(No Model.) 2 Sheets—Sheet 1.

# W. A. McKINLAY.

## DEVICE FOR SPLITTING OR BREAKING DOWN COAL, ROCK, &c.

No. 557,143. Patented Mar. 31, 1896.

Fig. 1.

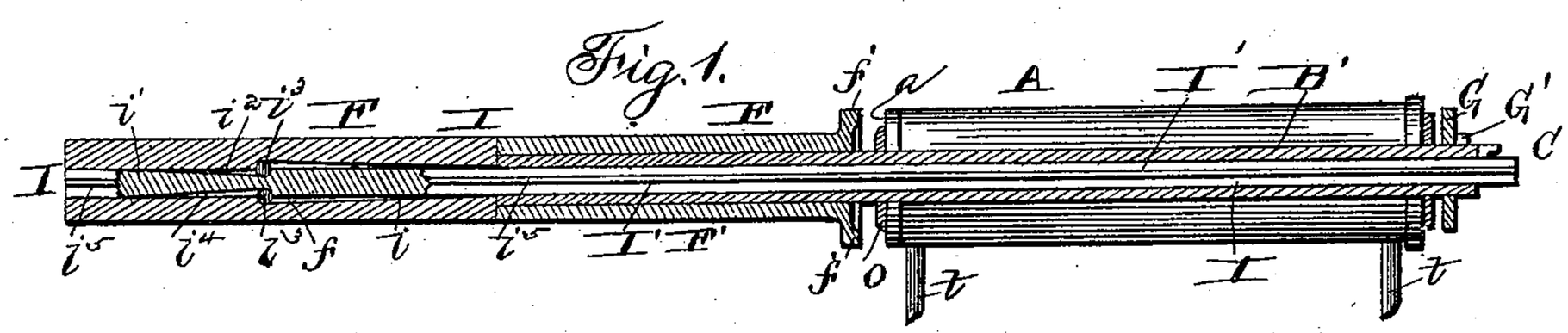



Fig. 2.

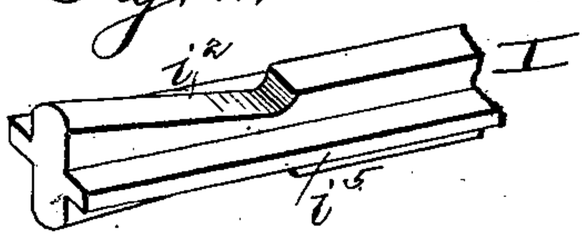



Fig. 3.

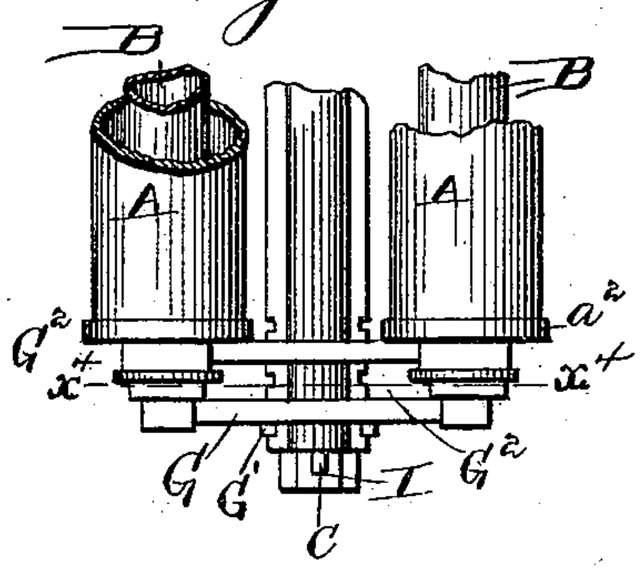



Fig. 4.

