around the drum of the winch, and the other end of the rope is fastened to the spring 31 which is also attached to the hook 32^a of the swivel collar 32 at the base of support 27. The winch 29 has ratchets 33, 34, on opposite sides of the winch, having teeth cut in opposite directions, and having engaging pawls 33^a, 34^a. When the sleeve 25 is clamped to the support 27 and the pawls are disengaged, the winch 15 turns freely on the rope and the arms are free to swivel in the saddle 24, and when the work tool is in position and upon the stone, the weight of the arm will rest upon the work tool which may however be moved freely in any direction to follow the inequalities or any desired angles of the surface.

To lock the arms to any angle, the pawl 33^a is thrown into engagement with the ratchet 33. To increase the weight upon the work tool, the pawl 33^a is disengaged, and pawl 34^a is thrown into engagement with ratchet 34, and the winch turned to stretch the spring 31, and thereby increase the tension on the arms and work tool. This leaves some slack rope 30 above the winch so that the arm is free to move down and it may be moved up against the spring tension. One or several weights similar to 27^a may be placed on the base of the support 27 so that it may support any weight or tension which may be put on the arms to hold the tool to the work. When the weight of the arm is resting on the work, the sleeve 25 may be raised or lowered on the support 27 by disengaging the proper pawls and turning the winch in the desired direction. When the machine is not in use, the head 17 is moved as close to support 27 as possible, and pawl 33^a, being thrown into engagement with ratchet 33, retains the arms at any desired angle. This angle may be maintained in raising or lowering the saddle on the support 27 by the initial location of the winch 29 on the guide tubes 22^a, 22^b, to balance the load when the head 17 is moved close to the support 27. By clamping the sleeve 25 to the support 27, the arms may be raised or lowered by the winch 29 to any desired angle with the support 27.

The sleeve 7 mounted on the cylinder 1 of the impact tool has attached thereto a guiding handle 35 for guiding the tool on the work. A lifting handle 36 pivoted at 36^b is provided with a hook 36^a which is in proximity to the shank of the working tool 4 and is normally kept from contact with the shank and against the bushing 5 by means of the spring 37 which also bears against the guiding handle 35 and normally keeps said handle against the stop 35^d on the sleeve 7.

When the handle 36 is lifted, the hook 36^a

grips the shank of the working tool and clamps the same in the bushing 5 to permit the working tool and arm to be lifted together to any level, the spring 37 retaining the handle 35 against the stop 35^d. The support 36^b, in which the handle 36 is jointed, has a nut 36^d fitted tightly to support 36^b and is free to turn in the plate 8 in the curved slot 36^c and the supporting bearing 36^c is free to turn on the bushing 5. A portion of the shank of the working tools used for bushing or finishing surfaces may be made square as shown at 4^a (Fig. 3) to fit loosely in the hook 36^a.

In bushing surfaces it is not necessary to lift the tool or arm, and the spring 37 may be disengaged from the guiding handle 35 and the handle 36 with the support 36^b may be turned to any desired position in the slot 36^c of plate 8 so as to maintain the tool marks on the surface in alinement. The guiding handle 35 is connected with a vertical bell crank lever 35^a pivoted at 35^j (see Fig. 8), the longer arm of which passes through an elongated slot 35^m in the arm 35^b of a horizontal bell crank lever which swings on the pivot 38 the pivot support 38^a being fixed to the plate 9. The arm 35^c is adjacent to the end of a throttle valve 39 in the head of the cylinder which normally is closed by fluid pressure. When the handle 35 is pressed down against the stop 35^e the lever 35^a, engaging the horizontal bell crank arm 35^b, forces the arm 35^c against the end of the throttle valve 39, and opens the same to admit fluid pressure to the cylinder. The hose nipple 40 is connected with a source of fluid pressure supply (not shown), and to the head of the cylinder, the fluid pressure serving normally to close the throttle valve. When the pressure on the guiding handle 35 is removed, the spring 37 moves the said handle up, and the bell crank arm 35^c is moved away from the cylinder and allows the fluid pressure to close the throttle valve and stop the operation of the machine.

