

No. 719,804.

PATENTED FEB. 3, 1903.

D. HONEYWOOD.

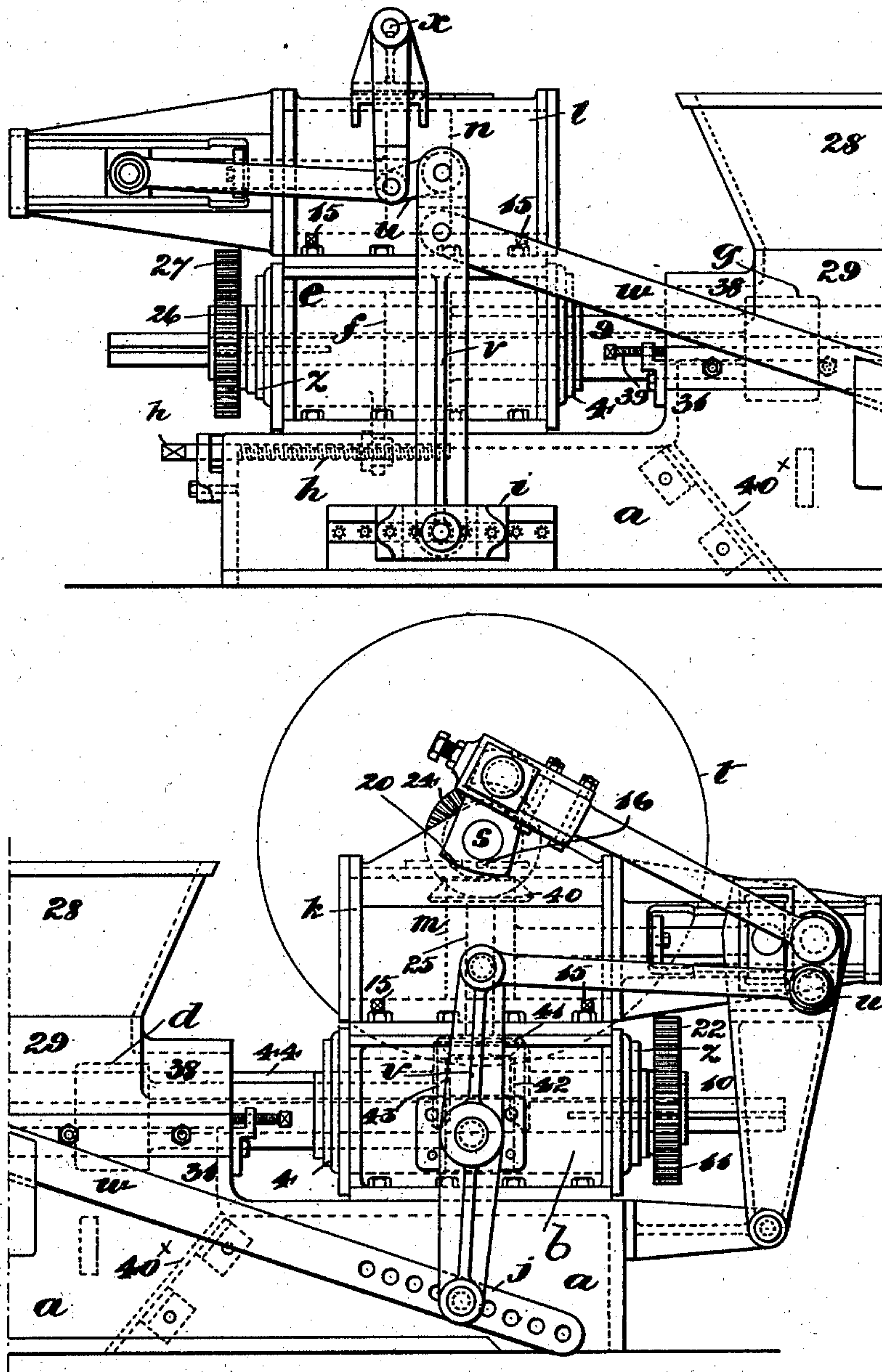
MACHINERY FOR CRUSHING OR GRINDING ORE, ROCK, CEMENT, &c.

APPLICATION FILED JUNE 20, 1902.

NO MODEL.