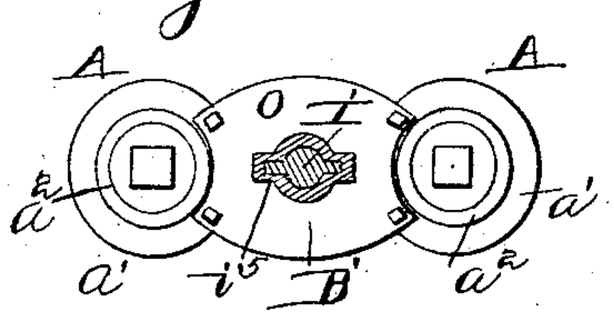
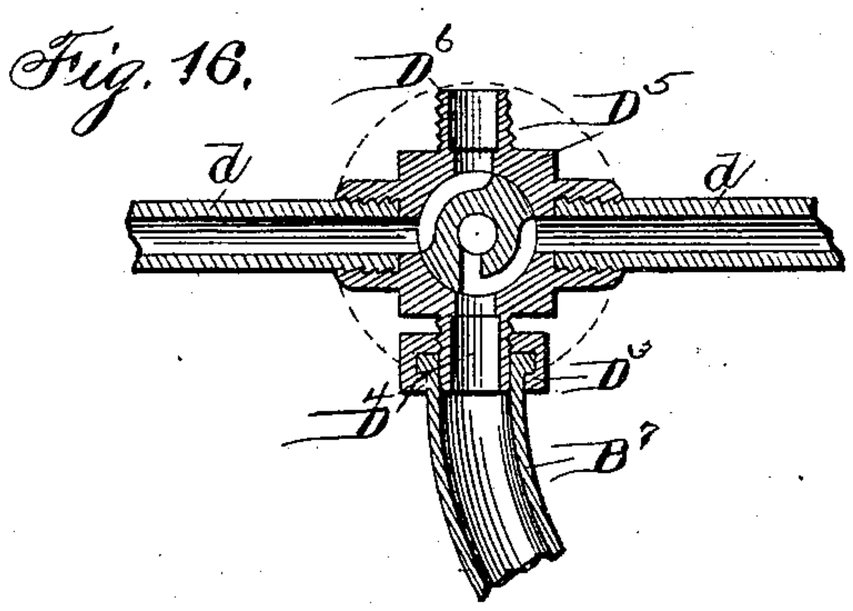



Fig. 16.




Witnesses:—
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Inventor:—
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by Doubleday & Bliss
Attys

(No Model.) 2 Sheets—Sheet 2.

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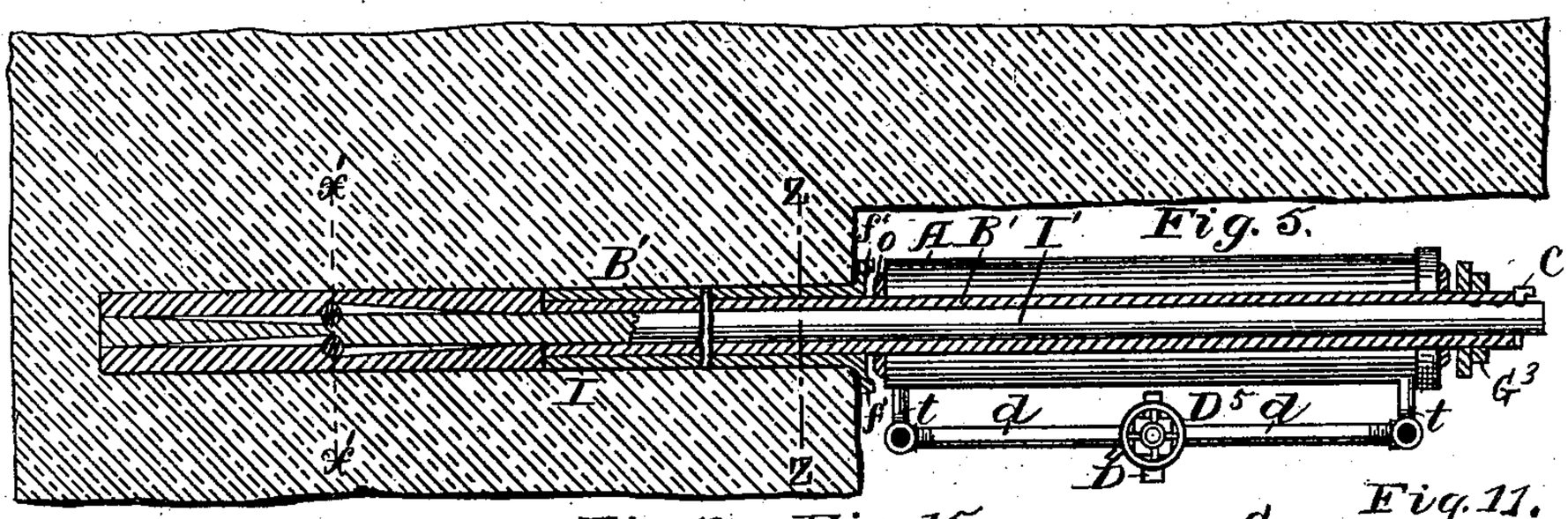
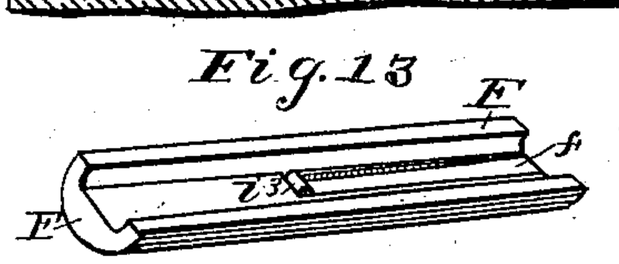
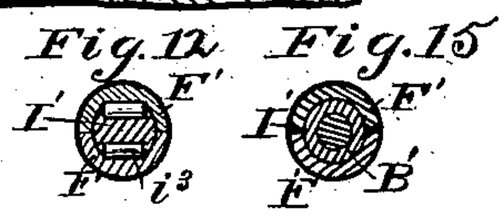
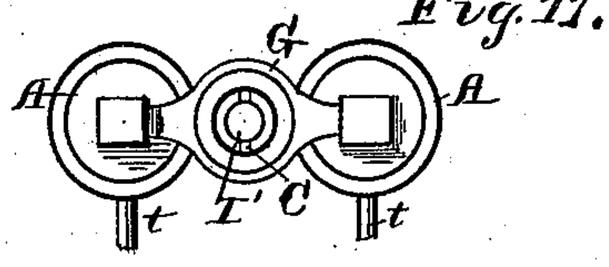