The stop 35^e is eccentrically mounted in bearings on the sleeve 7, and may be turned by the lever 35^f to regulate the forward movement of the guiding handle 35 and maintain the throttle valve open more or less to control the power of the impact tool for the varying conditions of the work, and enable the operator to work close to the edges and corners of the stone, without danger of breaking the same. The spring clip 35^g engages the teeth of the small pinion 35^h and permits the lever 35^f to be moved in either direction, and retains it to any adjustment. The handle 35 being pivotally fastened to the tool holding arm, and the throttle valve controlled therefrom, it is thereby immaterial what portion of the handle is grasped and the throttle valve is controlled by the natural movement of the operator to press the tool to the work by the handle to start the machine

and to stop the machine by releasing the handle.

When the spring 37 is in its normal position on the handles 35 and 36, and the handle 35 is pressed down against the stop 35^e to maintain the operation of the machine, the handle 36 may be lifted up by the operator by gripping both handles, without moving the handle 35 away from the stop 35^e, thus permitting the working tool 4 and the arm to be lifted together without stopping the operation of the machine, and the blow of the piston, either on the head or on the working tool, when the same is clamped to the head, is relieved by the springs 12, 13, thus easing the concussion to the tool and the operator. This is an important feature in machines of this class, wherein the working tool is free to drop from the impact-tool when not in contact with the work and adapts the machine to a much wider range of work.

The universal joints at the outer end of the arm permit the impact-tool to swivel in either direction either laterally or forward and backward with relation to the arm. By adjusting the swivel plate 16 and clamping the same to the head 17, the work tool may be maintained at a lateral angle to the arm and when not clamped thereto, the adjustment of the nut bearing on the spring 20 creates a friction swivel of any desired tension, which can be swiveled by the bow shaped guiding handle laterally to change the angle of the tool holder and maintain the work tool perpendicular to a curved surface.

The rotation of hand wheel 41 turns the shaft 41^a in bearings 7^a on the sleeve 7 and the worm 42, which is fast to the shaft 41^a, engages the segment of a gear as shown on the support 15^a, permitting the operator, while the machine is in operation, to swivel the sleeve 7 on the bearing screws 14^a, 14^b, either forward or backward, and the worm serves to lock the swivel at all times, and maintain the tool at a desired forward or rearward angle to the arm.

A stop ring 6 slides longitudinally in the lower head 3, being retained by the bushing 5 which is a tight driving fit in the head. The end of the working tool 4 is tapered to fit a tapered hole in the stop ring, and when the working tool is on the work and the tool carrying arm is lowered, the tapered end of the shank engages the stop ring and forces it against the shoulder 3^a formed in the head, thus limiting the rearward movement of the working tool and retaining it in alinement with the piston. The stop ring is free to move out of the path of the piston, there being sufficient play provided between the bushing 5 and the stop ring to permit the piston to strike on the end 3^b of the head 3, and to prevent the end of the piston striking the stop ring when it is against the bushing 5

and displacing the same. There is a certain range of movement between the end 3^b of the head and the shoulder 1^b of the piston to prevent the latter striking the head under ordinary working conditions, when the working tool receives the impact of the piston.

As heretofore described, this invention provides means for maintaining the working tool in a fixed rearward position with relation to the cylinder when the machine is in operation. If, however, the machine is started when the work tool is not in the head, or is not resting on the work, or is not properly seated for any cause, the piston will strike the head, and in order to prevent breakage and injury to the tool, the sliding heads 2 and 3 are retained against the cylinder by spring pressure, and any pounding on the heads is relieved by the springs 12, 13, as described, and the tool as a whole may be much lighter in construction than tools in which no relief is provided for such concussion.

The adaptability of the invention for surfacing stone is illustrated by the sketches of stone in Fig. 1 and Fig. 4, the stone 45 in Fig. 1 having curved surfaces and the stone 46 in Fig. 4 having five plane surfaces of different angles all of which may be dressed without resetting of the stone or stopping the machine except to change working tools. It may also be used to advantage in roughing and finishing many forms of molding.

I claim as my invention:

1. In apparatus of the character described, a support, a tool-carrier vertically adjustable on the support, an impact-tool mounted on the tool-carrier, means whereby the tool-carrier is free to move longitudinally with relation to the support, said means being adapted to maintain the tool-carrier in fixed angular relation to a vertical plane passing longitudinally through the tool-carrier, means for vertically adjusting the tool-carrier on the support and means independent of said vertically adjusting means whereby the tool may be moved to and from the work in a vertical plane.

