No. 743,799. PATENTED NOV. 10, 1903.

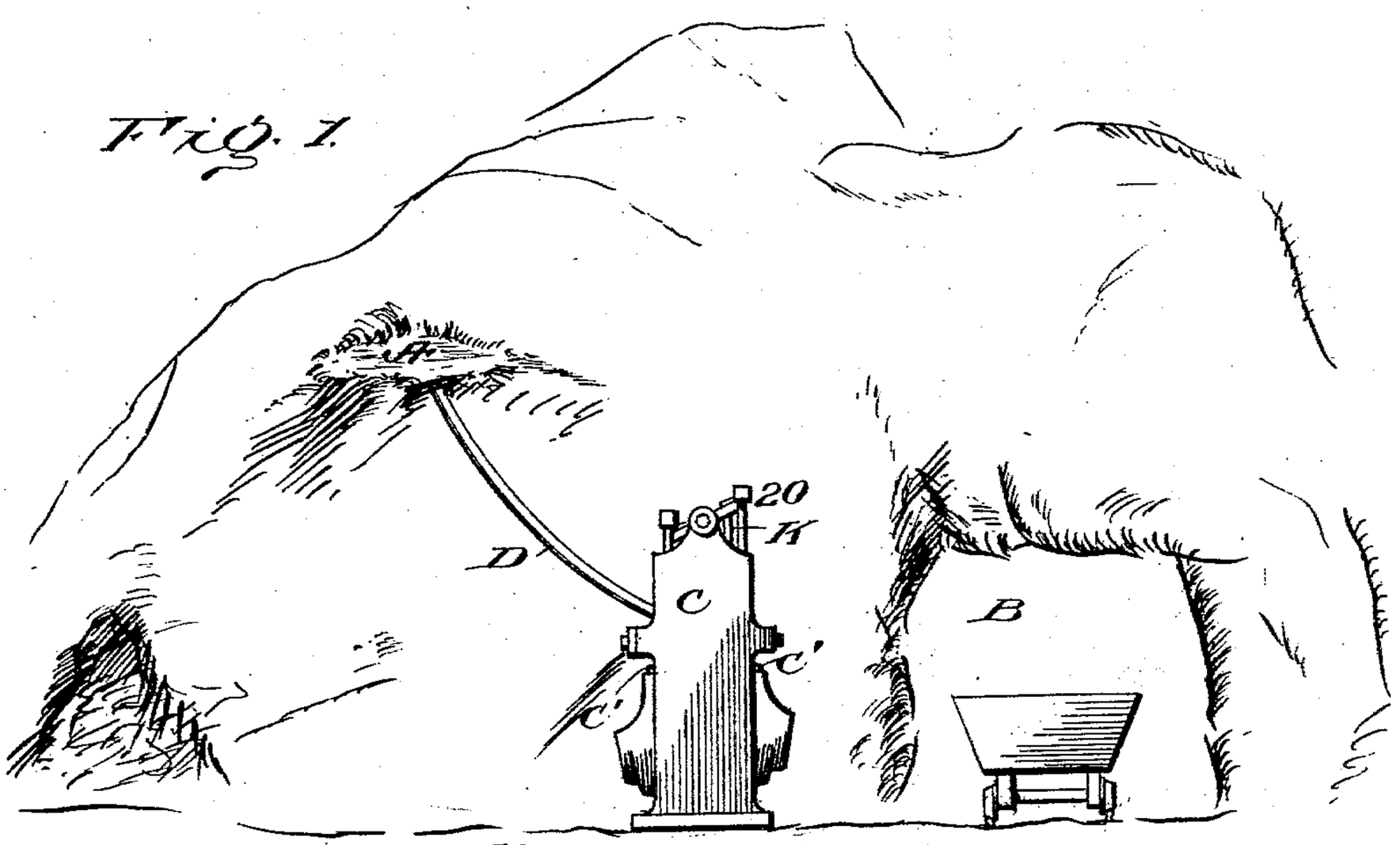
J. C. ANDERSON.

METHOD OF CRUSHING AND STAMPING ORES.

APPLICATION FILED MAR. 3, 1903.

NO MODEL. 5 SHEETS—SHEET 1.

Fig. 1.