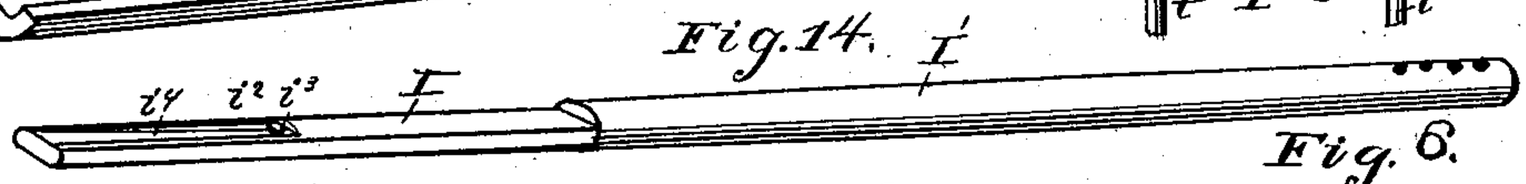




Fig. 6.

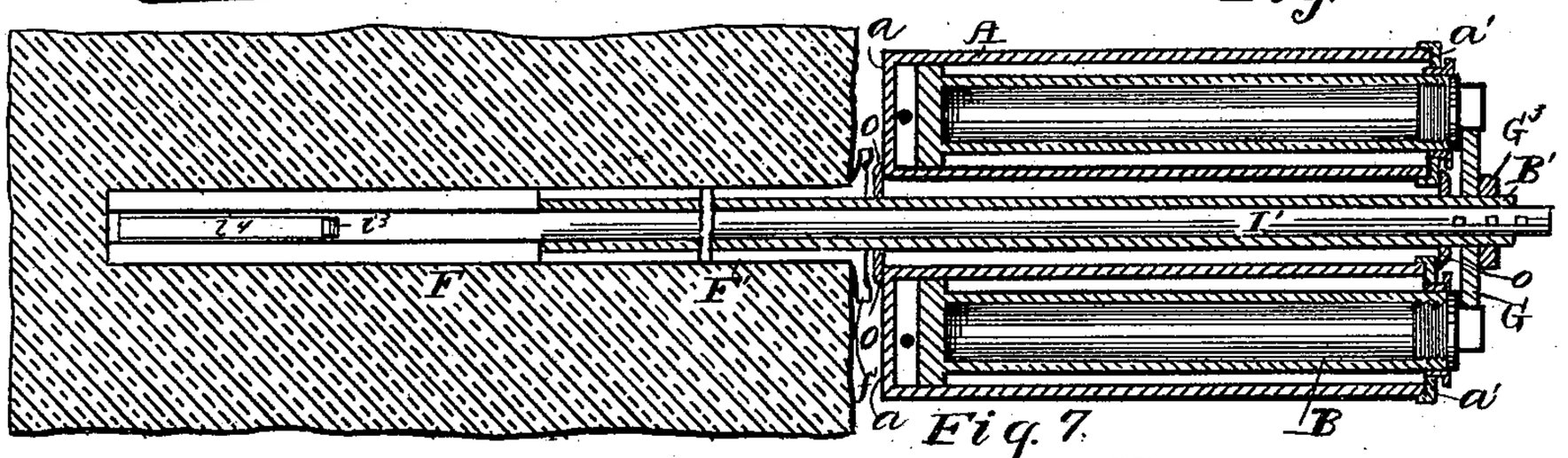
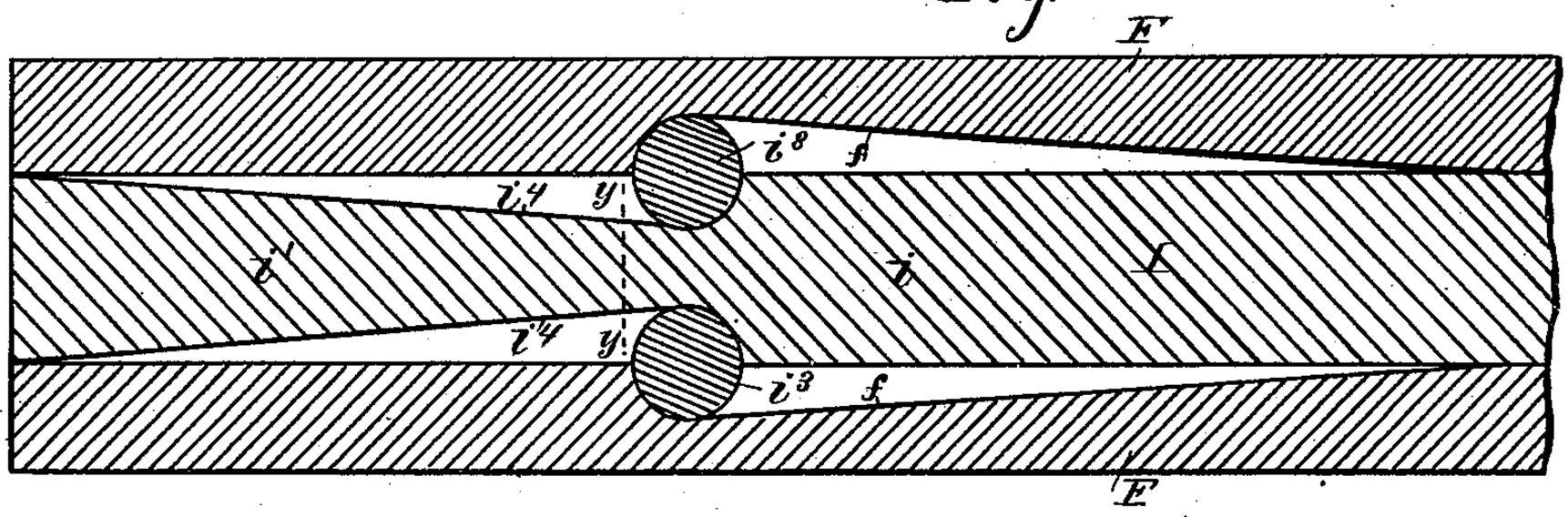