2. In apparatus of the character described, a support, a tool-carrier vertically adjustable on the support, an impact-tool mounted on the tool-carrier, means whereby the tool is free to move toward and from the support, said means being adapted to maintain the tool-carrier in fixed angular relation to a vertical plane passing longitudinally through the tool-carrier, means for vertically adjusting the tool-carrier on the support and means independent of said vertically adjusting means whereby the tool may be moved to and from the work in a vertical plane.

3. In apparatus of the character described, a pneumatic impact-tool, a working-tool, an arm to which said impact-tool is secured, a support on which said arm is mounted,

and movable longitudinally with relation to said support, means whereby in dressing the horizontal surface of a stone, the inclination of said arm may be varied from a plane parallel to the said surface and means whereby the working-tool may be moved in a horizontal plane independent of any movement of the support or the angle thereof with relation to the work.

4. In apparatus of the character described, a support, a tool-carrier vertically adjustable on the support, an impact-tool mounted on the tool-carrier, means whereby the tool is free to move toward and from the support, said means being adapted to maintain the tool-carrier in fixed angular relation to a vertical plane passing longitudinally through the tool-carrier, means whereby the tool is free to move transversely of the support, means for vertically adjusting the tool-carrier on the support and means independent of said vertically adjusting means whereby the tool may be moved to and from the work in a vertical plane.

5. In apparatus of the character described, a pneumatic impact-tool, a cylinder, a working-tool, means to limit the rearward movement of the working-tool with relation to the cylinder, an arm to which said impact-tool is secured, a support on which said arm is vertically adjustable, means for vertically adjusting said arm, means whereby the working-tool may be moved in horizontal planes at different levels in any direction, means whereby the angle of the arm to the support may be varied, and means whereby the working-tool may be maintained in a rearward position with relation to the cylinder independent of the said vertically adjusting means or the angle of the support to the work.

6. In apparatus of the character described, an impact-tool, an arm to which said tool is secured, a support on which said arm is vertically adjustable, means whereby said arm is free to move longitudinally with relation to the support, said means being adapted to maintain the arm in fixed angular relation to a vertical plane passing longitudinally through the arm, means for vertically adjusting the arm on the support and means independent of said vertically adjusting means whereby the tool may be moved to and from the work in a vertical plane.

7. In apparatus of the character described, an impact-tool, an arm to which said tool is secured, a support on which said arm is vertically adjustable, means whereby said tool is free to move toward and from the support, said means being adapted to maintain the arm in fixed angular relation to a vertical plane passing longitudinally through the arm, means whereby the tool is free to move transversely of the support, means for vertically adjusting the arm on the support and

means independent of said vertically adjusting means whereby the tool may be moved to and from the work in a vertical plane.

8. In apparatus of the character described, a pneumatic impact-tool, a cylinder, a working-tool, an arm to which said impact-tool is secured, a support on which said arm is vertically adjustable, means for vertically adjusting said arm, said arm being adapted to be moved longitudinally with relation to said support, means whereby the angle of the arm to the support and the angle of the arm to the work being dressed may be varied, means whereby the working-tool may be moved in a plane parallel to the desired plane of the surface being dressed, and means whereby the working-tool may be maintained in a given rearward position with relation to the cylinder independent of the said vertically adjusting means or the angle of the support to the work.

9. In apparatus of the character described, a pneumatic impact-tool, a working-tool, an arm to which said impact-tool is secured, a support on which said arm is vertically adjustable, and means whereby the working-tool is free to be moved in any direction independent of the vertical adjustment of the arm on the support, and any movement of the support or the angle thereof with relation to the work.

10. In apparatus of the character described, a pneumatic impact-tool, a cylinder, a working-tool, an arm to which said impact-tool is secured, a support on which said arm is rotatably mounted and vertically adjustable, means whereby the angle of the arm to the support and the angle of the arm to the surface being dressed may be varied and means whereby the working-tool may be moved in any direction and means whereby the working-tool may be maintained in a given rearward position with relation to the cylinder independent of the vertical adjustment of the arm on the support, or the angle of the support to the work.