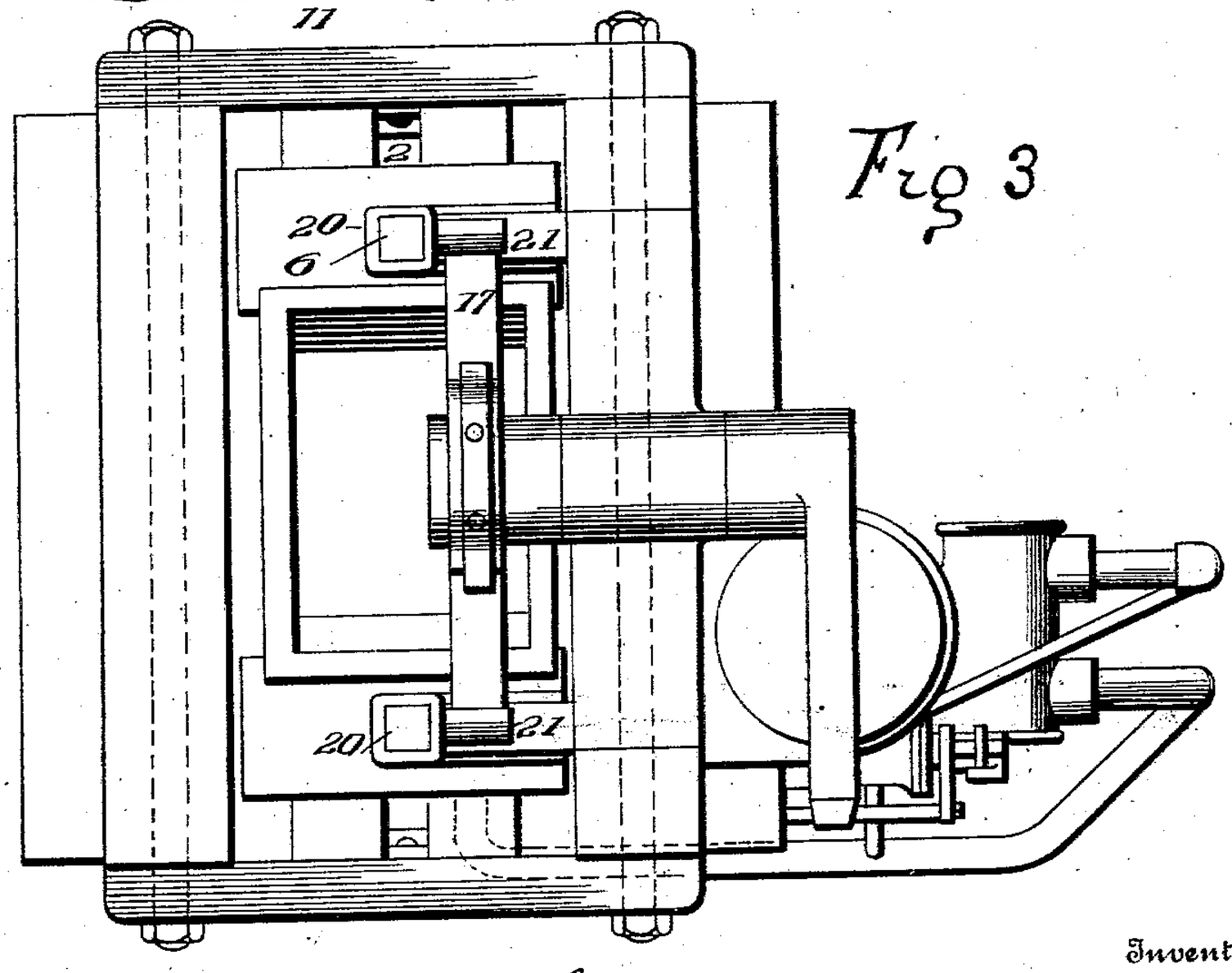


Fig 3

Witnesses

Jno. Munn

F. P. Kendall.

Inventor

Jas. C. Anderson

By Wm. C. W. Entire.

Attorney

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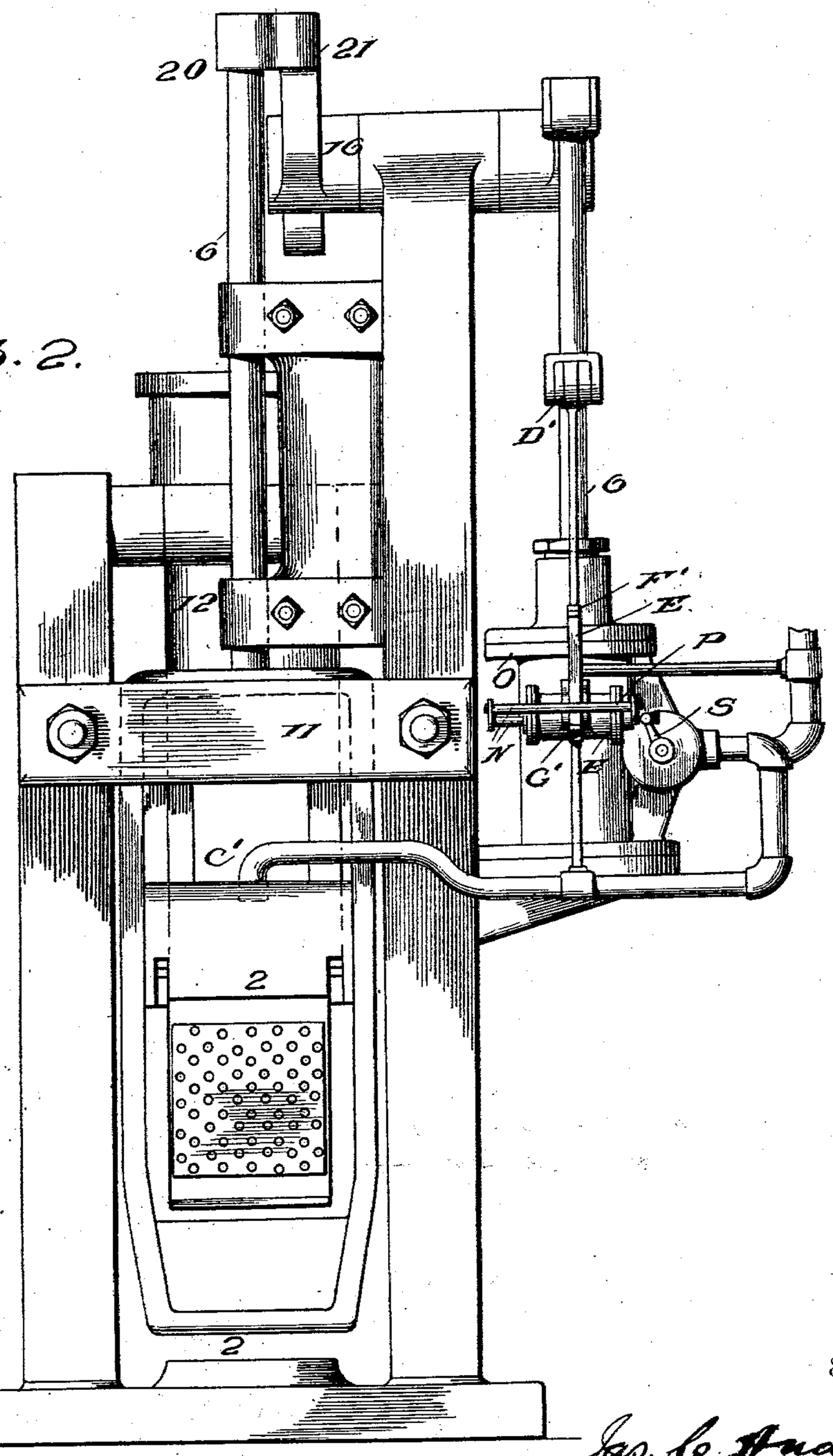
NO MODEL. 5 SHEETS—SHEET 2.