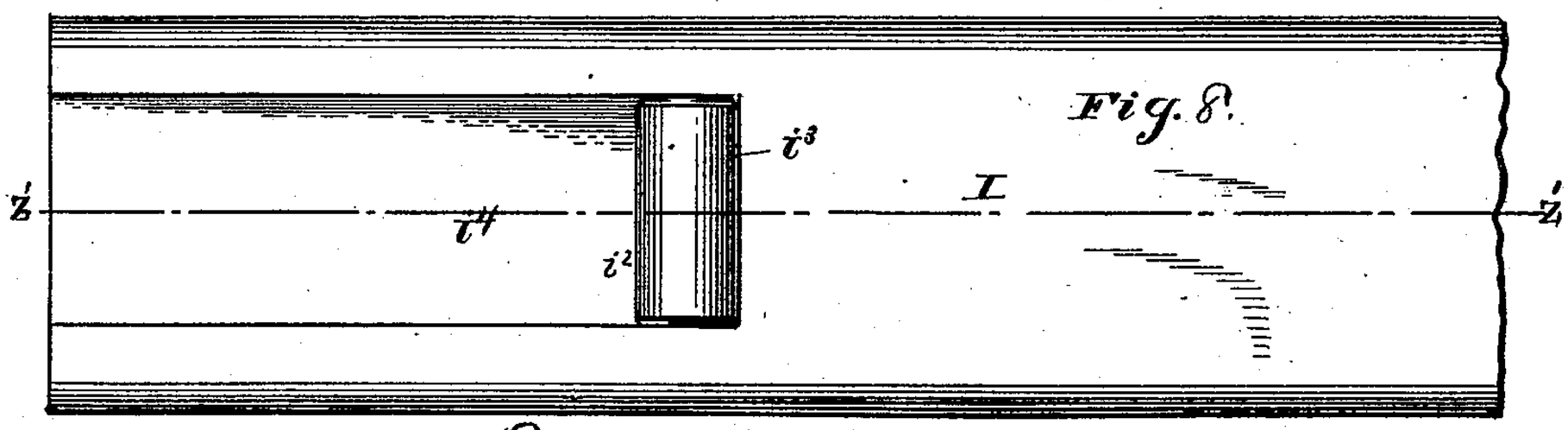
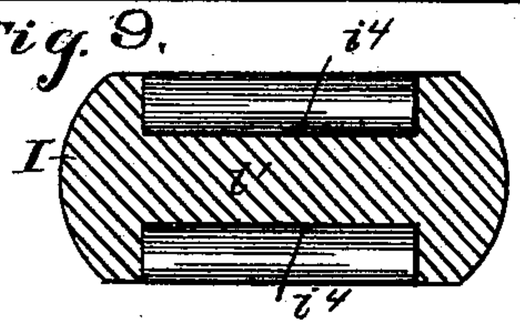
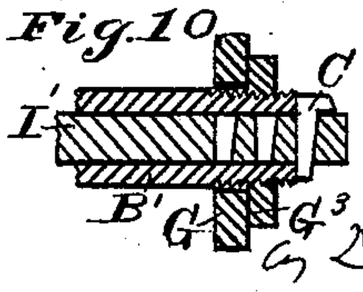



