(Model.)

2 Sheets—Sheet 1.

B. FITTS.

DENTAL PLUGGER.

No. 265,950. Patented Oct. 17, 1882.

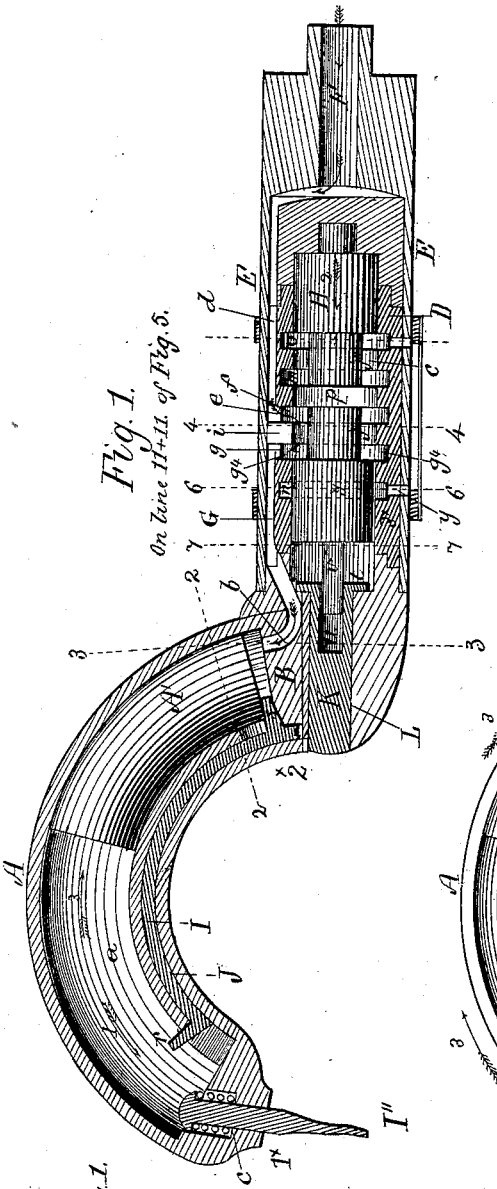

Fig. 1.
On line 1+1 of Fig. 5.

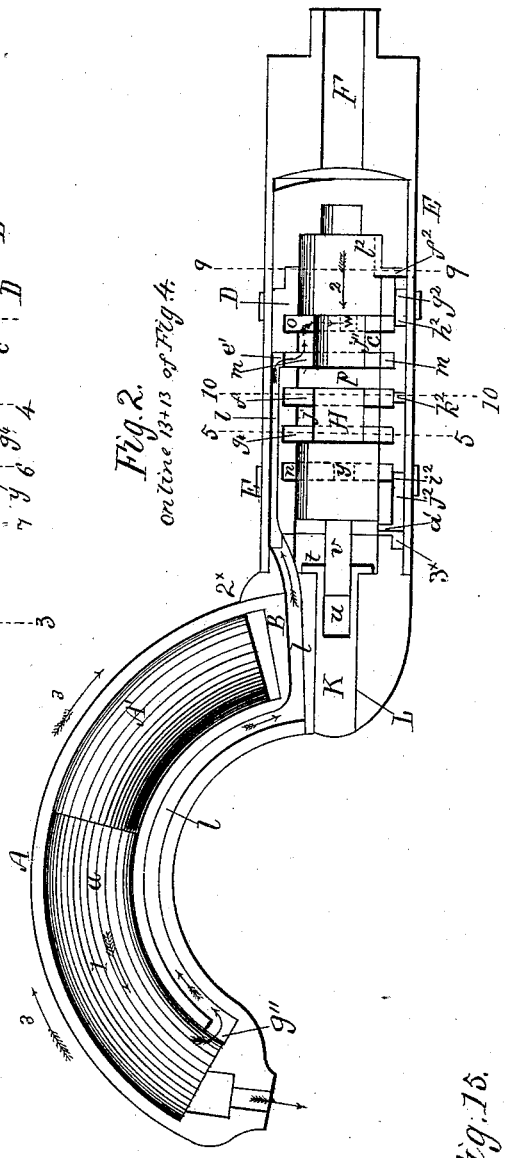

Fig. 2.
On line 2+2 of Fig. 4.

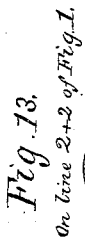

Fig. 13.
On line 2+2 of Fig. 1.