Fig. 2.



Witnesses

Inventor

Jas. C. Anderson

By Wm. Connolly Attorney

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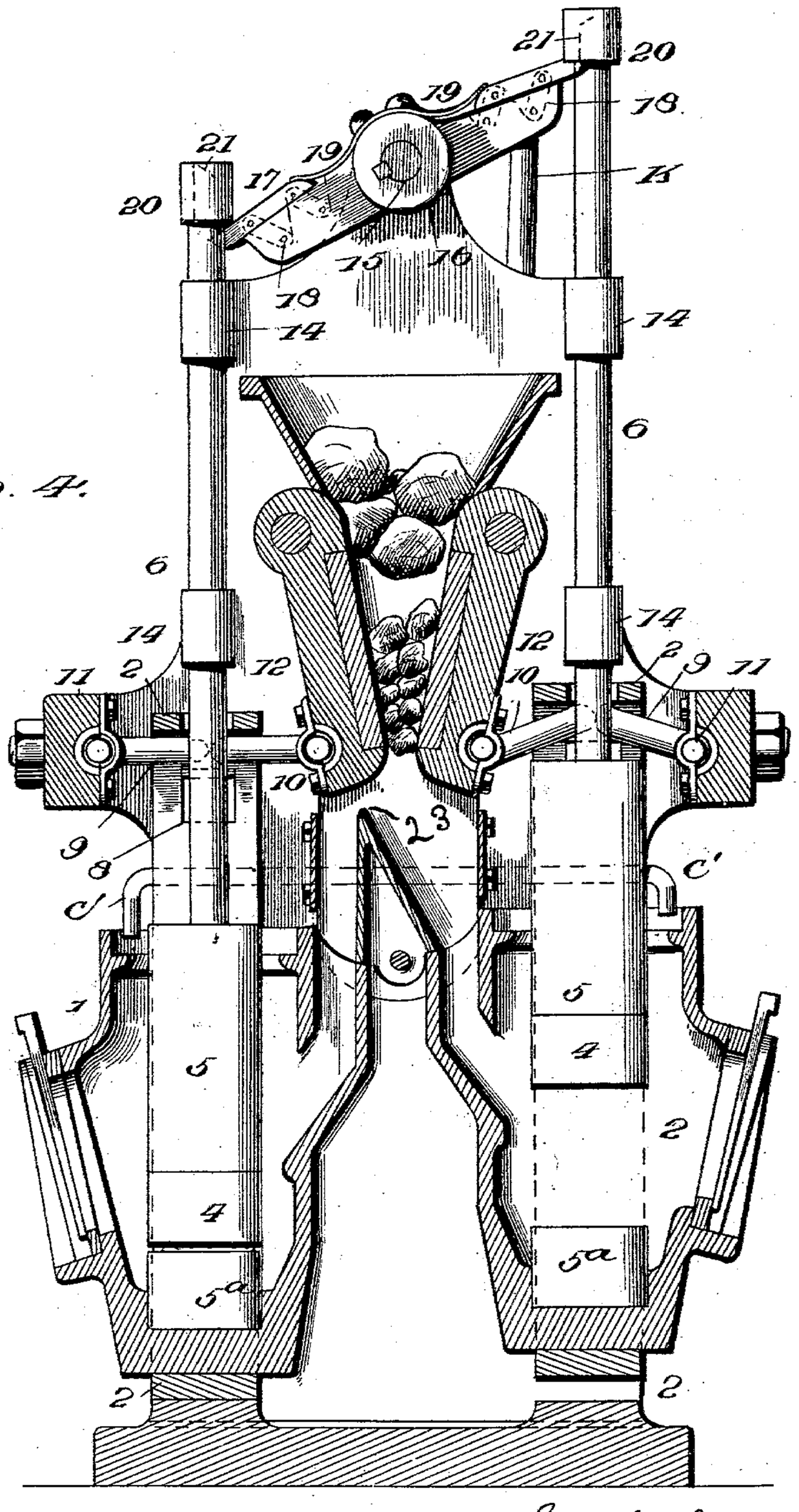
NO MODEL. 5 SHEETS—SHEET 3.

FIG. 4.



Witnesses

Inventor

Jas. C. Anderson

By Wm. C. Redmore

Attorney

No. 743,799. PATENTED NOV. 10, 1903.

J. C. ANDERSON.

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NO MODEL. 5 SHEETS—SHEET 4.