Fig. 7.




Witnesses:
J. C. Turner
J. S. Barker

Inventor;
William A McKinlay
by Dunlevy & Baldwin Attys.

# UNITED STATES PATENT OFFICE.

WILLIAM A. McKINLAY, OF DENVER, COLORADO.

## DEVICE FOR SPLITTING OR BREAKING DOWN COAL, ROCK, &c.

SPECIFICATION forming part of Letters Patent No. 557,143, dated March 31, 1896.

Application filed April 8, 1886. Renewed August 30, 1895. Serial No. 561,039. (No model.)

*To all whom it may concern:*

Be it known that I, WILLIAM A. McKINLAY, a citizen of the United States, residing at Denver, in the county of Arapahoe and State of Colorado, have invented certain new and useful Improvements in Devices for Splitting or Breaking Down Coal, Rock, &c., of which the following is a specification, reference being had therein to the accompanying drawings.

Figure 1 is a longitudinal section through the wedging device. Fig. 2 is a perspective of the inner end of the wedge-rod in Fig. 1. Fig. 3 is a partial plan view of the outer end of that in Fig. 1. Fig. 4 is a section on line $x^4$ $x^4$, Fig. 3. Fig. 5 is a central vertical section, and Fig. 6 is a central horizontal section, of a slightly-modified form, it being similar to that in Figs. 1, 2, and 3, except that the wedge-rod is not provided with lateral webs. Fig. 7 is a partial section, on a larger scale, of the inner wedge or rod, the outer wedges or shells, and the interposed rollers. Fig. 8 is a plan view of a wedge-rod. Fig. 9 is a cross-section on the line $y$ $y$, Fig. 7. Fig. 10 is a partial longitudinal section of the outer end of the wedge-rod and the adjacent parts in Figs. 5 and 6. Fig. 11 is a rear end view of that in Fig. 5. Fig. 12 is a section on line $x'$ $x'$, Fig. 5. Fig. 13 is a perspective of one of the inner shells, and Fig. 14 is a perspective of the wedge-rod in Figs. 5 and 6. Fig. 15 is a section on line $z$ $z$, Fig. 5, and Fig. 16 is a section of the four-way cock and of the connections by which the water is introduced into and withdrawn from the cylinders.

I will describe one form of apparatus for wedging containing my improvements which I have selected for illustration, and will set forth the details thereof in order that those acquainted with this art may fully understand the mode of construction and operating the same; but I wish it to be understood that in many respects either the whole or any or all of the various parts may be modified without departing from the essential features of the invention.

Referring to Figs. 1, 2, and 3, A A represent cylinders adapted to hold pistons and piston-rods and to receive the hydraulic or other agent. In many respects these cylinders may be of any well-known form; but I have constructed and arranged them in some respects in such a manner as to attain certain ends not attainable with those heretofore in use. They have heretofore been so constructed and arranged that the piston-rods pass through the front walls of the cylinders. This necessitates glands or stuffing-boxes in said front end walls of the cylinders, and these are very objectionable inasmuch as the driving agent cannot be advantageously employed at high pressure.