11. In apparatus of the character described, a support, a tool-carrier vertically adjustable on the support, an impact-tool mounted on the tool-carrier, means whereby the tool-carrier is free to move longitudinally with relation to the support, said means being adapted to maintain the tool-carrier in fixed angular relation to a vertical plane passing longitudinally through the tool-carrier, means for vertically adjusting the tool-carrier on the support and means independent of said vertically adjusting means whereby the tool is free to move toward the work in a vertical plane.

12. In apparatus of the character described, a support, a tool-carrier vertically adjustable on the support, an impact-tool mounted on the tool-carrier, means whereby

the tool-carrier is free to move longitudinally with relation to the support, said means being adapted to maintain the tool-carrier in fixed angular relation to a vertical plane passing longitudinally through the tool-carrier, means for vertically adjusting the tool-carrier on the support, means whereby the tool may be moved in a vertical plane independent of said vertically adjusting means and means independent of the vertically adjusting means whereby the tool may be maintained perpendicular to the plane of the finished surface of the work.

13. In apparatus of the character described, a pneumatic impact-tool, a working-tool, an arm, to which said impact-tool is secured, a support on which said arm is vertically adjustable, means for vertically adjusting said arm, means independent of the vertical adjustment of the arm on the support whereby the working-tool is free to be moved in any direction to dress the curved surface of a stone and means whereby the working-tool may be maintained perpendicular to any portion of the curve independent of the said vertically adjusting means.

14. In apparatus of the character described, a pneumatic impact-tool, a cylinder, a working-tool, an arm to which said impact-tool is secured, a support on which said arm is vertically adjustable, means whereby the arm is free to move longitudinally with relation to the support and means whereby when the machine is in operation the weight of the outer end of the arm and cylinder rests upon the working-tool in following the inequalities of the rough surface, or in dressing surfaces of varying planes or curves, independent of the vertical adjustment of said arm on the support or the angle of the support to the work.

15. In apparatus of the character described, a pneumatic impact-tool, a cylinder, a working-tool, means to limit the rearward movement of the working-tool with relation to the cylinder, an arm to which the impact-tool is secured, a support on which said arm is vertically adjustable, means for vertically adjusting said arm and means whereby when the machine is in operation, the weight of the outer end of the arm and cylinder may rest upon the working-tool in following the inequalities of the rough surface, or in dressing surfaces of varying planes or curves, independent of the said adjusting means.

16. In apparatus of the character described, a pneumatic impact-tool, a working-tool, an arm to which said impact-tool is secured, a support on which said arm is mounted, means whereby the outer end of the arm is free to move longitudinally of the arm to and from said support and means whereby the working-tool is free to be moved in a

plane parallel to the desired plane of the surface being dressed when said arm is not parallel to the plane of the desired surface.

17. In apparatus of the character described, a pneumatic impact-tool, a cylinder, a working-tool, an arm to which said impact-tool is secured, a support on which said arm is vertically adjustable, means whereby the outer end of the arm is free to move longitudinally of the arm to and from said support, and means whereby the working tool may be moved in any direction independent of the vertical adjustment of the arm on the support.

18. In apparatus of the character described, a support, a tool-carrier vertically adjustable on the support, an impact-tool mounted on the tool-carrier, means whereby the tool-carrier is free to move longitudinally with relation to the support, said means being adapted to maintain the tool-carrier in fixed angular relation to a vertical plane passing longitudinally through the tool-carrier, means for vertically adjusting the tool-carrier on the support and means independent of said vertically adjusting means whereby the weight of the tool will move it downward toward the work.

19. In apparatus of the character described, an impact-tool, an arm to which said tool is secured, a support on which said arm is vertically adjustable, means whereby said arm is free to move longitudinally with relation to the support, said means being adapted to maintain the arm in fixed angular relation to a vertical plane passing longitudinally through the arm, means for vertically adjusting the arm on the support, means independent of said vertically adjusting means whereby the tool may be moved to and from the work in a vertical plane and means whereby the tool may be maintained perpendicular to the surface of the work.

20. In apparatus of the character described, an impact-tool, an arm to which said impact-tool is secured, a working-tool, a vertical support on which said arm may be adjusted vertically, and means independent of the vertical adjustment of the arm on said support whereby the outer end of the arm is free to move to and from the work in a vertical plane.