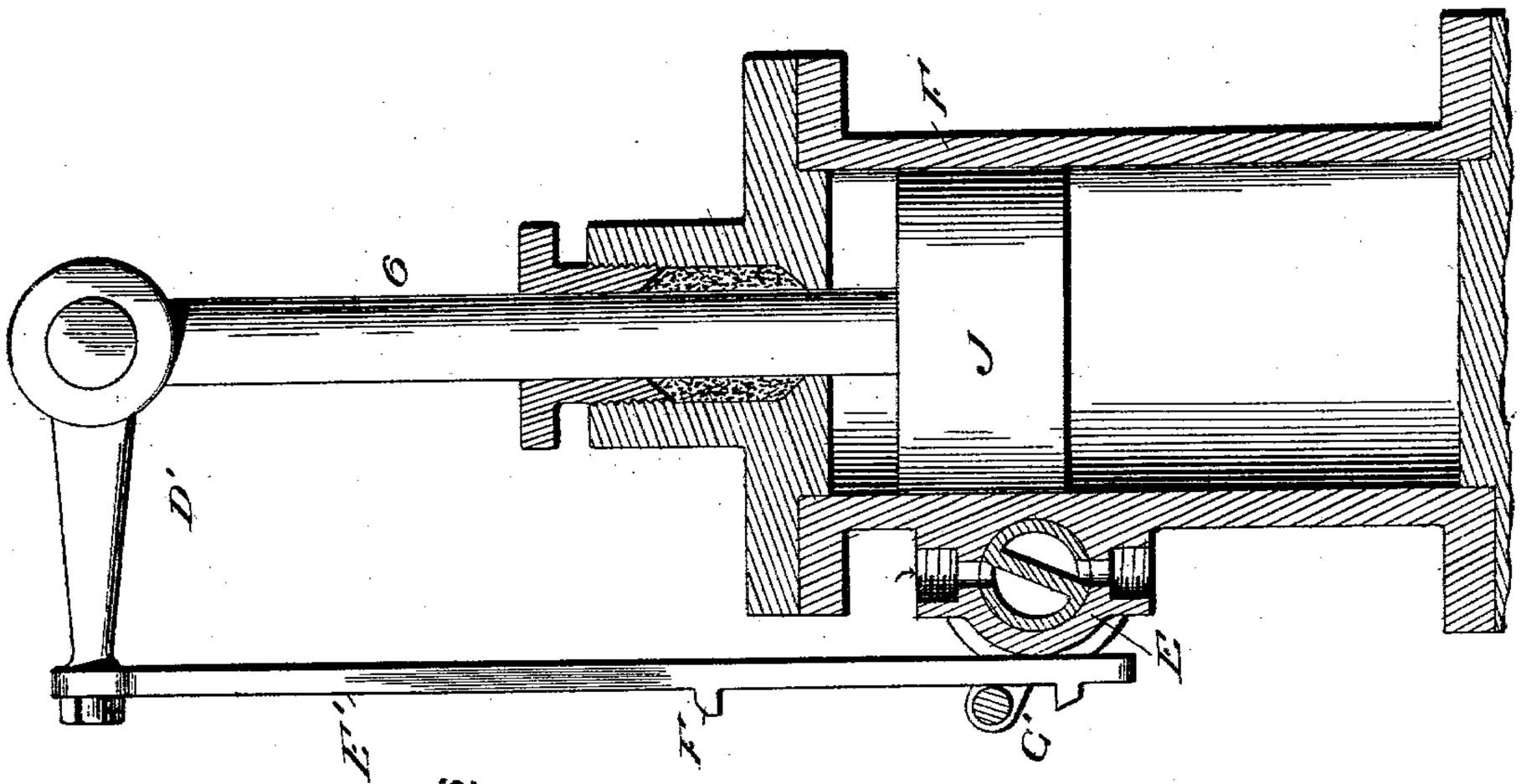

FIG. 6.