I so construct and arrange the parts that the driving agent can bear against the piston without reacting on any stuffing-box. It will be seen that the front end $a$ of each cylinder A is tight. (See more particularly Fig. 6.) The piston-rods B B pass through the rear end walls $a'$ of the cylinder, (see Fig. 3 and others,) $a^2$ being the glands or stuffing-boxes.

The piston-rods B B are united with a cross head or bar G, which in turn is connected, mediately or immediately, with the rod which pulls the wedge. In the machine shown in Figs. 1, 2, and 3 the work of the pistons is effected while they move outwardly—that is, away from the coal—and as the hydraulic or other motive agent is, during this movement of the pistons, between them and the front walls $a$ of the cylinders, the stuffing-boxes are relieved of pressure at the time of the greatest strain. If it is necessary to drive the pistons in an opposite direction, by means of the hydraulic or other motive agent, it can be done at a pressure so much lower that the presence of the stuffing-boxes on the side where the pressure is applied does not offer any difficulty. To attain this object—namely, the avoidance of the presence of glands or stuffing-boxes where the greatest pressure is being exerted—use can be made of devices considerably modified, some of which are illustrated in the drawings, and which will be more fully referred to hereinafter.

I′ represents the rod or shank, which carries the wedge part I. This rod, and the wedge also, may be of any suitable form, though for some reasons I prefer to employ one or another of the forms which I have shown.

In Figs. 1, 3, and 4 the wedge and the rod and shank are integral or in one piece.

$i^5$ $i^5$ are webs or flanges projecting laterally from the rod and wedge part for purposes to be described; but if the rod or wedge part be of

some other angular or non-circular form than that shown, it will attain the ends aimed at.

The wedge part I, Figs. 1 and 2, is formed with the thicker parts $i$ and the reduced parts $i'$, the reducing being preferably effected by forming recesses $i^2$ with inclined bottoms $i^4$. (See Figs. 1, 2, and 7.) In these recesses are placed antifriction-rollers $i^3$. That part of the metal which lies between the inclined surfaces $i^4$ $i^4$ is of the shape of a wedge, and when drawn outward it acts to expand or drive apart opposing wedges, plates, or shells F F, to be more fully described. The part I′ can be directly connected with the cross-head G or its equivalent, but under some circumstances I prefer to combine therewith a sleeve or tube B′ of such length that it shall extend some distance into the bed of the material, whereby a firmer bracing or support for the outwardly-projecting parts is provided, and whereby also other ends can be attained. The said tube or sleeve B′ can be united with a cross-head or its equivalent in any preferred way—as, for instance, by a stop G′, which is a key or pin adapted to fit one or another series of apertures or recesses $G^2$. By these the tube B′ can be adjusted relatively to the cylinder and the pistons, and when the latter move outward they form the tube or sleeve in the same direction. The wedge rod or bar I′ is also provided with a stop, (here shown as a key or pin C,) against which the sleeve or tube B′ can abut, and thus the wedge-rod I′ will be pulled outward. The key or pin C can be fitted into one or another of a series of apertures, (see Figs. 10 and 14,) and thus the rod I′ can be adjusted either in relation to the tube or sleeve B′, or in relation to the cylinders, or the pistons, either or all.

It will be seen that there are two cylinders A, one on each side of the wedge-rod. They may be connected together in any suitable way, plates $o$ being shown for this, one at each end of the cylinders. These plates are provided with apertures through which pass the wedge-rod and the sleeve B′. When these latter are angular or non-circular in section the holes in plates $o$ should be correspondingly shaped, and when the parts are thus constructed the cylinders and wedges are so held relatively to each other that neither shall turn. By having these plates $o$, one at each end of the cylinders, the latter are firmly supported upon the wedge-rod at their ends, and the rod can be drawn out in such way that all of the parts shall be held uniformly and rigidly in position.

When employing two cylinders, I can bring to bear a great increase of pressure, although the pressure in each cylinder can, as said, be much increased by reason of the features above described—namely, the absence of glands or stuffing-boxes, and by not having the area of piston-pressure decreased by the presence of a piston-rod in the pressure-chamber.