3 SHEETS—SHEET 1.

*Fig. 1.*



*Witnesses.*

*Stephen Edward Gumpson*  
*William Anderson Smith*

*Inventor.*

*David Honeywood*

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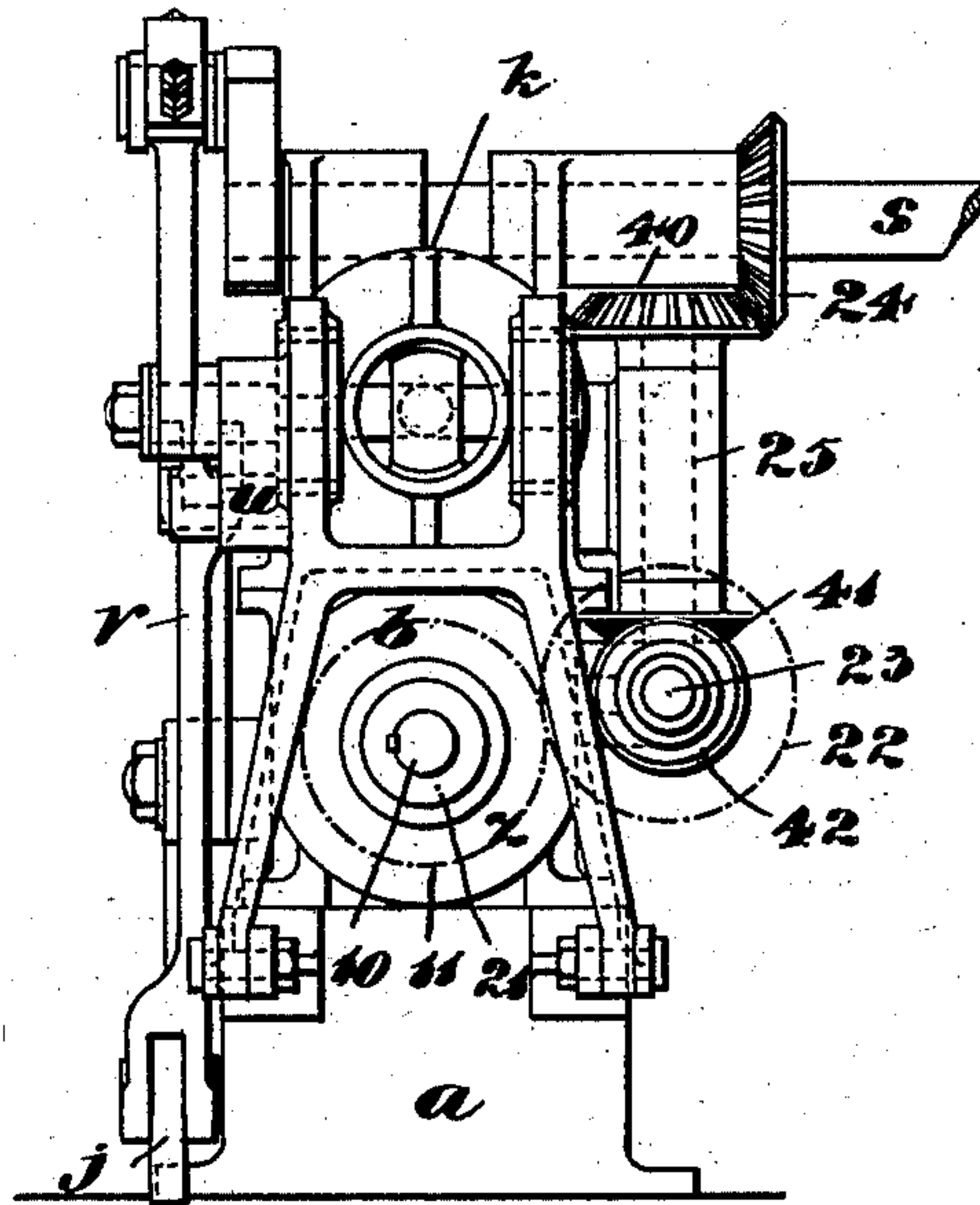
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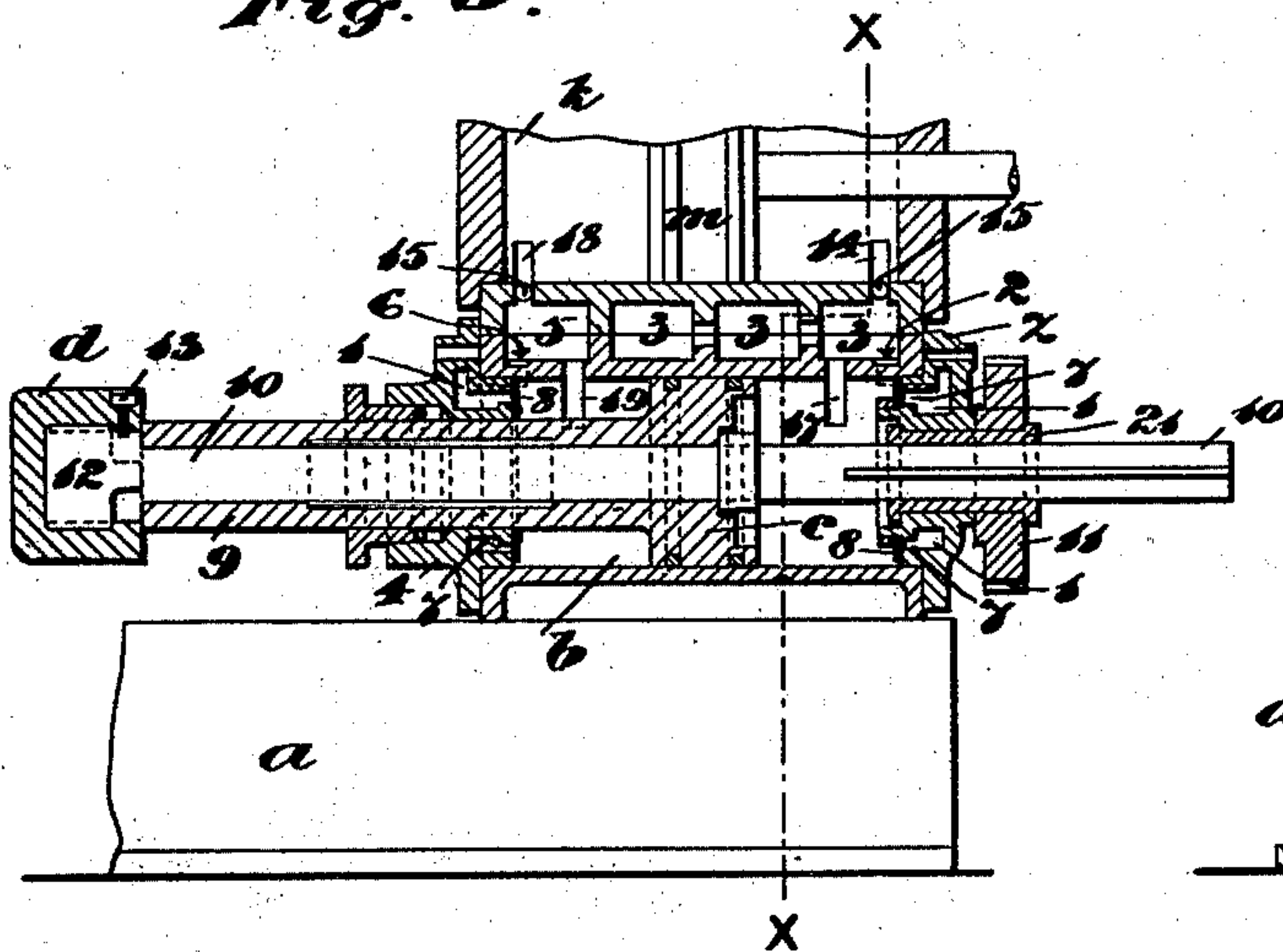
NO MODEL.