21. In apparatus of the character described, an impact-tool, an arm to which said tool is secured, a support on which said arm is vertically adjustable, means whereby said arm is free to move longitudinally with relation to the support, said means being adapted to maintain the arm in fixed angular relation to a vertical plane passing longitudinally through the arm, means whereby the outer end of the arm is free to move transversely of the support, means for vertically adjusting the arm on the support and means independ-

ent of said vertically adjusting means whereby the weight of the tool will move it downward toward the work.

22. In apparatus of the character described, an impact-tool, an arm to which said impact-tool is secured, a working-tool, a vertical support on which said arm may be adjusted vertically and moved longitudinally and means independent of the vertical adjustment of the arm on said support whereby the weight of the arm and tool tends to hold the working-tool to the work.

23. In apparatus of the character described, a support, a tool-carrier vertically adjustable on the support, an impact-tool mounted on the tool-carrier, means whereby the tool-carrier is free to move longitudinally with relation to the support, said means being adapted to maintain the tool-carrier in fixed angular relation to a vertical plane passing longitudinally through the tool-carrier, means for vertically adjusting the tool-carrier on the support, means independent of said vertically adjusting means whereby the weight of the tool will move it downward toward the work and means whereby the tool may be maintained perpendicular to the surface of the work being dressed.

24. In apparatus of the character described, a support, a tool-carrier vertically adjustable on the support, an impact-tool mounted on the tool-carrier, means whereby the tool-carrier is free to move longitudinally with relation to the support, said means being adapted to maintain the tool-carrier in fixed angular relation to a vertical plane passing longitudinally through the tool-carrier, means for vertically adjusting the tool-carrier on the support, means whereby the tool is free to move transversely of the support, means independent of said vertically adjusting means whereby the weight of the tool will move it downward toward the work and means whereby the tool may be maintained perpendicular to the surface of the work being dressed.

25. In apparatus of the character described, a support, a tool-carrier vertically adjustable on the support, an impact-tool mounted on the tool-carrier, means whereby the tool-carrier is free to move longitudinally with relation to the support, said means being adapted to maintain the tool-carrier in fixed angular relation to a vertical plane passing longitudinally through the tool-carrier, means for vertically adjusting the tool-carrier on the support, means independent of said vertically adjusting means whereby the tool may be moved to and from the work in a vertical plane and means whereby the tool may be adjusted to different angles with relation to the surface of the work being dressed.

26. In apparatus of the character de-

scribed, a vertical support, a tool-carrier which may be adjusted vertically on the support and be moved longitudinally with relation thereto, means for vertically adjusting said tool-carrier, an impact-tool mounted on the tool-carrier, and means independent of the vertical adjusting means of the tool-carrier on the support, whereby the tool may be moved to and from the work in a vertical plane.

27. In apparatus of the character described, a vertical support, a tool-carrier which may be adjusted vertically on the support and be moved longitudinally with relation thereto, means for vertically adjusting said tool-carrier, an impact-tool mounted on the tool-carrier, and means independent of the vertical adjusting means of the tool-carrier on the support, whereby the weight of the tool will move it downward toward the work.

28. In apparatus of the character described, a vertical support, a tool-carrier which may be adjusted vertically on the support and be moved longitudinally with relation thereto, means for vertically adjusting said tool-carrier, an impact-tool mounted on the tool-carrier, a working-tool and means to limit its rearward movement with relation to the impact-tool and means independent of the vertical adjusting means of the tool-carrier on the support, whereby the weight of the impact-tool tends to hold the working-tool in contact with the work.

29. In apparatus of the character described, a cylinder and piston, an arm to which the cylinder is secured, a vertical support on which the arm is vertically adjustable, a working-tool and means to limit its rearward movement with relation to the cylinder and means independent of said vertical adjustment whereby the outer end of the arm and cylinder is free to move in a vertical plane.

30. In apparatus of the character described, a cylinder and piston, a working-tool, means to limit the rearward movement of the working-tool with relation to the cylinder, an arm to which the cylinder is secured, a support on which the arm is vertically adjustable, means for vertically adjusting said arm, and means independent of said vertical adjusting means, whereby the weight of the cylinder rests on the working-tool and tends to maintain the rear end of the working-tool in a substantially fixed position with relation to the cylinder when the forward end of the working-tool is on the surface of the work being dressed.