Under some circumstances I prefer that the piston-rods B should not be like the ordinary solid rods, but hollow and of a diameter much enlarged in respect to the diameter of a solid rod. This enlarged hollow piston not only provides a much firmer and steadier guide for the piston proper when subjected to the great pressure requisite in these machines, but it also reduces the area of the piston upon the returning side to such an extent that the hydraulic or other motive agent can be used for returning with a pressure equal to that for advancing, without danger of too great rapidity or force. The hollow pistons are shown as being closed by plugs, each having a transverse aperture for attaching the cross-head G.

The outside wedging-pieces F F may be flat or of other suitable shape, and the wedge I correspondingly shaped. Whatever their form in cross-section, the wedges F may extend continuously to the outer end of the aperture in the coal, or they may be made separately from the outer parts F′ F′. The parts F′ are so arranged as to provide suitable abutments at $f'$, against which the cylinders can press inwardly.

The parts F F in Fig. 1 are constructed with inclined faces $f$ $f$, which lie adjacent to the antifriction-rollers $i^3$ $i^3$. When the wedge-rod is drawn outward the parts F F are forced apart, the result of which is to break down the mass of coal or other material lying below the wedges.

The flanges $i^5$ $i^5$ in Fig. 1 at the inner end of the wedge-rod, lie between the shells F F and act to prevent the wedge-rod from turning, and insure that they shall exert the expanding force in vertical planes.

In mining coal the mass to be broken down is generally undercut, as is indicated at M′.

Having now described in detail the construction and method of operation of one form of mechanism embodying my improvements, I will call attention to the fact that various modifications can be made wherein some of the parts above described can be dispensed with or can be somewhat changed, without departing from the characteristic features of the invention.

In Figs. 5 to 15, inclusive, there is shown a machine substantially similar to that in Figs. 1, 2, 3, and 4, the flanges $i^5$ being dispensed with. In this case the rod I′ and the sleeve B′ are circular in section. Instead of the key $G^3$, Fig. 7, use is made of a nut at $G^3$, Figs. 9, 10, and 14, as an abutment for the cross-head G, which nut or abutment can be secured and adjusted by means of threads on the periphery of tube B′. All of the details shown in these views, Figs. 5 to 15, can be understood as being present in the construction in Fig. 1, the latter having one or two additional ones, as above mentioned.

Figs. 5 and 16, taken together, indicate the method of supplying the water to the cylinders and exhausting it therefrom, though it will be understood that any suitable mech-

anism can be substituted for that shown. The flexible coupling-pipe $B^7$ is united to a four-way cock by a coupling $D^3$, the cock having a supply-port $D^4$ and an exhaust $D^6$. *d d* are pipes extending laterally from the cock and united with cross-pipes *d'*, and the latter communicate with the ports *t* of the cylinders. When the valve of the four-way cock is turned into one position, water will be let onto both cylinders at one end, and at the same time the ducts will be so related that there can be an exhaust from the other end, and vice versa. The coupling and uncoupling of the flexible pipe $B^7$ can be speedily accomplished, and with these devices I can with great rapidity apply the pressure and cut it off without having to wait for the generating of it.

It will be seen that with either of the machines above described the reaction from the cylinders is brought to bear against the outside wedges or shells F, either directly or mediately, through the parts F'. With a mechanism having the parts arranged in the way I have devised, I obviate the necessity of what have been called "distance-pieces," and can bring the front end of the engine or motor parts into direct proximity to the wall of the coal or material to be treated, and can therefore shorten up the whole apparatus, or can get a much longer pull relative to the whole length of the machine. Again, I can so arrange the parts that the cylinder shall be mainly or even entirely supported upon the wedge-rod without the appliances heretofore used—such as a car, column, posts, or their equivalent—one or the other of which is necessary when the aforesaid distance-pieces are employed.

I am aware of the fact that use has been heretofore made of an outwardly-moving wedge, in combination with a stationary pressure-cylinder, and an outwardly-moving piston therein; but in the earlier construction the cylinder and piston were so arranged in respect to the other parts that it was impossible to employ a wedge-rod extending along the longitudinal central or axial line of the whole apparatus. The wedge proper was carried by two eccentric bars, which have to be introduced into the drilled aperture and inserted to the inner end thereof. Outside of the aperture, they were carried eccentrically along the sides of the cylinder and piston.