3 SHEETS—SHEET 2.

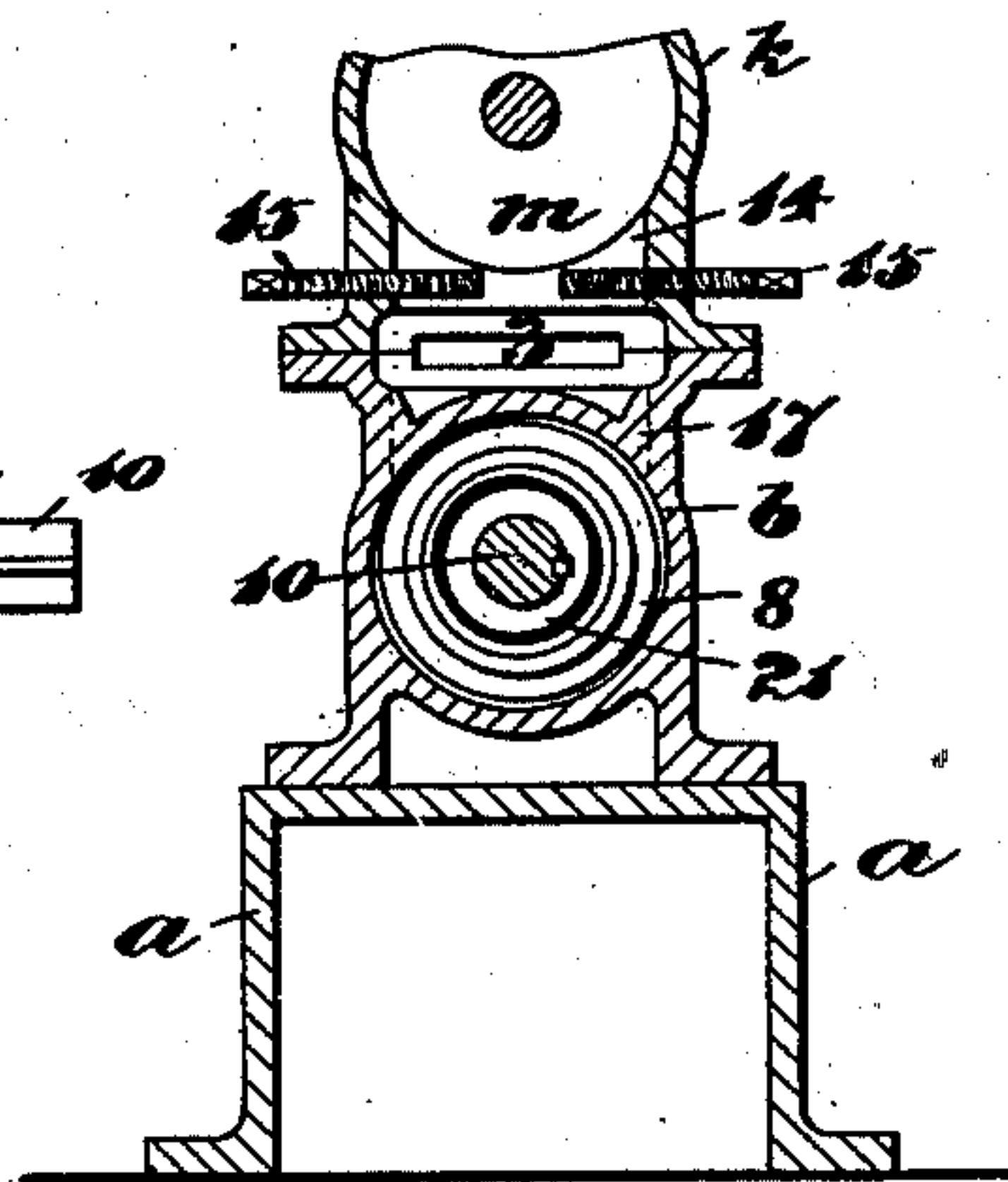
*Fig. 2.*



*Fig. 3.*



*Fig. 4.*



*Witnesses.*

*Stephen Edward Gumpson*

*William Anderson Smith*

