

Dec. 15, 1925.

1,565,262

A. V. DA COSTA

DROP HAMMER

Filed Nov. 25, 1921

3 Sheets-Sheet 1

Fig. 1.

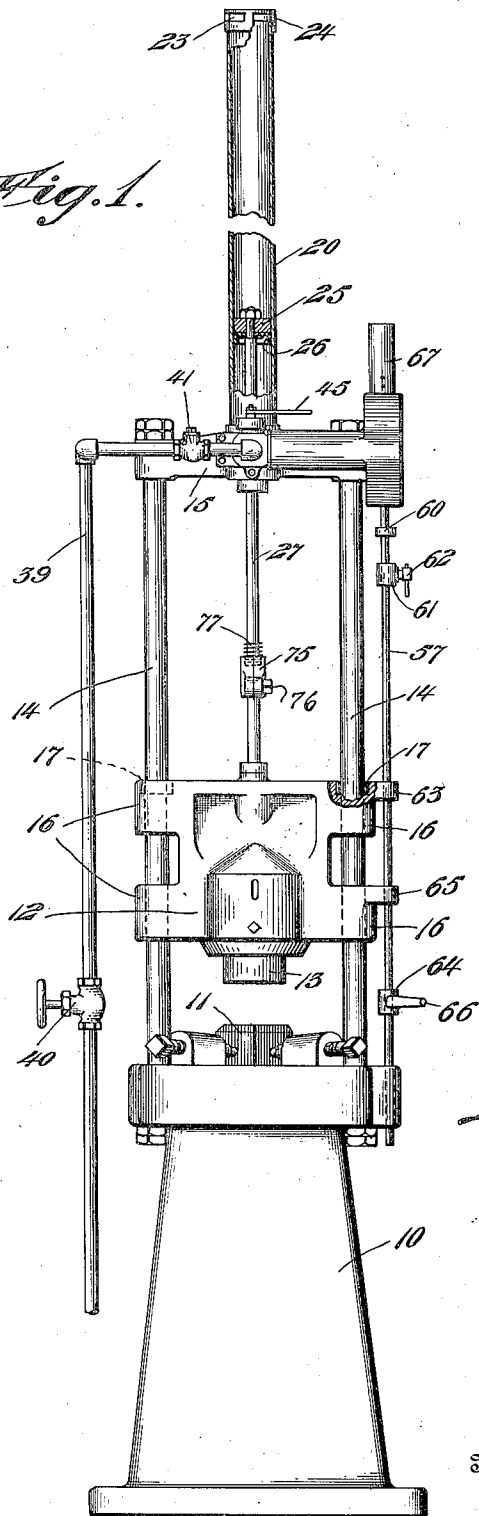


Fig. 7.

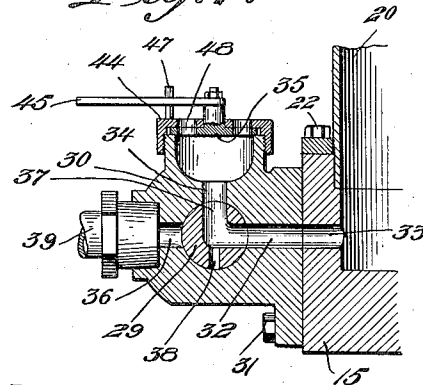


Fig. 8.

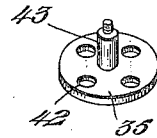


Fig. 9.

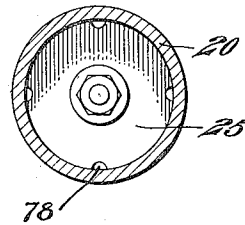
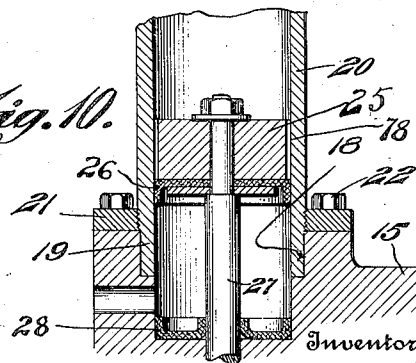


Fig. 10.