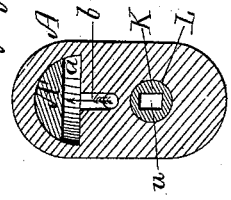

Fig. 14.
On line 3+3 of Fig. 1.

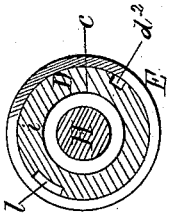

Fig. 11.
On line 4+4 of Fig. 1.

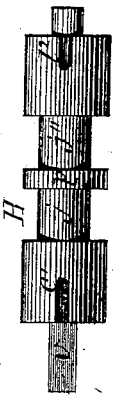

Fig. 15.

Witnesses.
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H. C. Lodge

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H. Curtis. Atty.

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(Model.) 2 Sheets—Sheet 2.

B. FITTS.

DENTAL PLUGGER.

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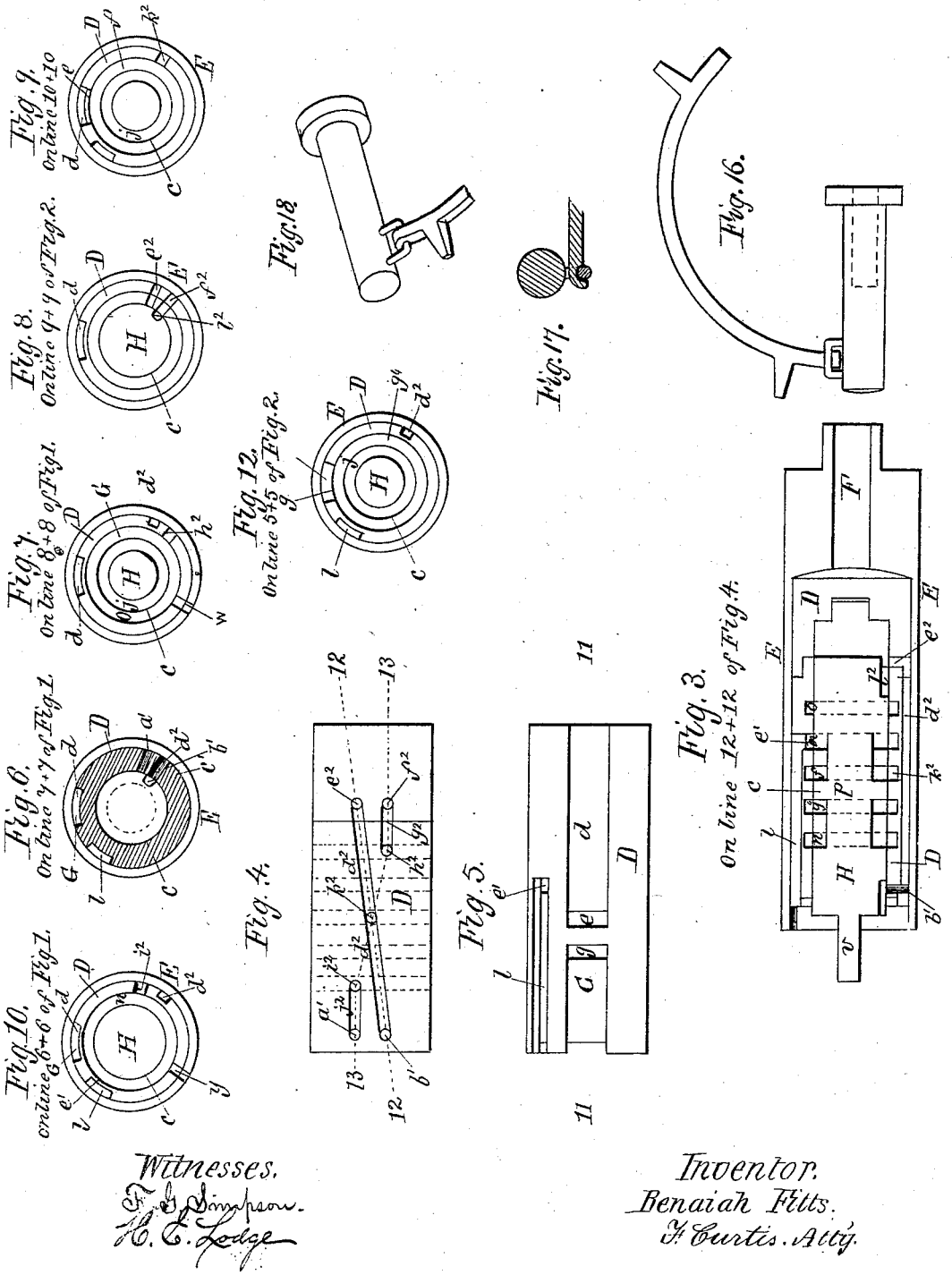

Witnesses.
E. G. Simpson.
H. C. Lodge

Inventor.
Benaiah Fitts.
Y. Curtis. Atty.