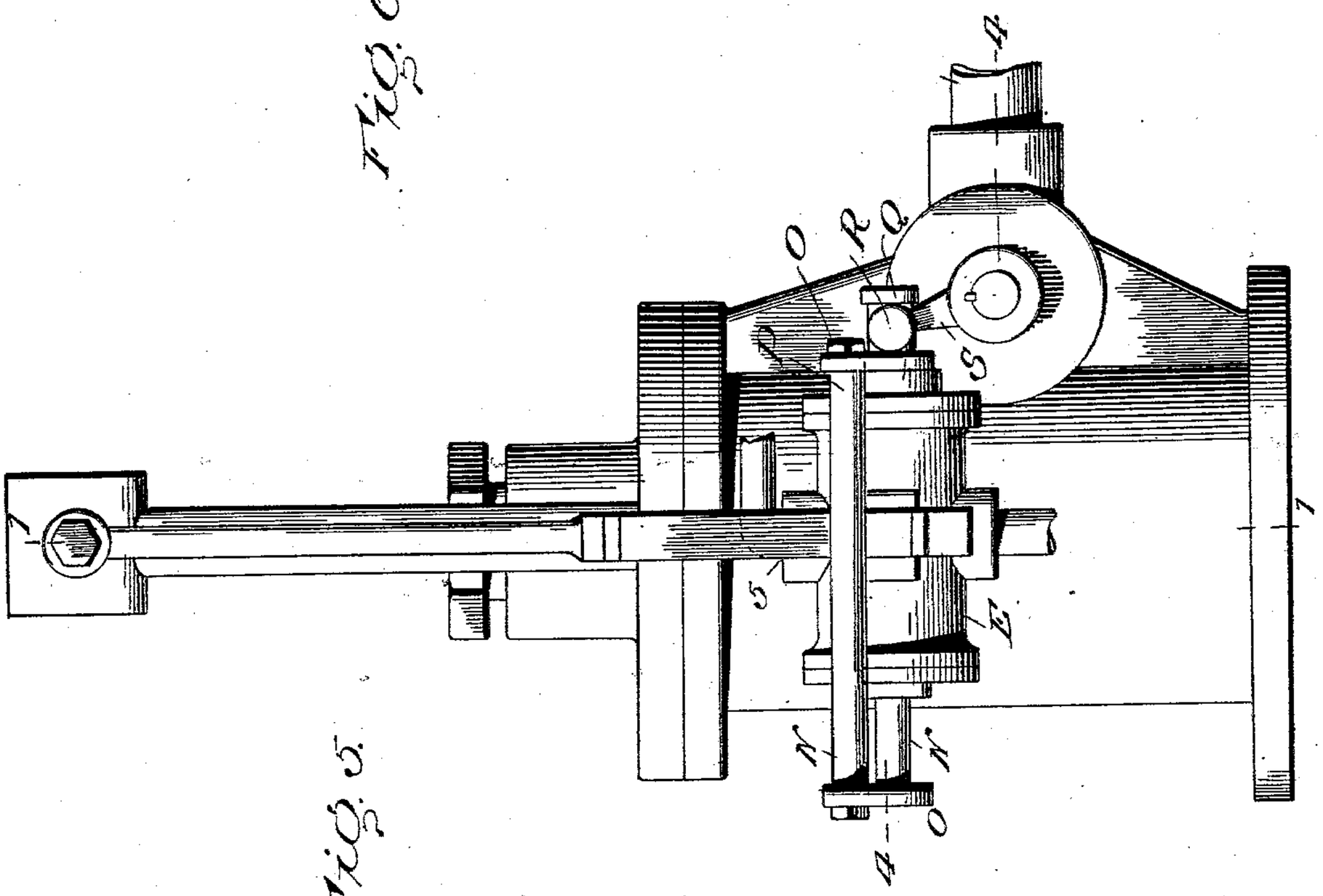

FIG. 5.

Witnesses

Jas. C. Anderson

Inventor

Wm. J. Jacobi

By Wm. C. Dodd & Sons

Attorney

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NO MODEL. 5 SHEETS—SHEET 5.

FIG. 7.

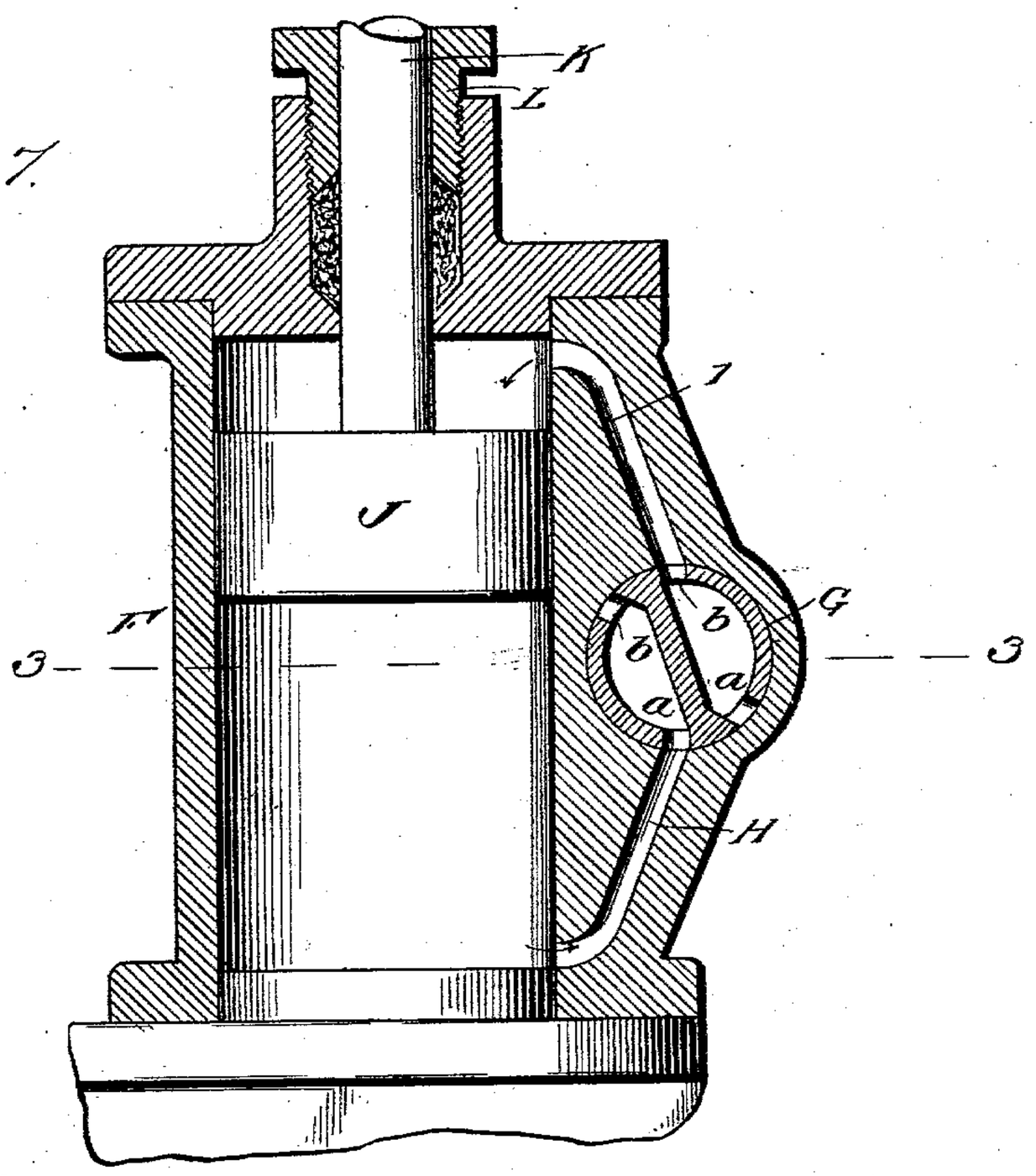


FIG. 8.