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3 Sheets-Sheet 2

Fig. 2.

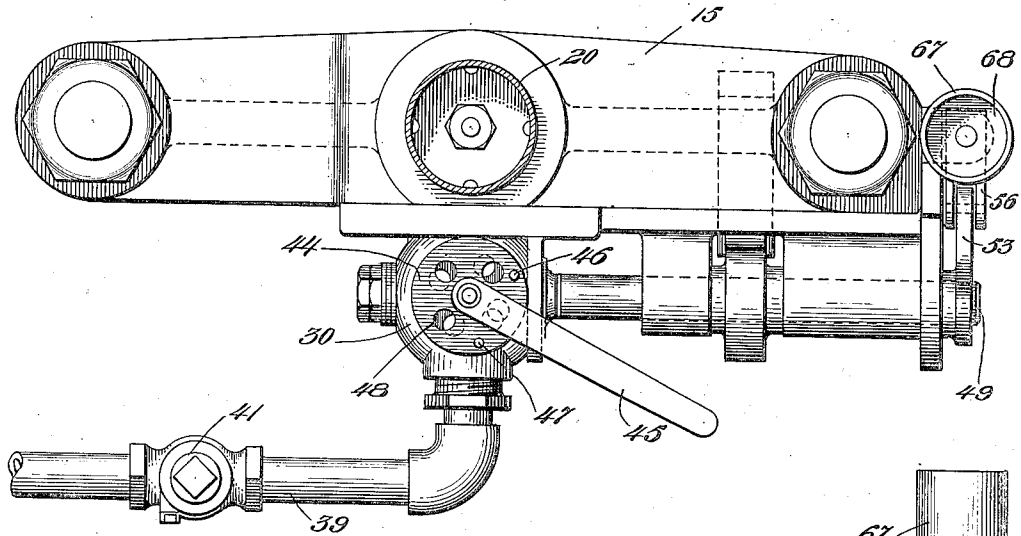
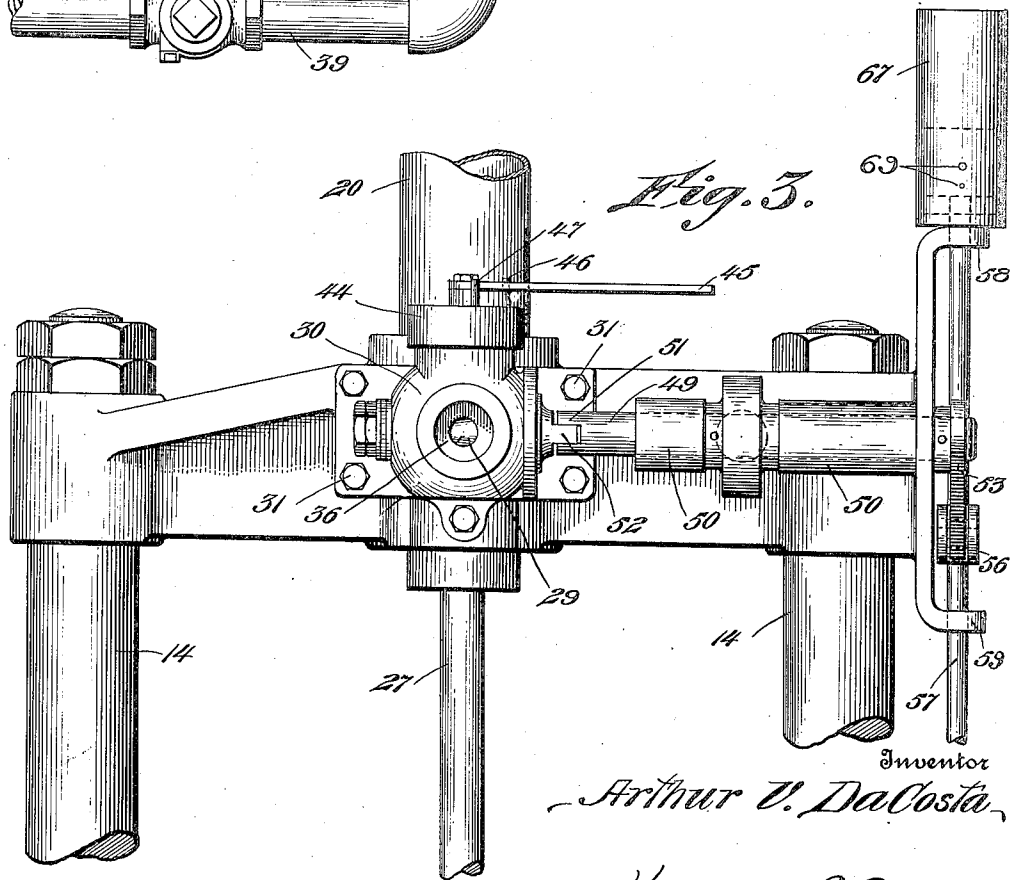