UNITED STATES PATENT OFFICE.

BENAIAH FITTS, OF WORCESTER, MASSACHUSETTS.

DENTAL PLUGGER.

SPECIFICATION forming part of Letters Patent No. 265,950, dated October 17, 1882.

Application filed June 16, 1882. (Model.)

To all whom it may concern:

Be it known that I, BENAIAH FITTS, a citizen of the United States, residing at Worcester, in the county of Worcester and State of Massachusetts, have invented certain new and useful Improvements in Dental Pluggers; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to letters or figures of reference marked thereon, which form a part of this specification.

This invention relates to dental plugging-machines; and it consists principally in a valve having reciprocating and partial rotary motion, in combination with its case, a hammer operated by air passing through said valve, a plugger-point operated by said hammer, a cylinder inclosing said hammer and provided with an opening, and an adjustable device for partly closing or uncovering said opening and thereby determining the rapidity of the hammer-strokes.

It also consists in additional improvements in construction and combination of parts, as hereinafter set forth and claimed.

The drawings accompanying this specification represent, in Figures 1 and 2, longitudinal sections of a dental plugger containing my improvements, while Fig. 3 is a longitudinal section of the valve-case and valve and parts. Fig. 4 is an under side view, and Fig. 5 a plan, of the valve-case. Figs. 6, 7, 8, 9, 10, 11, and 12 are cross-sections through the valve and handle. Figs. 13 and 14 are cross-sections through the cylinder. Fig. 15 is a plan of the valve. Figs. 16, 17, and 18 are views showing the manner of connecting the valve with the mechanism by which its axial vibrations are effected.

A in such drawings represents a hollow cylinder, whose bore *a* is of uniform diameter, and I have shown this cylinder in the present instance as curved, or describing the arc of a circle longitudinally, in lieu of being straight, the better to adapt it to the various changes in position required for dental uses.

In order to have a clear understanding of the construction and operation of this engine, I have represented the outlet end of the cylder A—that is, the end at which the air operates to drive the hammer of the plugger—at 1, and the inlet end, by which the air enters the cylinder, at 2. The piston A′ contained in the cylinder A, and which constitutes the hammer of the plugger, is a plain round bolt in the form longitudinally of an arc of a circle or curve, and corresponds to the bore of the cylinder. The ends of this piston are preferably flat radii of the circle of which the arc is part. The inlet end 2 of the cylinder is closed by a head, B, which is pierced by a live supply-port, *b*, while the exit-port at the opposite end, 1, of the cylinder is shown at *c* as occupied by the head of the plugger-point, to be hereinafter described.

The valve-chamber is the bore C of a straight circular tube, D, contained within an outer shell or case, E, which constitutes the handle of the plugger, and is adapted to closely surround such tube, this case E having a supply-port, F, at one end, through which air under pressure finds its way to the valve-chamber by a channel or roadway formed in one end of the circumference of the tube D, as shown at *d* in Figs. 1, 5, 6, 7, and 8 of the drawings. The inner end of this channel *d* terminates in a radial passage or port, *e*, (see Figs. 1 and 5,) cut through the wall of the tube and entering the valve-chamber. This port *e* also constitutes part of or is enlarged into an annular channel or passage, *f*, created in the wall of the bore of such tube and extending peripherally above it, as shown in Figs. 1, 2, and 9, this passage *f* being of larger diameter than the greatest diameter of the valve. I form in the opposite end of the outer circumference of the tube D a second longitudinal channel or roadway, G, (see Figs. 1, 5, and 7,) the inner end of which terminates in a radial port or passage, *g*, which is a companion to the port *f*, and in line with it lengthwise of the tube, and is separated from said port *f* by a narrow integral ledge or unbroken portion, *i*, of the tube D, Figs. 1 and 13, such ledge being practically midway of the ends of the said tube, while the port G is continued into an annular peripheral channel, g^4, formed in the wall of the bore of the tube D. The channel *l* is continued beneath or behind the head B of the cylinder,