31. In apparatus of the character described, a cylinder and piston, a working-tool and means to limit its rearward movement with relation to the cylinder, an arm to which the cylinder is secured, a support on which

the arm is vertically adjustable and longitudinally movable, means for vertically adjusting said arm and means independent of the vertical adjusting means whereby the weight of the cylinder rests on the working-tool and tends to hold the latter in substantially fixed relation to the cylinder when the working-tool is in contact with the work.

32. In apparatus of the character described, a cylinder and piston, an arm to which the cylinder is secured, a support on which the arm is vertically adjustable, a working-tool and means to limit the forward movement of the cylinder with relation to the working-tool when the latter is in contact with the work said arm being mounted on the support to swivel so that the outer end of the arm and the cylinder will move toward the work in a vertical plane.

33. In apparatus of the character described, a cylinder and piston, a working-tool receiving direct piston impact, said working-tool being normally free to move out of the path of the piston when not in contact with the work, a clamping device and means whereby the working-tool may be temporarily clamped to the cylinder and retained in the path of the piston when the working tool is lifted from the work.

34. In apparatus of the character described, an impact-tool, including a cylinder and piston, a tool-carrier on which the impact-tool is mounted, a support on which the tool-carrier is vertically adjustable, means for vertically adjusting the tool-carrier, a working-tool having its shank fitting loosely into the forward end of the impact-tool, means whereby the impact-tool may be moved to and from the work in a vertical plane and a device projecting at an angle from the impact-tool adapted to be grasped by the operator by which the working-tool may be retained in the path of the piston.

35. In apparatus of the character described, an impact-tool including a cylinder and piston, a tool-carrier on which the impact-tool is mounted, a support on which the tool-carrier is vertically adjustable, means for vertically adjusting the tool-carrier, a working-tool having its shank fitting loosely into the forward end of the impact-tool, means whereby the impact-tool may be moved to and from the work in a vertical plane and means whereby the working-tool may be clamped to the impact-tool and retained in the path of the piston while the machine is in operation and the working-tool is not in contact with the surface of the work.

36. In apparatus of the character described, an impact-tool including a cylinder and piston, a tool-carrier on which the impact-tool is mounted, a support on which the tool-carrier is vertically adjustable, means for vertically adjusting the tool-carrier, a

working-tool having its shank fitting loosely into the forward end of the impact-tool, means independent of the vertical adjusting means of the tool-carrier on the support whereby the impact-tool may be moved to and from the work in a vertical plane, and means whereby the working-tool may be retained in the path of the piston while the machine is in operation and the working-tool is not in contact with the work.

37. In apparatus of the character described, a cylinder and piston, a working-tool receiving direct piston impact, said working-tool being normally free to move out of the path of the piston when not in contact with the work, a head at the forward end of the cylinder, a clamping-device secured to said head and adapted to engage the working-tool to retain it in the head while the working-tool is being moved from a lower to a higher plane on the surface of the work and means for holding said head against the cylinder by spring pressure.

38. In apparatus of the character described, an impact-tool including a cylinder and piston, a working-tool receiving direct piston impact, a tool-carrier on which the impact-tool is mounted, a support on which the tool-carrier is vertically adjustable, means for vertically adjusting the tool-carrier, means whereby the cylinder may be moved to and from the work in a vertical plane and means whereby the working-tool may be lifted from the surface of the work and retained in the path of the piston while the machine is in operation.

39. In apparatus of the character described, a cylinder and piston, a working-tool, an arm to which the cylinder is secured, means whereby the cylinder is free to be moved over the surface of the work, a handle connected with said arm, a throttle-valve adapted to control the supply of motive fluid to the cylinder and means in connection with said handle whereby the operation of the throttle-valve may be controlled.

40. In apparatus of the character described, a cylinder and piston, a working-tool, an arm to which the cylinder is secured, a support on which said arm is adjustably mounted, a throttle-valve adapted to control the supply of motive fluid to the cylinder, a handle connected with the arm to control the movement of the latter over the surface of the work, said handle being pivotally mounted and the outer end vertically movable with relation to the arm, means to normally retain said handle in a rearward position and means whereby when the handle is moved forward with relation to the arm the throttle-valve will be unseated to supply motive fluid to the cylinder.