Fig. 3.



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3 Sheets-Sheet 3

Fig. 6.

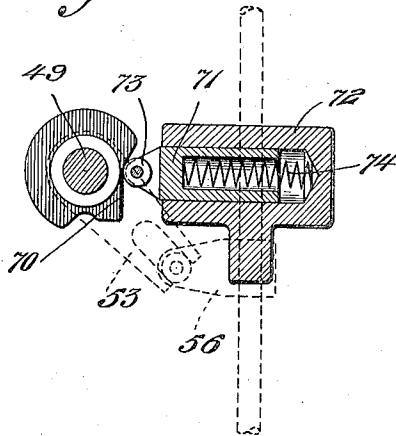


Fig. 4.

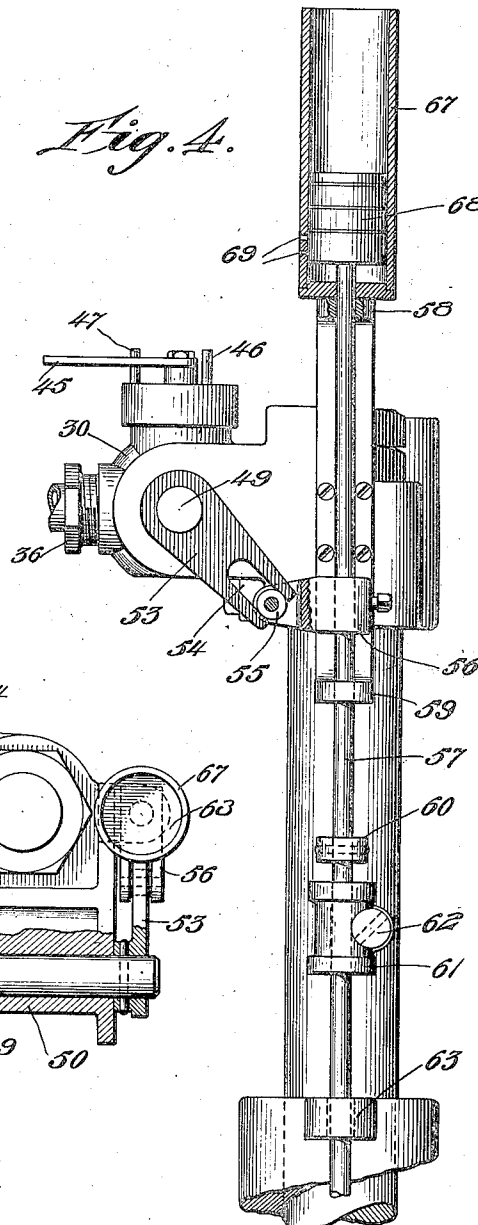
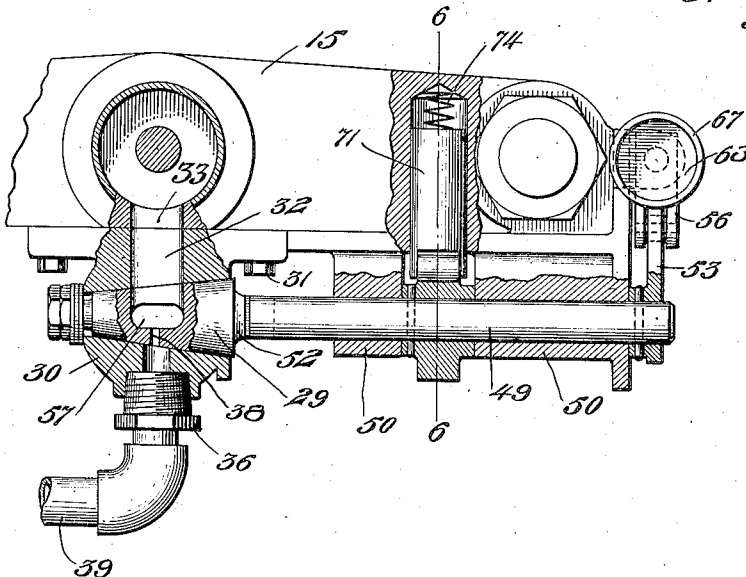