thence extends through the cylinder and makes exit into the bore *a* of the latter at its extreme opposite end by a port, *g''*. In addition to the channels G *d* and ports *e g*, I form in the circumference of the tube D, and upon the same end as the passage G, a third parallel longitudinal passage or roadway, *l*, Figs. 2 and 5, extending from the front end of the tube rearward to and communicating with a radial port, *e'*, formed in the wall of the tube, this port *e'* making part of an annular passage or channel, *m*, in the inner circumference of the tube D parallel with the channels *f* and g^4. In addition to the annular channels *f*, g^4, and *m*, I form in the inner periphery of the tube D two other annular channels, *n o*, Figs. 1 and 2, parallel with the channels *f*, g^4, and *m*, and of like size, the purposes of these two last channels being hereinafter explained.

To avoid confusion I shall first describe the construction and operation of the valve in relation to its functions in governing the ports which control the admission of air to the cylinder and the exhaust therefrom, afterward describing the motions of the valve as impelled by the slide-bar before named.

The valve, as shown at H in the drawings, (see Fig. 15,) is a straight cylindrical bolt, adapted in its greatest diameter to closely fill the valve-chamber, and being formed with two peripheral annular channels, *j j''*, separated by a narrow peripheral ledge, *p*, these channels *j j''*, Figs. 1, 2, and 15, constituting in conjunction alternately passage-ways for live air and governing the supply of the same to the cylinder A, as well as to the valve-chamber *c*. These channels *j j''* are of such width as to embrace the two central pairs of peripheral channels in the bore of the valve-chamber with the intervening ledge, as shown in Figs. 1 and 2 of the drawings, and constitute passages by which air may pass from one to the other of such pairs of channels.

I in the drawings, Figs. 1, 2, and 11, represents a curved bar contained and playing longitudinally within a chamber, J, formed in the body of the cylinder A, below its bore *a*, and parallel with the channel *l*, the length of the bar being slightly less than that of the bore of the cylinder, and having upon each end a spur, *r* or *s*, which extends into the said bore, and so as to intercept the piston as the latter completes its motion in either direction. The inner end of the slide-bar I is loosely attached in a suitable manner to the outer end of a cylindrical head or bolt, K, (see Figs. 1 and 16,) which is contained loosely within a socket or chamber, L, formed in the base of the cylinder A below its head B, the inner end, *t*, of the head or bolt K extending into the valve-chamber *c*, and being formed with an axial socket, *u*, polygonal or square in cross-section, which loosely receives an axial horn or spur, *v*, from the adjacent end of the valve, this spur *v* being adapted to slide longitudinally, but not rotate within the socket *u*.

Suppose the valve to be in its extreme position to the right, as shown in Figs. 1 and 2 of the drawings, and the piston A' at the corresponding end of the cylinder A, in which case the valve-channel *j* is in communication with the inlet supply-channel *d* and port *e*, and the peripheral channels *n* g^4 of the valve-chamber, while the channel *j''* of the valve is in communication with the passage *l* and port *e'*, the two pairs *m o* and *f* g^4 of channels being divided by the central rib or ledge, *p*, of the valve closely filling the bore of the valve-chamber. Air under pressure enters the valve-chamber *c* by way of the inlet F, flows into and through the passage *d* and port *e* into the channel *j* of the valve, (see Fig. 1 of the drawings) thence pours from such channel *j*, escapes by way of port *g* into channel G, and from the latter enters the cylinder A by the port *b* and impels the piston in the direction of the arrow 1 until such piston reaches the opposite end of the cylinder and delivers its blow upon the plugger-point, which is shown in Figs. 1 and 2 of the drawings, at 1'', as of the form and adaptation to be hereinafter explained. As the piston completes its traverse and imparts the blow to the plugger-point, a portion of the air in front of such piston, which may be termed the "exhaust," escapes from the cylinder A through the port *g''* into and through the channel *l* and port *e'*, into the channel *j''* of the valve, thence into the peripheral channels *m o* of the valve-chamber, and exhausts or escapes from the instrument by exit-port *w*, leading from the channel *o*, as shown in Fig. 7 of the drawings. As the piston completes its stroke last named and imparts a blow to the plugger-point, such piston, immediately prior to delivering this blow, abuts against the spur *r* of the slide-bar I, and carries the latter with it until its traverse is completed, thereby rocking the head or bolt K, and through the latter the valve H, and shifting the latter to the other set of ports, by which its motion is reversed, as hereinafter explained. The valve H now moves longitudinally in the direction of its arrow 2 until its channel *j* embraces the two outermost channels, *n* g^4, of the valve-chamber, and its channel *j''* the channels *f m* of such valve-chamber, the channel *o* being closed by the solid portion of the valve, so far as connections between this channel *o* and the valve-chamber *c* is concerned, while the central rib or ledge, *p*, of the valve is during the travel of such valve shifted from between the ports *f m* to a point between the ports *f* and g^4, so as to shut off communication between the ports *e* and *g*. Live air now flows through the passage *d* and port *e* into the channel *j''* of the valve, thence into the channels *f* and *m* of the valve-chamber *c*, and makes exit from the latter by the port *e'* into the passage *l*, thence through the latter by way of the port *g''* into the cylinder A, and drives the piston in the reverse direction on its return-stroke, as shown by arrow 3. The passage *l*, which, on the direct stroke of