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NO MODEL.

3 SHEETS—SHEET 3.

Fig. 5.

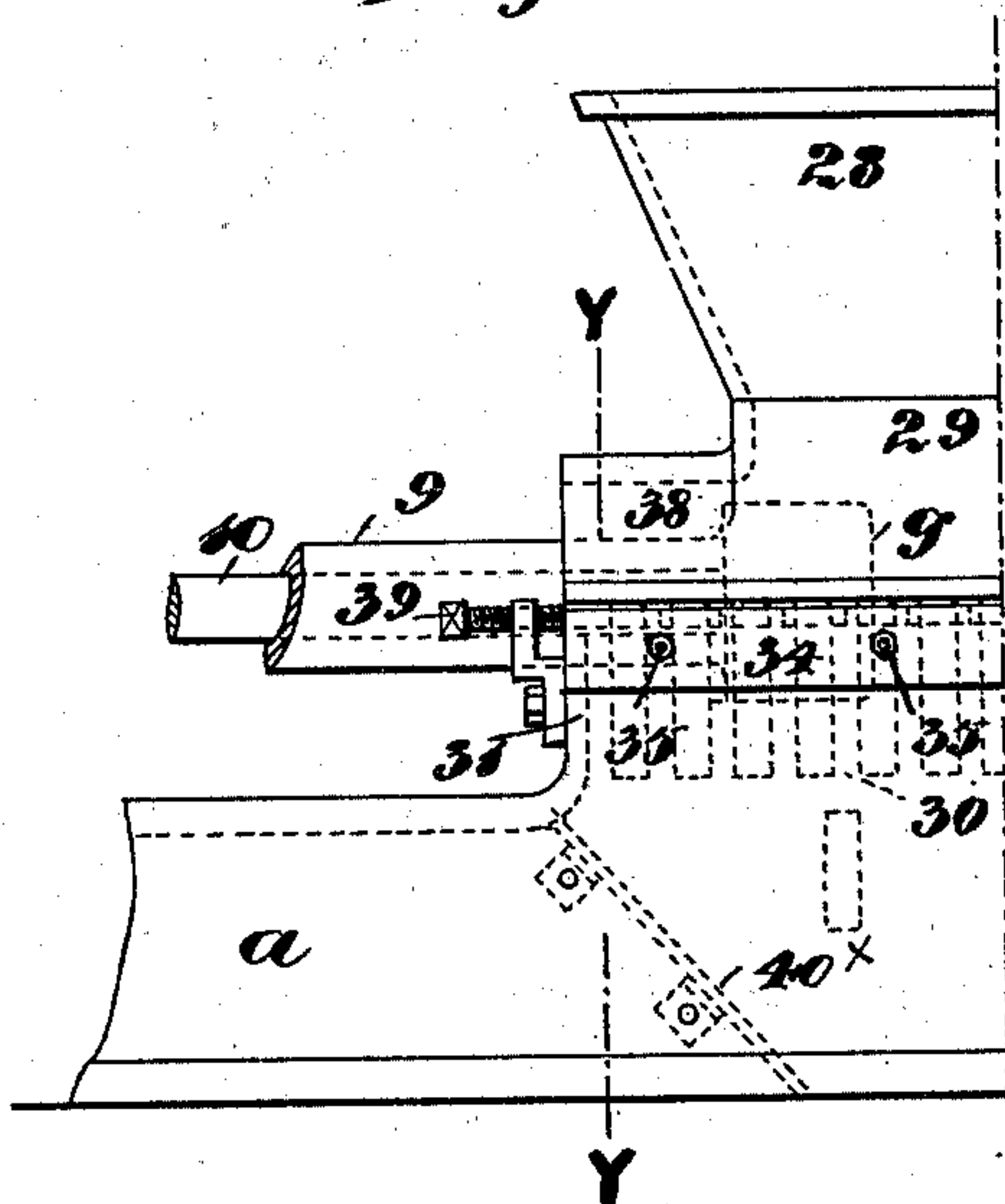


Fig. 7.