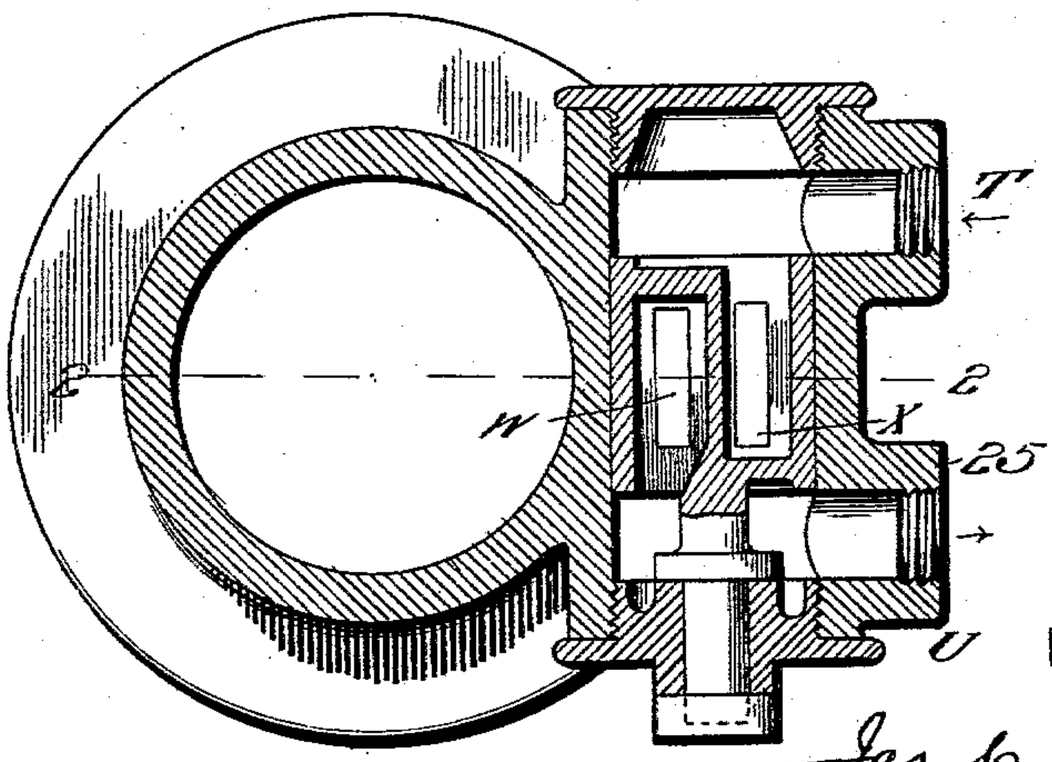
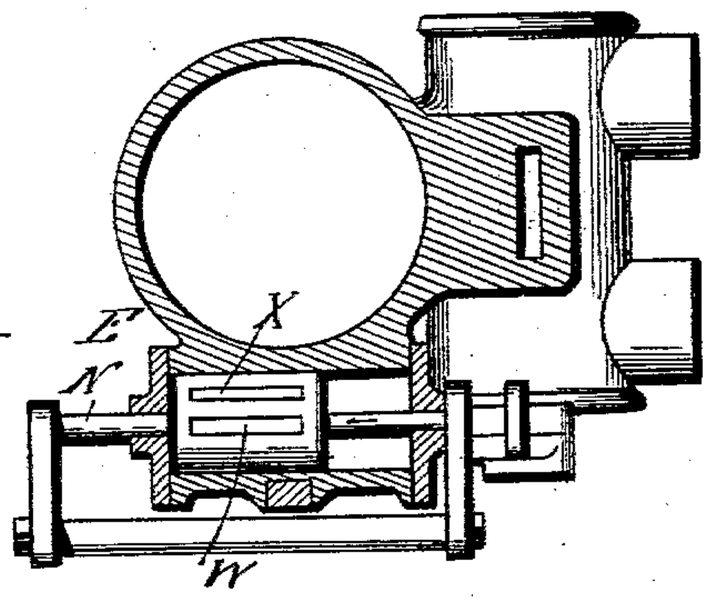


FIG. 9.



Witnesses

Jas. C. Anderson

Inventor

Wm. J. Jacobi

By Wm. C. Dewitt

Attorney

No. 743,799. Patented November 10, 1903.

UNITED STATES PATENT OFFICE.

JAMES C. ANDERSON, OF HIGHLAND PARK, ILLINOIS.

METHOD OF CRUSHING AND STAMPING ORES.

SPECIFICATION forming part of Letters Patent No. 743,799, dated November 10, 1903.

Application filed March 3, 1903. Serial No. 145,994. (No model.)

To all whom it may concern:

Be it known that I, JAMES C. ANDERSON, a citizen of the United States, residing at Highland Park, in the county of Lake and State of Illinois, have invented certain new and useful Improvements in Methods of Crushing and Stamping Ores; 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.

My invention relates to a new and useful improvement in the general system or method of crushing and stamping ores and extracting the minerals therefrom.