the piston or hammer, is the exhaust from the cylinder, now becomes the live-passage to drive the said piston in its return, while the cylinder exhausts, by way of the passage *b* G (which at first was the live-inlet) and port *g*, into the channel *j* of the valve and channels *n* g^4 of the valve-chamber, and exhausts from the instrument by way of a port, *y*, leading from said channel *n*, as seen in Fig. 3 of the drawings and dotted lines in Figs. 1 and 2. As the piston or hammer A′ completes its return-stroke last named it abuts against the slide-bar I, and carries the latter with it until it completes its stroke, thereby rocking the head or bolt K and valve H in the opposite direction and shifting such valve with respect to its supply-ports.

I will now describe the arrangement of parts which govern the longitudinal traverse of the valve.

In the under side of the outer or front end, 3, of the tube or valve-case D, I create two radial parts, *a′ b′*, (see Figs. 4 and 6,) which communicate alternately with a longitudinal channel, *c′*, formed in the periphery of the outer end of the valve, (see Figs. 6 and 15,) the extent of axial rocking motion of the valve at the hands of the slide-bar I and bolt or head K being sufficient to shift the port *c′* from one to the other of the ports *a′ b′*. When the valve is in its extreme inward position, as shown in Figs. 1 and 2, the inner boundary of the channel *c′* is covered by the solid portion of the valve-case. When the valve is in its opposite or outward position the inner boundary of the said channel *c′* coincides with either the port *a′* or *b′*, as the case may be. The port *b′* communicates with the outer end of a channel, d^2, created in the circumference of the valve-case D, this channel d^2 being arranged obliquely to the axis of the said case D to such an extent that its rear inner termination is in axial alignment with the port *a′*, (see Fig. 4,) and is continued into a radial port, e^2, Figs. 3, 4, and 9, formed by the valve case D and communicating with the rear end of the valve-chamber *c* when the valve is in its extreme outermost position, as shown in Fig. 3. Furthermore, I form through the valve-case D, at its rear end and on a peripheral line with the port e^2, a radial port, f^2, (see Figs. 2, 4, and 8,) which, like the said port e^2, enters the rear end of the valve-chamber, and this port f^2 communicates by a passage, g^2, formed longitudinally in the periphery of the valve-case D, Figs. 2 and 4, with a radial port, h^2, extending through the valve-case and opening communication between the port e^2 and the channel *o* of the valve-chamber, Figs. 2, 4, and 7. The ports f^2 h^2, channel g^2, and port *b′* are in alignment with the axis of the valve H and valve-case D. Continuing this portion of the instrument, I form a radial port, i^2, Figs. 2, 4, and 6, in the valve-case D, which enters the valve-chamber at a point to communicate with the peripheral channel *n* of such chamber, this port i^2 and the port *a′* being connected by a short channel, j^2, as shown in Figs. 2 and 4. I also form a radial port, k^2, in the valve-case D, which enters the peripheral channel *f* of the valve-chamber and intercepts the long oblique channel d^2. (See Figs. 2, 3, and 4.) Finally, I form in the periphery of the valve H, at its rear or inner end and in axial alignment with the channel *c′*, before named, a short longitudinal channel, l^2, (see Figs. 2, 8, and 15,) the length of which is such that when the valve is at its extreme rearward position, as shown in Figs. 1 and 2 of the drawings, the inner termination of this channel coincides alternately with the ports e^2 f^2, and when the valve is in its extreme outward position, as shown in Fig. 3, the channel l^2 is covered by the solid portion of the valve-case.