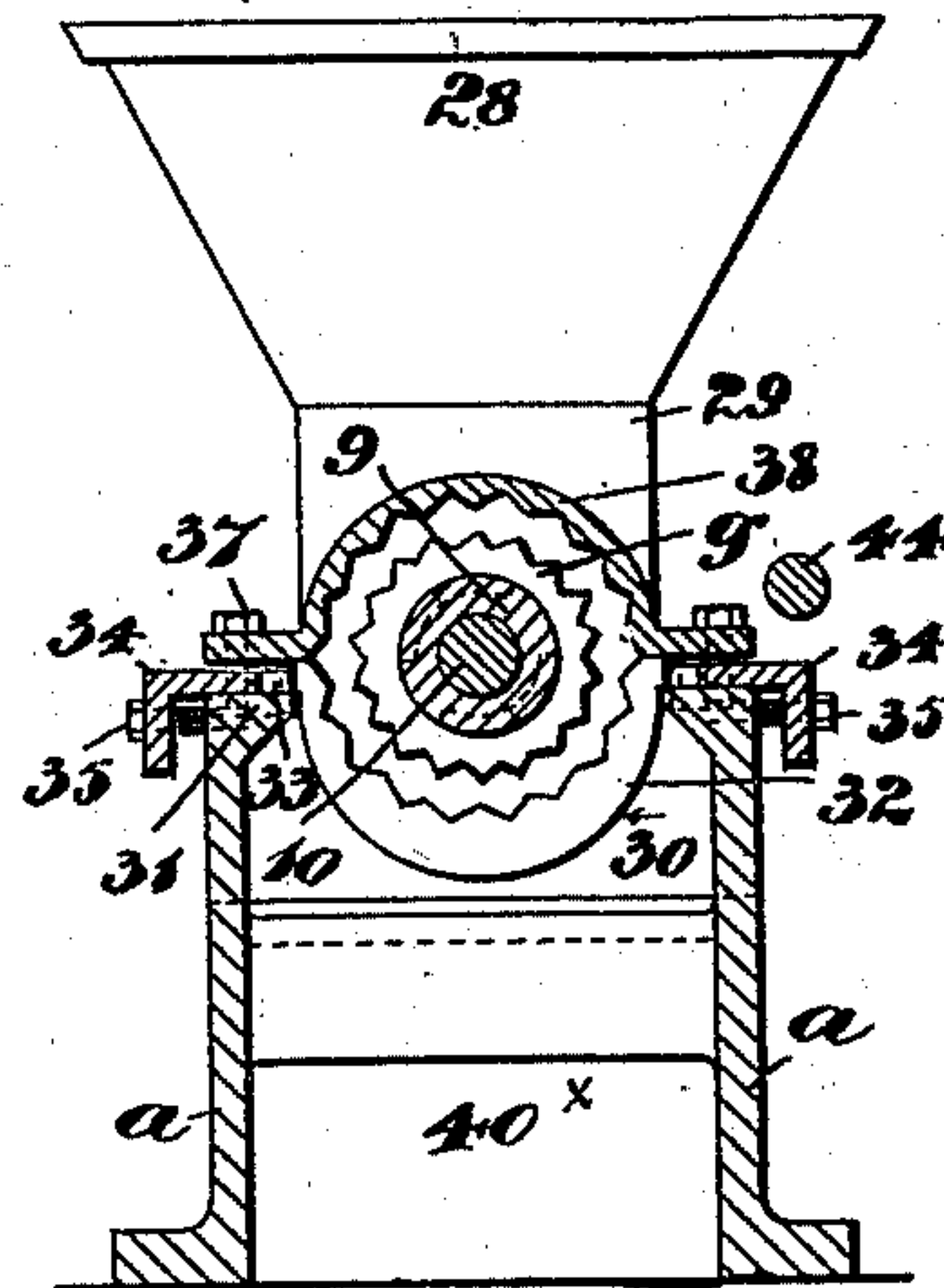
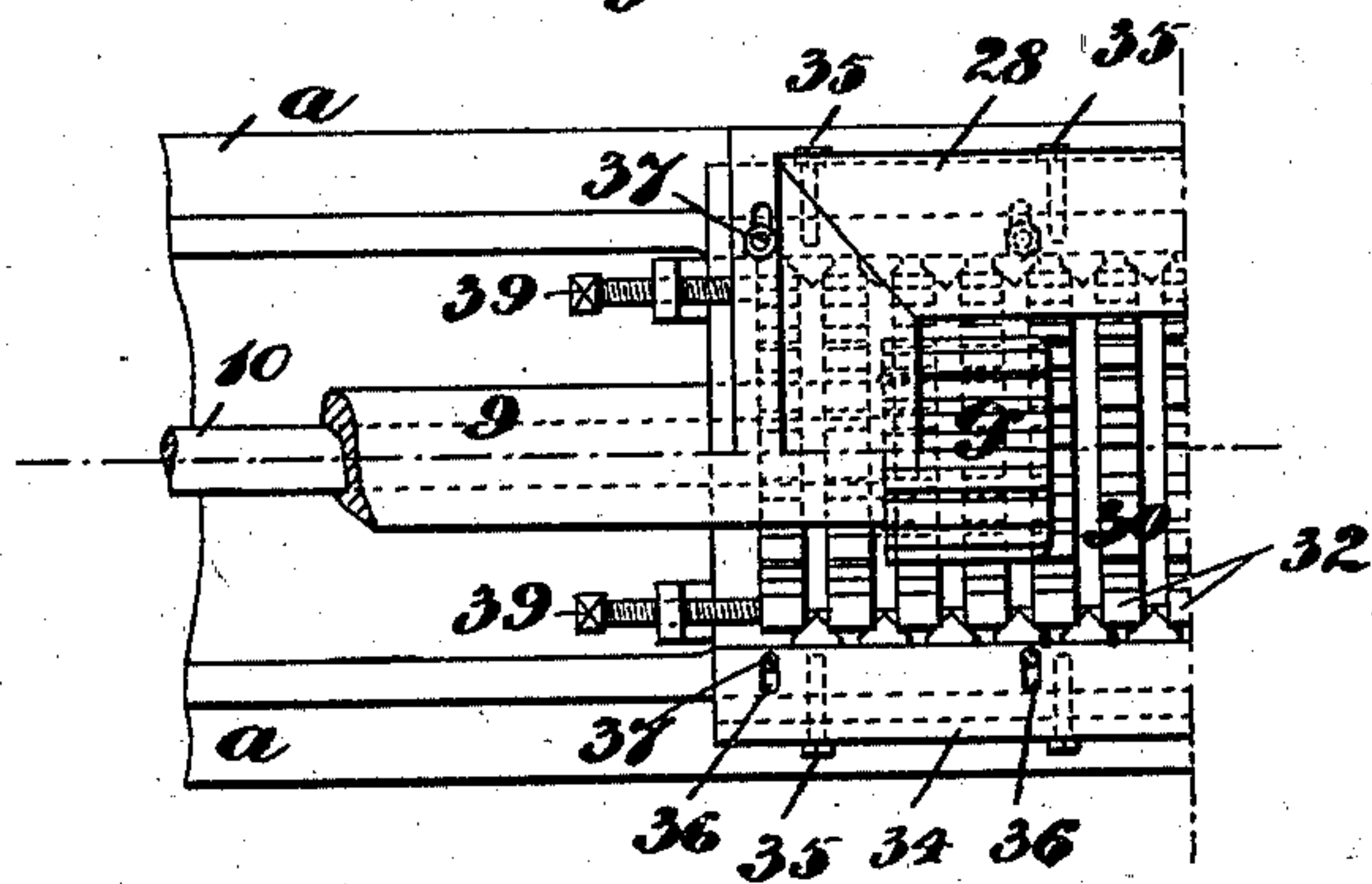