41. In apparatus of the character described, a cylinder and piston, a working-tool

an arm to which the cylinder is secured, a support on which the arm is adjustably mounted, means whereby the outer end of the arm is free to be moved to and from the support, a throttle-valve adapted to control the supply of motive fluid to the cylinder, means to normally retain the throttle-valve in seated position, a handle connected with said arm by means of which the working-tool may be guided on the surface of the work, the outer end of said handle being vertically movable with relation to the arm and means whereby the operation of the throttle-valve may be controlled by said handle.

42. In apparatus of the character described, a vertical support, a tool-carrier vertically adjustable thereon, said tool-carrier being free to move longitudinally with relation to the support, means for vertically adjusting the tool-carrier on the support, an impact-tool adjustably mounted on the tool-carrier, means independent of the vertical adjusting means of the tool-carrier on the support, whereby the tool may be moved to and from the work in a vertical plane and means to vary the angular adjustment of the tool on the tool-carrier.

43. In apparatus of the character described, a support, a tool-carrier vertically adjustable on the support, an impact-tool adjustably mounted on the tool-carrier, means whereby the tool-carrier is free to move longitudinally with relation to the support, said means being adapted to maintain the tool-carrier in fixed angular relation to a vertical plane passing longitudinally through the tool-carrier, means for vertically adjusting the tool-carrier on the support, means independent of said vertically adjusting means whereby the tool may be moved to and from the work in a vertical plane and means controlled by the operator to adjust the tool on the tool-carrier while the machine is in operation.

44. In apparatus of the character described, a support, a tool-carrier vertically adjustable on the support, an impact-tool adjustably mounted on the tool-carrier, means whereby the tool-carrier is free to move longitudinally with relation to the support, said means being adapted to maintain the tool-carrier in fixed angular relation to a vertical plane passing longitudinally through the tool-carrier, means for vertically adjusting the tool-carrier on the support, and means controlled by the operator to vary the angular adjustment of the tool in a forward and backward direction while the machine is in operation.

45. In apparatus of the character described, a support, a tool-carrier vertically adjustable on the support, an impact-tool adjustably mounted on the tool-carrier, means whereby the tool-carrier is free to

move longitudinally with relation to the support, said means being adapted to maintain the tool-carrier in fixed angular relation to a vertical plane passing longitudinally through the tool-carrier, means for vertically adjusting the tool-carrier on the support, means controlled by the operator to vary angular adjustment of the tool while the machine is in operation, said last mentioned means being adapted to retain the tool in adjusted position until the adjustment is changed by the operator.

46. In apparatus of the character described, a support, an arm mounted thereon, an impact-tool adjustably mounted on the arm under adjustable tension to normally retain the tool in position and means controlled by the operator whereby the angular adjustment of the tool may be varied while the machine is in operation.

47. In apparatus of the character described, a support, a tool-carrier vertically adjustable on the support, an impact-tool adjustably mounted on the tool-carrier, means whereby the tool-carrier is free to move longitudinally with relation to the support, said means being adapted to maintain the tool-carrier in fixed angular relation to a vertical plane passing longitudinally through the tool-carrier, means for vertically adjusting the tool-carrier on the support, means independent of said vertically adjusting means whereby the tool may be moved to and from the work in a vertical plane, means to normally retain the tool in position on the tool-carrier and means controlled by the operator whereby the angular adjustment of the tool may be changed while the machine is in operation.

48. In apparatus of the character described, a support, an arm mounted thereon, an impact-tool adjustably mounted on the arm, means to normally retain the tool in position under adjustable spring tension and allow the angular adjustment of the tool to be varied in a lateral direction while the machine is in operation.

49. In apparatus of the character described, a support, an arm mounted thereon, an impact-tool mounted on said arm, means to vary the angular adjustment of the tool thereon in a forward and backward direction while the machine is in operation, said means being adapted to positively retain the tool in adjusted position, and means whereby the angular adjustment of the tool may be varied in a lateral direction and normally retained in adjusted position under spring tension.

50. In apparatus of the character described, a support, a tool-carrier mounted thereon, an impact-tool mounted on the tool-carrier, means to vary the angular adjustment of the tool thereon while the tool

is in operation, said means including a swivel under spring tension.