While the valve is being driven to its extreme rearward position, (to the right in the drawings,) as shown in Figs. 1 and 2, live air is admitted into the valve-chamber in front of the valve from the space surrounding the channel *j* of such valve by way of the port k^2, channel d^2, and port *b′*, and as the valve reaches its extreme rearward position the piston or hammer encounters the spur *r* of the slide-bar I, and, by moving such bar, rocks the valve (by means of the intermediate head or bolt K,) to such an extent that its channel *c′* is brought into coincidence with the ports *a′* and t^2 and channel j^2, while its channel l^2 is brought in communication with the ports e^2, k^2, and *b′* and channel d^2. The live air now enters the valve-chamber surrounding the channel *j* of the valve through the channel d^2 by way of port k^2, flows through port e^2 and channel l^2 into the rear end of the valve-chamber, (see Fig. 3,) and impels the valve in the direction of its arrow 2. As before stated, live air now passes from valve-chamber *c* to the cylinder by way of the port *g* and passage G *b*, and the hammer A′ is driven in direction of arrow 1, as first stated. As the hammer A′ completes its stroke it moves the bar I and rocks the valve in the opposite direction, thereby bringing the valve-chamber *c′* into communication with the ports *b′*, e^2, and k^2, while the channel l^2 of such valve is covered and idle. Air now enters the front end of the valve-chamber by way of the ports k^2 and *b′* and passage *c′*, and drives the piston rearward until it brings up at the opposite end of its chamber.

It is not essential that the cylinder A should be curved, as explained. It may be straight and in axial alignment with the handle E, and in this case a plain slide-valve may be employed in lieu of a cylindrical one having the compound motion explained, or the entire body of the instrument, including the handle, with some modifications of the valve, may be upon a curve in lieu of the handle being straight.

I prefer that the position of the axis of the plugger-point shall be a tangent to the curve of the bore of the cylinder, as shown in Figs. 1 and 2 of the drawings, in order that the blows of the hammer upon the head of such

point may tend to crowd the latter in a direction outward from the patient's mouth, in order the more effectually and easily to plug the tooth from any position.

The channel J, as before stated, constitutes on the direct stroke of the hammer a vent or exhaust to the cylinder A, which is essential to avoid the resistance which would otherwise be opposed to such hammer, and such channel, also, as before explained, constituting the direct airway when the hammer returns; and as it is desirable in instruments of this class that the repetitive blows of the hammer shall be comparatively slow, while the blow struck is a quick and powerful one, I have added to my instrument means for permitting the hammer to return as slowly as may be desired, while it is driven forward with great rapidity and momentum. To effect this I have shown in the present instance a sleeve, a^3, surrounding and adapted to slide upon the cylinder A, and operating to open or close to any extent an opening, b^3, in such cylinder. The greater the area of the aperture b^3 the less the power exerted upon the hammer A′ in its return-stroke, and vice versa.

I claim—

1. A valve having reciprocating and partial rotary motion, in combination with its case, a hammer operated by air passing through said valve, a plugger-point operated by said hammer, a cylinder inclosing said hammer and provided with an opening, and an adjustable device for partly closing or uncovering said opening and thereby determining the rapidity of the hammer-strokes, substantially as set forth.

2. In combination with the tubular cylinder A, piston-hammer A′, and valve H, the head or bolt K, connected with one end of the slide-bar I, the latter having spurs upon each end protruding into the cylinder to intercept the hammer, substantially as stated.

3. The passage *l*, in combination with the cylinder A, piston-hammer A′, handle E, and valve H with the various ports and passages, as hereinbefore described, whereby the said passage becomes during the direct stroke of the hammer a vent or exhaust to the cylinder, and on the return-stroke of the hammer a direct live-port, substantially as before described.

4. In combination with the cylinder and its piston-hammer and vent or exhaust-passage, a device for governing the area or capacity of such exhaust, for purpose explained.

5. The valve H, containing the annular peripheral channels *j*, co-operating with the peripheral channels $f\,g^4$ in the valve-chamber, and the channel j'', co-operating with the channels *m o* in said chamber, with the intermediate ledge or collar, *p*, adapted to close communication between such two pairs $f\,g^4$ and *m o* of channels.

6. The combination, with the cylinder A, handle E, and valve-cage D, of the passages G, *b*, and *l* and ports *g* and e', communicating with such cylinder and with the valve-chamber, as explained, whereby air admitted to the cylinder direct by way of the port *g* and passage G *b* exhausts by way of the passage *l* and port e'.

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

BENAIAH FITTS.

Witnesses:

H. E. LODGE,

F. CURTIS.