Fig. 6.



Witnesses.

Stephen Edward Gungor  
William Anderson Smith

Inventor.

David Honeywood



# UNITED STATES PATENT OFFICE.

DAVID HONEYWOOD, OF LONDON, ENGLAND.

MACHINERY FOR CRUSHING OR GRINDING ORE, ROCK, CEMENT, &c.

SPECIFICATION forming part of Letters Patent No. 719,804, dated February 3, 1903.

Application filed June 20, 1902. Serial No. 112,541. (No model.)

*To all whom it may concern:*

Be it known that I, DAVID HONEYWOOD, a subject of the King of Great Britain, residing at London, England, have invented certain  
5 new and useful Improvements in Machinery for Crushing or Grinding Ore, Rock, Cement, and the Like; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable  
10 others skilled in the art to which it appertains to make and use the same.

My invention relates to improvements in apparatus for crushing or grinding metallic ore, rock, cement, and the like, and is designed to  
15 furnish more efficient means whereby the object is attained in less time than with apparatus heretofore in use.

The invention consists in the features and combination and arrangement of parts hereinafter described, and particularly pointed  
20 out in the claims.

In order that my invention may be clearly understood, I will now describe the same with the aid of the accompanying drawings, in  
25 which—

Figures 1 and 2 are respectively longitudinal and end elevations of a crushing-machine with my improvements applied thereto; Fig. 3, a partial longitudinal section of the compression-cylinder and the crusher-head or stamp cylinder; Fig. 4, a cross-section taken on line X X of Fig. 3; Figs. 5 and 6, respectively, an elevation and plan of the central portion of the machine, showing details of the  
30 feeding-hopper and graduating-screen or grating beneath; and Fig. 7, a cross-section on line Y Y of Fig. 5.

Similar reference letters and numerals relate to like parts throughout the drawings.

40 In the example illustrated in the above figures at the right-hand end of the cast-iron or other suitable bed-plate *a* is fixed the cylinder *b*, containing a piston *c*, the rod of which carries a crusher-head or stamp *d*, somewhat  
45 similar to the ordinary steam or other pressure actuated hammer. At the opposite end of the bed-plate *a* is adjustably fixed a similar cylinder *e*, with its piston *f*, the rod of which also carries a crusher-head or stamp *g*.  
50 This latter cylinder *e* and its appurtenances are fixed adjustably, so that the whole can be moved toward or away from the first-men-

tioned cylinder *b* in order to increase or diminish the distance between the crusher-heads *d* and *g*, and thereby regulate to a certain extent the crushing effect. By reference  
55 to Fig. 1 of the drawings it will be obvious that this is accomplished by means of the screw-gear *h*, the slide *i*, and the adjustment provided at the end of the connecting-rod *j*  
60 for operating the mechanism.