51. In apparatus of the character described, a support, a tool-carrier mounted thereon, an impact-tool mounted on the tool-carrier, means to vary the angular adjustment of the tool in a forward and backward direction and retain the latter in adjusted position on the tool-carrier, and means whereby the angular adjustment of the tool may be varied in a lateral direction and normally retained in position under adjustable spring tension.

52. In apparatus of the character described, an impact-tool including a cylinder and piston, a tool-carrier to which the tool is secured, a support on which the tool-carrier is mounted, a working-tool receiving direct piston impact, means to limit the rearward movement of the working-tool with relation to the cylinder, and means whereby the working-tool may be retained in the path of the piston when the machine is in operation and the working-tool is not in contact with the work.

53. In apparatus of the character described, an impact-tool including a cylinder and piston, a tool-carrier to which the tool is secured, a support on which the tool-carrier is mounted and longitudinally movable with relation thereto, a working-tool receiving direct piston impact, means to limit the rearward movement of the working-tool with relation to the cylinder, means whereby the working-tool may be moved over the surface of the work when it is in contact therewith, and means whereby the working-tool may be retained in the path of the piston when the machine is in operation and the working-tool is not in contact with the work.

54. In apparatus of the character described, a cylinder and piston, a working-tool, an arm to which the cylinder is secured, means whereby the cylinder and working-tool are free to be moved over the surface of the work, a handle connected with said arm, the outer end of the handle being vertically movable with relation to the arm, a throttle-valve adapted to control the supply of motive fluid to the cylinder and means whereby the operation of the throttle-valve may be controlled by said handle.

55. In apparatus of the character described, a cylinder and piston, a working-tool, an arm to which the cylinder is secured, means whereby the cylinder and working-tool are free to be moved over the surface of the work, a handle connected with said arm, the outer end of the handle being vertically movable with relation to the arm, a throttle-valve adapted to control the supply of motive fluid to the cylinder, means whereby the operation of the throttle-valve may be controlled by the vertical movement of said han-

dle with relation to said arm, and an adjustable stop adapted to limit the downward movement of the handle.

56. In apparatus of the character described, a cylinder and piston, a working-tool, an arm to which the cylinder is secured, means whereby the cylinder and working-tool are free to be moved over the surface of the work, a handle connected with said arm, the outer end of the handle being vertically movable with relation to the arm, a throttle-valve adapted to control the supply of motive fluid to the cylinder, means whereby the operation of the throttle-valve may be controlled by the vertical movement of said handle with relation to said arm, an adjustable stop adapted to limit the downward movement of the handle and means to retain said stop in adjusted position.

57. In apparatus of the character described, a cylinder and piston, a working-tool, an arm to which the cylinder is secured, means whereby the cylinder and working-tool are free to be moved over the surface of the work, a handle connected with the cylinder adapted to engage the working-tool and means whereby the working-tool may be kept in alinement with any edge of the surface when the arm is moved to different portions of the surface.

58. In apparatus of the character described, a cylinder and piston, a working-tool, an arm to which the cylinder is secured, means whereby the cylinder and working-tool are free to be moved over the surface of the work, a handle connected with the cylinder and normally in alinement with said arm, adapted to engage the working-tool, and means whereby the handle may be swiveled with relation to said arm to keep the working-tool in alinement with any edge of the surface when the arm is moved to different positions on the surface.

59. In apparatus of the character described, an impact-tool, a tool-carrier to which the tool is secured, a support on which the tool-carrier is mounted, a working-tool, means whereby the working-tool is free to be moved over the surface of the work, a device retained in operative relation to the working-tool when the latter is moved to different positions on the surface of the work and means whereby the working-tool may be engaged by said device and be maintained in alinement with any edge of the surface when it is moved to different portions of the surface.

60. In apparatus of the character described, an impact-tool, a tool-carrier to which the tool is secured, a support on which the tool-carrier is mounted, a working-tool, means whereby the working-tool is free to be moved over the surface of the work, a device retained in operative relation to the working-tool when the latter is moved to different po-

sitions on the surface of the work, means whereby the working-tool may be engaged by said device and means whereby the device may be swiveled with relation to the tool-carrier to maintain the working-tool in alignment with any edge of the surface being dressed.

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

GEORGE L. BADGER.

Witnesses:

GEORGE H. BROWN,
CHARLES H. WILSON.