In the usual and well-known method of treating the ores removed from the mine the ore is subjected to the action of "crushers" or "breakers" to reduce the sizes of the pieces of ore and adapting them to still further reduction in what are known as "stamp-mills" or mortars. After the ore has been treated in the crusher or breaker it is fed to the stamp-mill or mortar and is therein reduced to "pulp" with a suitable quantity of water and the employment of a proportionate amount of quicksilver and may thereafter be still further treated by methods well understood in the art to recover the minerals released from the ore in the stamp-mill. The usual accessories for this system of operation involve the employment of a boiler and engine, with its consequent fuel and attention of an engineer, a crusher or stone-breaker, a feeder from which the crushed ore is delivered to the stamp-mill, and a stamp-mill to reduce the crushed ore to what is commonly designated "pulp," from which the metal contained therein is collected by the use of quicksilver or by any other of the well-known methods. The machinery employed is necessarily of weighty construction to secure durability and effectiveness, and hence a complete "plant" of minimum capacity and size necessarily involves great weight and consequent difficulty of transportation when the locality at which it is to be used is remote from railroad transportation and has to be carried upon the backs of animals.

In the use of a plant such as described there is of course necessity of water for the boiler and fuel to generate the necessary steam for running the engine, and consequently and when the supply of fuel at least has become exhausted or is unattainable such a plant as described must of necessity be abandoned and the ore, if its value justifies, be transported to a plant located where fuel and water can be obtained. Under such conditions and where the poverty of the ore does not justify the cost of transportation to a remote plant such ore becomes valueless and is abandoned.

My invention is designed to overcome all of the disadvantages and difficulties named and others not enumerated, and has for its object a system of treatment of the native ore which shall be simple and expedient in localities remote from railroad transportation and in the entire absence of all opportunities for the procurement of fuel.

It has for its object to utilize the small quantities of water which may be accumulated from attenuated mountain-streams or husbanded from any other sources (and which under ordinary and existing conditions cannot be effectively used in mining operations) and to employ such water as a direct motive force for operating the machinery necessary in reducing ores in the usual stamp-mill methods and to subsequently use the same water as the necessary constituent of the pulp in the mortar and for any subsequent "washing" processes. As an incident of this generic idea my invention involves dispensing with the heavy and cumbrous boiler and engine, as well as the attendant expense and difficulty of transporting the same, and the necessity for a skilled engineer, and consequently results in a plant of much less bulk and weight, more readily transported, and not only more economically run under the conditions that would justify the use of the ordinary plant, but which may be transported to and utilized at localities where the ordinary plant could not. For instance, in mining operations it frequently occurs that in receding from the source of supples, such as fuel and a sufficient quantity of water to supply the boiler and stamp-mill and for washing purposes, it becomes necessary to transport the ore to a locality where the plant can be surrounded by such accessories, and when the difficulty or cost of thus transporting the ore is out of proportion to the value of the product such

a mine is necessarily abandoned and whatever of value there may be in the same is lost to the world. On the other hand, my invention is designed to not only effectively utilize a quantity of water which would be totally inadequate under ordinary circumstances, but at the same time to render unnecessary the transportation and employment of bulky, weighty, and expensive machinery and the necessity for skilled labor.

With these aims and objects in view my invention consists in the method, hereinafter more fully described, of running all of the necessary elements or devices of a stamp-mill by the direct application thereto of the motive force of a limited supply of water and the reuse of such supply of water as a constituent of the pulp within the "mortar" and for all subsequent and necessary washing purposes.

In more particularly describing my improved method reference is made to the accompanying drawings, illustrating in part the construction and arrangement of improved machinery for carrying into effect my improved method, such machinery constituting the subject-matter of another application filed by me concurrently with this and bearing Serial No. 145,995.

In the accompanying drawings, Figure 1 is a landscape view of a mountainous region with my improved plant installed and properly located to effectively carry out my improved method. Fig. 2 is a side elevation of a two-stamp mill adapted for use in my method and constituting the subject-matter of my concurrent application above referred to. Fig. 3 is a top or plan view of the same, and Fig. 4 is a vertical section taken on the line $x\,x$ of Fig. 3. Fig. 5 is a side elevation, on enlarged scale, of the motor or hydraulic piston for driving the stamp-mill mechanism. Fig. 6 is a central vertical section taken on the line 1 1 of Fig. 5. Fig. 7 is a similar view taken at right angles thereto and on the line 2 2 of Fig. 8. Fig. 8 is a horizontal section taken on the line 3 3 of Fig. 7, and Fig. 9 is a similar view taken on the line 4 4 of Fig. 5.

Referring to Fig. 1, a mountainous region is represented, and A indicates a natural or artificial basin or reservoir designed to impound the waters flowing from melted snow or springs. B represents the working entrance to a mine from which ore is to be removed, and C is one of my improved stamp-mills erected upon a suitable foundation on a plateau or level space adjacent to the entrance B of the mine. Leading from the reservoir or basin A is a pipe or hose D, the lower end of which is suitably connected with the valve-cylinder E on one side of a piston-cylinder F. In the piston-cylinder F, at right angles to the valve-cylinder E, are arranged an oscillatory valve G and inlet and exhaust ports H and I, leading to opposite sides of the piston-head J, the rod K of which extends through a suitable stuffing-box L in the upper end of the cylinder and is connected to one end of a walking-beam mounted upon a shaft at the top of the frame of the mill. Within the valve-cylinder E is arranged an oscillating and reciprocating cylindrical valve M, the stem N of which extends through suitable stuffing-boxes at each end of the valve-cylinder. Keyed to this valve-stem N at each end are radial arms O, carrying a longitudinal shaft P. The extreme right-hand end of the valve-stem N is provided with a disk or head Q a suitable distance from the radial arm O to constitute a housing for a wrist-pin R on the extremity of a radial arm S, keyed to the outer end of the shaft of the wing-valve G of the piston-cylinder F, so that as the valve M of the valve-cylinder E is reciprocated the wing-valve G will be oscillated to alternately open and close the inlet and exhaust ports H and I.