Above the aforesaid cylinders *b* and *e* are fixed or formed therewith cylinders *k* and *l*, the pistons *m* and *n* of which by their respective reciprocating motions compress air and  
65 force it through ports or valves into and withdraw it from the stamp or crusher-head cylinders *b* and *e* for the purpose of actuating the stamps *d* and *g*. The last-named pistons *m* and *n* are preferably actuated by means of  
70 a crank-shaft *s*, driven by the pulley *t* and belt-gear or other convenient means provided at one end of the machine. The production of pressure and the corresponding action of  
75 the stamp *g* at the other end of the machine are governed by the same crank-shaft *s* through the links *u*, levers *v*, connecting-rod *w*, and rocking shaft *x*, thus effecting the movement of the one stamp toward the other at the same  
80 moment. In some cases I prefer to maintain the hammer-head or stamp *g* in the forward position supported by a cushion of air inclosed within the cylinder *e* at the back of the piston *f* in order to resist the blow given by  
85 the other stamp *d* in the act of crushing. This is effected by closing the inlet or exhaust port of cylinder *l*, so as to effectually prevent the admission or escape of air, thereby keeping the stamp *g* in the extended position for  
90 the time being.

The constructions of the cylinders and stamps at both ends of the machine are identical, so that the description in detail of one will suffice.

Referring to Figs. 3 and 4, at one end of the  
95 cylinder *b* is provided a hollow cover *z*, the annular chamber 1 of which is in direct communication, by means of port 2, with the compressed-air reservoirs 3, which are interposed between the cylinders *b* and *k*. At the oppo-  
100 site end of the cylinder *b* is provided a similar hollow cover 4, communicating with the reservoir or exhaust chamber 5 by means of the port 6. In these covers *z* and 4 are pro-



vided ports 7, leading to the interior of the cylinder *b* and are covered by a leather or other suitable flap to form a valve 8, being kept closed or opened, as the case may be, by the action thereon of the compressed air or other fluid.

To effect the turning movement of the crusher-head or stamp *d*, hereinafter more fully described, I have found it convenient to provide the piston *c* with a hollow piston-rod 9, which is threaded loosely on the rod or shaft 10, carrying the crusher-head or stamp *d*, thereby leaving the piston *c* free to reciprocate without necessarily rotating, while at the same time the rod or shaft 10, carrying the crusher-head or stamp *d*, may be continuously rotated by means of the spur-wheel 11 and the gearing at the end of shaft or by other suitable means.

The crusher-head or stamp *d* is preferably made of steel and fixed to the enlarged end 12 of the rod 10 by means of a bayonet-joint attachment and set-screw 13, whereby the heads can be very readily renewed.

The compressed-air reservoirs 3 between the cylinders *b* and *k* may communicate with one another or not, as may be required, and the area of the ports 14, admitting air from the compressor-cylinder *k* into the chamber 3, may be regulated at will by means of the adjusting-screws 15 or other equivalent means. The exhaust-port 18 may be similarly fitted, whereby the compression of air is limited and the effect of the blow decreased or increased, as may be desired.

The action of the machine is as follows: When the driving-pulley *t* is rotated by means of belt-gear or otherwise, the crank-shaft *s*, with its connecting-rod and gear, imparts a reciprocating motion to the compressor-piston *m*, and by means of the links *u*, lever *v*, connecting-rod *w*, and rocking shaft *x* a like reciprocating motion is transmitted to the opposite end of the machine, as hereinbefore described. Air admitted by the port 16 behind the piston *m* is compressed and forced through a port 14, Fig. 3, into the reservoir or chamber 3 and thence into the annular reservoir 1 in the cover *z*, (the crusher-head or stamp piston *c* meanwhile covering and preventing admission of air by means of the port 17.) Upon a predetermined degree of compression being reached sufficient to overcome the resistance offered by the cushion of air made by the return stroke of the stamp *d* the flap-valve 8 is opened, thereby allowing the admission of the compressed air or other fluid into the cylinder *b* behind the piston *c*, forcing it slowly forward until it passes the port 17, when the full pressure and volume of air contained in the reservoir 3 acts directly onto the back of the piston and effects the crushing blow between the two stamps, the other and opposite stamp *g* traveling at the same time toward *d* by similar means. The return stroke of the crusher is effected partially by the recoil, aided by the admission of a small

quantity of compressed air through the port 18 into the reservoir 5, thence through the port 6 into the hollow cover 4, and directly into the cylinder *b* by the port 19 to the opposite side of the piston, air being admitted into the compression-cylinder *k* by the port 20.