Fig. 5.



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UNITED STATES PATENT OFFICE.

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OF NEWTON, MASSACHUSETTS.

DROP HAMMER.

Application filed November 25, 1921. Serial No. 517,752.

To all whom it may concern:

Be it known that I, ARTHUR V. DA COSTA, citizen of the United States, residing at Providence, in the county of Providence and State of Rhode Island, have invented certain new and useful Improvements in Drop Hammers, of which the following is a specification.

This invention relates to drop hammers more particularly of that class in which the hammer-head is lifted by fluid pressure such as compressed air acting through the medium of a piston, and the object of this invention is to provide a hammer of this character which can be nicely regulated to strike the exact blow required upon the work varying in force from the lightest to the very heaviest blow, tap means being provided in the hammer whereby it may be either automatically or manually controlled in its action.

A further object of the invention is the provision of means for controlling the force of a blow by throttling the exhaust of the lifting pressure.

A still further object of the invention is the provision of means for preventing a rebounding blow of the hammer upon the work.

The invention further consists in the provision of cushioning means for gradually arresting the valve mechanism after having received a quick impulse from the striking stroke of the hammer-head.

With these and other objects in view, the invention consists of certain novel features of construction, as will be more fully described, and particularly pointed out in the appended claims.

In the accompanying drawings:

Figure 1 is a front elevation of my improved hammer partly in section.

Figure 2 is a top view of the hammer frame showing the valve-operating mechanism, the pressure cylinder being shown partly in section.

Figure 3 is a front view of the upper hammer frame in elevation.

Figure 4 is an edge view of the machine showing the valve-operating mechanism with a dash-pot in section and connected to the valve rod for cushioning the throw of the valve mechanism.

Figure 5 is a top view of the hammer frame showing the valve-operating mechanism partly in section.

Figure 6 is a sectional elevation on line 6—6 of Figure 5 showing the valve-throwing locking plunger.

Figure 7 is a sectional elevation through the main inlet and outlet plug valves showing the valve in exhausting position.

Figure 8 is a perspective view of the auxiliary exhaust throttle valve.

Figure 9 is a top view showing the piston in the cylinder and the openings through the piston through which air may be drawn from the upper to the lower side of the piston to fill the space unsupplied by the small inlet port to prevent a rebounding blow of the hammer upon the work.

Figure 10 is a sectional elevation showing the slots through the piston also showing the packing in the cylinder about the connecting rod.

It is found in the practical operation of drop-hammers of this general character particularly those used in the jewelry-manufacturing art where it has a wide field for swaging and forming of jewelry parts and where intricate, delicate and expensive dies are employed, to be of advantage to use compressed air instead of steam in the operation of the hammer as a pressure of air is easily obtained by a pump and is commonly employed for different purposes in all jewelry shops, while the generating of steam in small units in a jewelry plant to operate a hammer of this character would be quite impractical and unsatisfactory. It is also found in the use of drop hammers in this art of utmost importance to be able to so nicely regulate the force of the blow that it may perform the most delicate swaging operation on very thin precious metal, while in other instances it must be called upon in shaping the heavier metals to strike with great force. In other words, the construction of the hammer must be such that its blow can be very readily and most accurately controlled, which in the present instance is accomplished by the simple manipulation of an exhaust throttle valve to nicely regulate the outflow of pressure from the cylinder after it has lifted the hammer, and the following is a detailed description

of one means by which this result may be accomplished:—

With reference to the drawings, 10 designates the base or bed-portion of a machine, which supports the anvil member 11 on which the work is placed to receive a swaging or operating blow of the hammer-head 12 in which the upper die 13 is carried, the usual means being provided by which the dies may be readily changed for different work.