In order to have the parts sufficiently strong, the cross dimensions must be large, and the drilling of a large aperture is necessary, as the aperture must be as wide as the cylinder and the two rods outside thereof which draw the wedge. Moreover, this arrangement of the wedge-rods eccentrically along the outer sides of the apparatus increases largely the frictional resistance to the movements of the parts. I reduce the relative dimensions of the parts which enter the drill-aperture and provide for employing a pressure apparatus of any desired diameter, and also greatly reduce the frictional resistance of the wedge-rod as concerns contact with the wall of the drilled aperture by placing the wedge-rod and drawing it outwardly on the central longitudinal line of the aperture. Then in order to provide for the central arrangement of the wedge-rod I arrange the pressure-exerting mechanism, such as the cylinders A A, eccentrically—*i. e.*, one on each side—as it is not practicable to pass the wedge-rod through the pressure mechanism if the latter be centrally placed.

An important advantage incident to having the wedge-rod, or the rod which exerts draft on the wedge, at the central longitudinal line, lies in the fact that I can employ outside wedge-pieces as long as may be desired—that is, I can apply the expanding pressure over as long a surface as is desired—whereas the dimensions of the outside wedge-pieces and of the pressed surface are limited when draft-rods are carried around or along the sides of the apparatus. By having the draft-rod thus arranged, not only can the pressure-cylinder be made of any desired diameter, but I make it possible to employ multiple cylinders, so that I provide for an indefinite increase in energy and provide for such increase at a much lower pressure. By having two cylinders such as shown, they can be made of thinner and lighter parts, as the pressure-area is increased and the danger of bursting or breakage is reduced. The tube or sleeve B', as above said, greatly increases the strength of the parts on the central line in comparison with that attainable when use is made of a solid rod of the total thickness of rod I' and tube B'. Again, this tube can be so adjusted as to properly support the cylinders under given conditions, and at the same time it permits an adjustment of the wedge-rod independently of the relative positions of the piston, the cylinder, and the tube or sleeve. Therefore provision is made for inserting the wedge-rod a greater or less distance without altering the relations of the tube B' to the pressure-cylinder.

What I claim is—

1. In a mechanism for wedging or breaking down coal or other material, the combination of a wedge-rod, pistons for operating said rod, cylinders on either side of said rod containing said pistons, and an adjustable connecting-piece for connecting together the wedge-rod and the pistons, substantially as set forth.

2. In a mechanism for splitting coal the combination with the wedge-rod, the pistons and the cylinders disposed outside the longitudinal lines of the said rod, of the wedge-pieces adapted to be forced outward by said wedge-rod, and the sleeve or tube supplemental to the cylinder, surrounding said rod and connected thereto and projecting into the breast of the coal, substantially as set forth.

3. The combination with the wedge-rod and the outside wedges or bars, of means for moving the wedge-rod, a tube or sleeve around

and connected to the wedge-rod and projecting into the material and lying between the aforesaid wedges or bars, and the tube or sleeve F′ inclosing the aforesaid sleeve and wedge-rod, substantially as set forth.

4. The combination of the wedge, the wedge-rod, the piston which operates said rod, the cylinder which contains the piston, and an adjustable connecting device outside of the cylinder for connecting the piston with the wedge-rod at either of several places, substantially as set forth.

5. The combination of the wedge, the wedge-rod having a series of apertures, the piston which operates it, the cylinder containing said piston, and a connecting device outside of the cylinder consisting of a cross-bar and a key, said key being detachably inserted in said apertures, substantially as set forth.

6. The combination of the wedge, the wedge-rod having a series of apertures, a pin or key in one of said apertures, a sleeve on said rod abutting against said pin, a cylinder, a piston in said cylinder, and a cross-bar, connecting said piston and said sleeve, substantially as set forth.

7. In a mechanism for splitting or wedging coal, the combination of a wedge-rod, piston-heads, cylinders inclosing said piston-heads, and a tube B′ for communicating power to the wedge-rod, said tube having a front bearing and a rear bearing relatively to the cylinder, substantially as set forth.

8. In a mechanism for splitting or wedging coal, the combination of a wedge-rod, pistons operating said rod, cylinders containing said pistons, and the tube B′ extending from a point in front of the cylinders to a point in rear thereof, substantially as set forth.

9. The combination of the wedge, the wedge-rod I′, the tube B′ connected with the wedge-rod, and the piston-head D connected with the tube B′, substantially as set forth.

10. The combination of the wedge, the wedge-rod, cylinder A, piston D, tube B′, and stop C, substantially as set forth.

11. The combination of a sliding wedge-rod, the twin cylinders A situated opposite each other, the plate adjoining the cylinders provided with apertures through which can pass the wedge-rod, the cross-head G, and the stop C, substantially as set forth.

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

WILLIAM A. McKINLAY.

Witnesses:

GEO. T. SHACKELFORD,

E. A. CLARK.