My improved stamp-mill consists of two mortars I I, supported in yokes or bails 2, mounted within the stamp-frame 3. The shoes 4 of the stamp-dies 5 are designed to contact in their fall with ore upon the anvils 5^a at the bottom of the mortars 1. The die-stems 6 pass through openings in the upper portion of the yokes or bails 2, and below the upper ends of said yokes or bails is a bridge 7, secured at its ends by bolts or otherwise to the bails, so that this bridge and the parallel upper end of the bail constitute a housing for the adjacent ends of toggle-levers 9 10. The outer ends of the toggle-levers 9 are located in suitable housings or bearings 11 in the frame 3. The inner ends of the toggle-levers 10 are housed in suitable bearings at the lower ends of the vibrating jaws 12 of an ore-crusher 13, mounted within and properly secured to the frame 3. The stems 6 of the stamp-dies pass through suitable bosses or lugs 14 on the frame 3, which constitute guides for said stems.

15 is a horizontal rock-shaft mounted in suitable bearings at the top of the frame 3, and keyed to said shaft is a walking-beam 16, at the outer ends of which are latches 17, secured to the beam by parallel pivoted arms 18. Springs 19, secured to the walking-beam 16, return the latches to their normal positions.

The upper ends of the die-stems 6 are equipped with collars 20, having lateral studs 21, (see Fig. 3,) beveled as shown in dotted lines at Fig. 4. The outer ends of the latches 17 are correspondingly beveled, so that when the walking-beam is vibrated the latches will alternately first lift the stems 6 and their dies 5 and when the beam reaches its highest plane release the stems and allow the dies to fall, and then the beveled latch contacting with the beveled stud 21 will be forced back against spring 19 and then by the action of said spring be shot under the stud 21 and in position to again raise the stem and its die.

Mounted in the frame 3 upon a shaft 22

and below the crusher 13 is an A-shaped deflector 23, the lower edges of the walls of which rest upon the upper edges of the inner walls of the mortars 1 1, and consequently when the die-stems 6 are alternately lifted by the walking-beam 16 and the toggle-levers are correspondingly lifted to alternately open the jaws 12 of the crusher the upward movement of the adjacent ends of each pair of toggles will lift the respective bail 2, and with it the corresponding mortar 1, and hence the deflector 23 will be vibrated to alternately deflect and feed the crushed ore first to one and then the other of the mortars and on to the respective anvils 5^a, where it is stamped by the falling dies 5. The first effect of the weight and momentum of the falling dies is to crush the ore upon the anvils, and the weight and momentum unexpended in this action, supplemented by the continued gravity movement of the dies, carries the mortars and their yokes down to the bed or base of the frame 3, and this shock, which would otherwise be transmitted through the bed or base to the earth, is utilized to alternately straighten the toggles 9 and 10 on each side of the crusher, and consequently to force the jaw 12 on that side inward, and as the toggles on the opposite side are then straight or in alinement they constitute a brace to hold the jaw on the same side rigidly, and hence the ore between the two jaws is crushed in an obvious manner. When the crushed ore has been alternately fed to the two mortars, the water which is exhausted alternately from above and below the piston J is conveyed in suitable quantities by pipes 24, leading from the exhaust-nipple 25 of the valve-cylinder E, to the respective mortars 1 1 to assist in making the pulp, and the excess is utilized for the subsequent washing process.

I have thus described so much of the details of construction as is necessary to a full understanding of my improved method; but a more detailed description of the construction and operation of the mechanism employed will be found in concurrent application hereinbefore referred to.

From what has been said it will be understood that my improved method or system involves the application of a comparatively small supply of water directly to suitable mechanism to lift the stamp-dies, which are then released and permitted to fall by gravity to pulverize the ore upon the anvils of suitable mortars and utilizing the momentum shock of the falling dies at the final end of their movement to operate the jaws of a crusher above the mortars and to alternately feed the crushed ore to said mortars and then conveying the water after it has been utilized to lift the dies in sufficient quantities to pulp the pulverized ore and to wash the recovered minerals.

While the apparatus shown and described has been devised as a satisfactory one for carrying out my improved method, it will be understood that I do not wish to be confined to the use of any particular apparatus, but may use any apparatus capable of utilizing a limited quantity of water in the manner described.

As an illustration of the advantages and effectiveness of my improved method I may state that with a two-stamp mill having the minimum capacity of treating from one and a half to two tons of ore per hour sufficient power can be acquired from a column of water one hundred feet high and one-half inch in diameter. It will be obvious that a column of water of the height stated and one-quarter of an inch in diameter would of course be effective for running the apparatus at a reduced rate of speed.

Having described my improved method or system, so that those skilled in the art to which it appertains may know how to practice the same and fully appreciate its advantages, what I claim as new, and desire to secure by Letters Patent, is—

1. The method herein described of milling ores, which comprises essentially first, the direct application of the weight of a suitable column or head of water, delivered to the point of application of power through a pipe or similar closed conduit to overbalance and elevate the die; and secondly permitting the water to escape and the die to descend by gravity.

2. The method herein described, of milling ores, which comprises essentially, first lifting a die of a stamp-mill by the direct application of a suitable column or head of water delivered to the point of application of power through a pipe or similar closed conduit; secondly, allowing the water to escape and permitting the die to descend by gravity; and thirdly, conducting the water exhausted into the stamp-mortar for pulping the crushed ore.

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

JAMES C. ANDERSON.

Witnesses:
D. G. STUART,
W. M. HOLLIS.