The lower ends of the upright columns 14 are secured in the base member 10 while their upper ends are arranged to support a cross-head 15. These columns are preferably cylindrical in shape and on them is slidably mounted the hammer-head 12 which is provided with two bearings 16 on either side which engage these columns with a close sliding fit. The upper surface of each of the upper bearings is preferably recessed as at 17 to receive a lubricating pad for maintaining the columns in proper lubricating condition.

The upper surface of the cross-head 15 is counterbored as at 18 into which an end 19 of the cylinder 20 is set, see Figure 10. This cylinder is provided with a flange 21 threaded thereon by which it is secured to the cross-head by bolts 22. The upper end of this cylinder is preferably left open as at 23 to permit a free passage of air in and out therethrough so as not to interfere with the quick movement of the piston in the cylinder particularly when it is desired that the hammer-head should drop freely to strike a heavy blow. On the upper end of this cylinder I preferably place a cap 24 having side openings to prevent foreign matter from dropping into and injuring the cylinder.

In this cylinder I have mounted a piston 25 which may be of metal or other suitable material, the same being provided on its lower face with an inverted cup-shaped leather packing 26 and this piston is connected to the hammer-head 12 by the rod 27 and in the lower end of the cylinder I have positioned a ring packing 28, see Figure 10, having both middle and peripheral upturned flanges to prevent leakage of pressure from the cylinder out around the connecting rod.

In order to control the intaking of air into the cylinder and the exhaust therefrom to reverse the action of the hammer, I have mounted a plug-form of valve 29 in the casing 30, the latter being secured to the face of the cross-head 15 by bolts 31. This casing is provided with a large port opening 32 communicating with an opening 33 in the cross head into the cylinder also with a large exhaust opening 34 leading out through the auxiliary or exhaust throttle valve 35 presently described, also with an inlet port 36 while the valve-plug is pro-

vided with a large exhaust opening 37 for conducting the exhaust out through the throttle 35. This plug is also provided with comparatively small inlet opening 38 which is adapted to register with the inlet port 36 connected by a pipe 39 from the supply (not shown) through the pressure throttle valve 40 and check valve 41.

The throttle valve 35 in this particular instance, comprises a plate, see Figure 8, seated on the edge of the valve casing and is provided with a plurality of outlet openings 42 and an operating stem 43. This plate is held in position on the valve casing by a cap 44 and an operating handle 45 is attached to the throttle stem by which it may be rotated to swing between the stops 46 and 47 to regulate the effective or operating size of the openings 48 in this cap 44.

In order to control the reversing action of this plug valve 29 I have mounted a valve shaft 49 in bearings 50, the same being slotted at one end as at 51 to engage the head 52 of the plug valve. To the opposite end of this shaft is connected a lever arm 53 forked at its outer end 54 to engage a roller 55 in the collar 56 secured to the valve-operating rod 57. This valve-rod is mounted to slide vertically in upper and lower bearings 58 and 59 and on it is fixed a stop washer 60 to limit its upward throw, also an adjustable reversing dog 61 is mounted thereon which may be bound in any desired position on the rod by a binding screw 62 so as to be engaged by an ear 63 on the hammer-head when the same rises to lift the valve-operating mechanism and reverse the action of the hammer, also a lower dog 64 is mounted below the hammer-head to be engaged by an ear 65 thereon to throw the valve in the reverse direction as the hammer falls upon the work. This dog is also provided with a handle 66 by which the rod may be operated by hand when desired to control the movement of the hammer-head.