In some cases I impart a turning movement to the hammer-heads or stamps similar to that provided in the well-known rock-drills; but in the drawings I have shown means whereby the crusher-heads or stamps *d* and *g* are continuously rotated in opposite directions. For the purpose of rotating the crusher-head or stamp *d* I key the spur-wheel 11 to a suitable sleeve 21, provided with a longitudinal slot to allow of the reciprocating movement of the piston or crusher-head. The spur-wheel 11 is driven by the spur-wheel 22, mounted on the shaft 23, Figs. 1 and 2, which receives its motion from the crank-shaft *s* through the bevel-wheels 24 and 40, vertical shaft 25, and bevel-wheels 41 and 42. (Clearly indicated in Figs. 1 and 2.) The bevel-wheel 41 also imparts rotary motion to the bevel-wheel 43, (dotted lines, Fig. 7,) keyed on the end of the shaft 44 and carrying at its other end the spur-wheel 27, which by the spur-wheel 26 rotates the hammer-head or stamp *g* in the opposite direction to that of the hammer-head or stamp *d*, means being provided on the shaft 44 for the adjustment of the spur-wheel 27 when the stamp *g* is brought nearer to or farther from the stamp *d* by means of the screw adjustment *h*, hereinbefore referred to. In some cases, however, the two stamps *d* and *g* may be caused to rotate in the same direction.

To facilitate the delivery and dealing with the ore or other material to be crushed between the hammer-heads or stamps, I interpose between the stamps *d* and *g* a hopper 28, containing-box 29, and grating or graduating-screen 30, built up, as shown clearly, for example, in Figs. 5, 6, and 7, in the following manner: The bed-plate *a* is provided with a raised portion 31, upon which the bars 32, forming the screen or grating 30, are placed. Upon the same surface and between each of these bars 32 is placed loosely a wedge-shaped piece of metal 33, which pieces are kept up to their work by means of the angle-bars 34, which are provided with adjusting-screws 35, screwed into the raised portion of the bed-plate 31. The angle-bars 34 are also provided with slotted holes 36 and bolts and nuts 37, whereby they are firmly clamped to the bed in any desired position. The bars 32 are preferably made to conform more or less to the circumferential contour of the hammer or crusher heads, and I have found it advantageous to provide them with a serrated surface, thereby obtaining to an extent a grinding effect when the crusher-head is rotating, as shown in Figs. 6 and 7. The hopper 28, containing-box 29, and extension of same 38 may be conveniently made in one piece, as shown, and form a ready means of clamping the grating or graduating-screens 30 firmly to



the bed-plate in any desired position, the extension 38 being similarly provided with an internal serrated surface. The dogs or clamping-screws 39 shown at the end of screen 30 are for the purpose of insuring that the whole of the bars 32 are perfectly closed upon the edges of the wedges 33 previous to the tightening of the nuts on the bolts 37. A hopper 40<sup>x</sup>, Figs. 1 and 5, is provided beneath the grating or screen 30, wherein the material crushed is collected and taken away by any convenient means.

It is obvious that the above-described method of supporting the anvil of a crushing-machine or stamp by a cushion of compressed air may also be applied to any of the known forms of vertical crushing-machines or stamps.

I am aware that various forms of stamps have from time to time been employed for the purpose of crushing or grinding ore and other material, which stamps have been actuated by fluid-pressure through a cylinder and piston similar to the action of the steam, pneumatic, or vacuum hammers commonly used for forging purposes; but the results obtained have hitherto been more or less unsatisfactory.

I am aware that it is old to employ two reciprocating stamping-heads movable toward and from each other—such, for instance, as in Letters Patent of the United States No. 534,866, dated February 26, 1895, which discloses also the feature of giving the stamps rotary movement in opposite directions—and I do not claim these broad features as of my invention.

I claim—

1. In a grinding or crushing machine, the combination of two horizontally-reciprocating heads or stamps, moving toward and from each other, a fixed driving-cylinder for one

of the heads or stamps, a fixed compression-cylinder, driving and compression cylinders for the other stamp, adjustable toward and from the driving and compression cylinders of the head first mentioned; pistons in the compression and driving cylinders and adjustable lever and link connections between the pistons of the compression-cylinders, substantially as described.

2. In a crushing or grinding machine, a head or stamp, a piston connected therewith, a cylinder in which the piston moves, a compression-cylinder and piston, reservoir-chambers 3 between the cylinders, a port 17 leading from the reservoir-chambers into the cylinder of the stamp, said cylinder having a reservoir-chamber also in its end cover, a port leading from the reservoir-chambers 3 to the said reservoir-chamber in the cover and valves controlling the inlet of the fluid from the last-named reservoir-chamber into the cylinder back of the piston to move said piston to the port 17 to receive therefrom the full pressure of air, substantially as described.

3. In a crushing or grinding machine the combination of two horizontally reciprocating and rotating hammer-heads or stamps, with variable strokes, a fixed driving-cylinder and compression-cylinder, an adjustable driving-cylinder and compression-cylinder, adjustable valve mechanism whereby one of the said driving-cylinders and compression-cylinders may be thrown out of gear and the hammer-head or stamp thereof serve as a more or less cushioned anvil or block, substantially as described.

In witness whereof I have hereunto set my hand in presence of two witnesses.

DAVID HONEYWOOD.

Witnesses:

STEPHEN EDWARD RUNYON,  
WILLIAM ANDERSON SMITH.