In some instances it is found that when the hammer-head drops rapidly and strikes this dog 64 to reverse the action of the valve and admit a lifting pressure to the cylinder, that this sharp blow throws the valve-mechanism so quickly that it is apt to rebound and so affect the action of the valve. To obviate this difficulty I have mounted a dash-pot cylinder 67 on the rod guide bearing 58 and in this cylinder I have mounted a piston 68 connected at its lower end to the valve rod 57 and I have provided two openings 69 in this cylinder near its lower end through which air is admitted when the piston is raised and through which it is forced as the piston descends, the lowermost hole being very small to check the downward motion of the piston, the cylinder being closed below this hole to trap the air therein and so provide an easy stop for ar-

resting the rapid downward throw of the valve rod. It is also found in practice in some instances necessary to provide additional means for completing the throw of the reversing valve from one position to its other after it has been started by action of the hammer-head, which is accomplished in this particular case by fixing an angularly faced collar 70 on the valve shaft 49, see Figure 6, said collar having a pointed or V-shaped portion, and I have mounted a spring-pressed plunger 71 in a cylinder 72 having a roller 73 at its outer end to press against the angular faces of the collar whereby when the valve shaft is rotated into position to move the point of the angular face just past the center then the spring 74 acting through the plunger on the flattened face of this collar, causes the same to continue its motion and complete the rotation of the valve-shaft and the valve to its extreme throw in either direction, also a further feature is that this spring-pressed plunger serves to assist in preventing a rebounding action of the valve mechanism when rapidly drawn by a movement of the hammer head.

It will be noted that the main or plug-valve 29 has been provided with a relatively small pressure inlet opening 38 owing to the fact that it is found in practice advisable to limit the lifting speed of the hammer so that if for any reason the inlet throttle valve 40 should be opened wide by a careless operator, the upward speed of the hammer would not be sufficient to smash or injure the parts, which would probably be the case in many instances if the size of this port were not so restricted. The pressure usually employed in the operation of my improved hammer varies with the weight of the hammer-head and is just sufficient to raise the hammer at a reasonable speed, but it is of importance that the exhaust port should be of such a size that the volume of the lifting pressure be freely exhausted preferably through a short port leading directly to the air so as not to interfere with the free dropping of the hammer-head in order to obtain its maximum effective blow.

In order to control the extent of the lifting stroke of the hammer-head, I have mounted an adjustable collar 75 on the connecting rod 27 which may be bound in any suitable position thereon by a screw 76, and I have provided a yieldable or flexible buffer to arrest the upward movement of the hammer and I have cupped out the upper end of this collar 75 and have fitted therein a comparatively heavy coiled spring 77 thus absorbing the shock of arresting the upward movement of the hammer even though it is moving rapidly.

It is found in practice that each time the hammer strikes a heavy blow it has a re-

bounding action which causes the piston 25 to lift so quickly in its cylinder that if there is no other means for supplying air to the space below except the small inlet port 38 which is inadequate under these conditions, a partial vacuum is produced in the cylinder below the piston and as result the piston is drawn back with a sudden impulse after being thus raised, permitting the hammer to strike a secondary or rebounding blow which is very apt to spoil the work.

To obviate this difficulty I have provided a plurality of vertical slots 78 in the periphery of the piston so that when raised rapidly the leather packing 26 will collapse slightly or be forced inwardly sufficiently to permit the air under substantially atmospheric pressure to pass into the lower end of the cylinder through these slots and when lifting pressure is again applied to the under side of the piston the packing will spread out and again close these slots forming controlling valves therefor. Such admission of air to the cylinder beneath the piston not only serves to break the partial vacuum produced by the rebounding of the hammer, but also provides an air cushion—which is introduced into the cylinder during the rebounding stroke—which will prevent the hammer from striking a secondary blow upon the work. By thus admitting air at relatively low pressure beneath the piston after the hammer has struck its blow, no resistance is offered to the full free drop of the hammer so that the force of the blow of the hammer is always strictly dependent upon the height to which the hammer is raised above the work and the blows which are given to successive articles are uniform.

Furthermore, by thus admitting air under a low pressure to the cylinder during the rebounding movement of the hammer, a much more uniform movement of the hammer is obtained when the lifting pressure is admitted. By this construction a rebounding blow of the hammer is effectually prevented, but the above describes but one of a number of means which may be employed for accomplishing this purpose.

In the operation of my improved drop-hammer the pressure throttle valve 40 is first opened to admit the cylinder air pressure from any convenient source through the small inlet port to lift the piston and hammer-head.

If it is desired that the device should operate automatically the dog 61 is adjusted to engage the rising hammer to reverse the valve and permit the hammer to drop which dropping action engages the adjusted dog 64 to again reverse the valve to lift the hammer and so to automatically continue its striking action, the extent of the stroke being controlled by the positioning of the dog 61 on the valve rod.

If the exhaust throttle 35 should be tightly closed it would be impossible for the hammer to drop after having been raised, and if it is desired that the hammer should drop slowly to strike a light blow this valve is opened slightly, and when it is desired that the hammer should drop freely to strike a heavy blow it is only necessary to move this throttle valve to wide open position when the hammer will drop with its maximum force.

When it is desired to control the action of the hammer by hand it is only necessary to raise the upper dog 61 and drop the lower dog 64, when by manipulating the handle 66 the stroke of the hammer in both directions may be manually controlled.

My improved pressure-operated drop-hammer is extremely simple and practical in its construction and effective in its operation and by its use, a blow of the hammer may be so nicely controlled that it will strike the lightest tap and its force may be either increased gradually or instantly up to striking the heaviest blow, whereby my improved hammer is particularly well adapted for use in the jewelry art for operating upon the most delicate parts formed of the thinnest of precious metals and in the next instant it may be caused to strike the maximum blow of the free falling hammer-head.

The foregoing description is directed solely towards the construction illustrated, but I desire it to be understood that I reserve the privilege of resorting to all the mechanical changes to which the device is susceptible, the invention being defined and limited only by the terms of the appended claims.

I claim:

1. A pneumatic drop hammer comprising a hammer-head, a cylinder, a single-acting piston in said cylinder having a piston rod connected to said hammer-head, an inlet for supplying air under pressure to said cylinder to lift the piston and hammer, an exhaust valve, means for actuating the exhaust valve to permit the hammer-head to drop to the full end of its stroke, an inlet valve operable to admit said air under pressure to lift the piston when the hammer-head has made its full stroke and means for ad-

mitting air into said cylinder during the rebounding movement of the hammer at a lower pressure than that required to lift the hammer-head, whereby the partial vacuum produced by the rebounding of the hammer will be broken and an air cushion provided in said cylinder which will prevent a secondary blow.

2. A pneumatic drop hammer comprising a hammer-head, a cylinder, a single-acting piston in said cylinder having a piston rod connected to said hammer-head, an inlet for supplying air under pressure to said cylinder to lift the piston and hammer, an exhaust valve, means for actuating the exhaust valve to permit the hammer-head to drop to the full end of its stroke, an inlet valve operable to admit said air under pressure to lift the piston when the hammer-head has made its full stroke and means for admitting air at atmospheric pressure into said cylinder during the rebounding movement of the hammer, whereby the partial vacuum produced by the rebounding of the hammer will be broken and an air cushion provided in said cylinder which will prevent a secondary blow.

3. A pneumatic drop hammer comprising a hammer-head, a cylinder open to the atmosphere at its upper end, a single-acting piston in said cylinder having a piston rod connected to said hammer-head, an inlet for supplying air under pressure to said cylinder to lift the piston and hammer, an exhaust valve, means for actuating the exhaust valve to permit the hammer-head to drop to the full end of its stroke, an inlet valve operable to admit said air under pressure to lift the piston when the hammer-head has made its full stroke, said piston head being provided with ports to permit air from the atmosphere to flow into the chamber of the cylinder beneath said piston head during the rebounding movement of the hammer-head and thereby to break the vacuum in said chamber and a valve on the under face of said piston head operable to close said ports when the pressure of the air admitted beneath the piston head exceeds atmospheric pressure.

In testimony whereof I affix my signature.

ARTHUR V. DA COSTA.