(No Model.)

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R. McCULLY.

ORE CRUSHER AND PULVERIZER.

No. 277,763. Patented May 15, 1883.

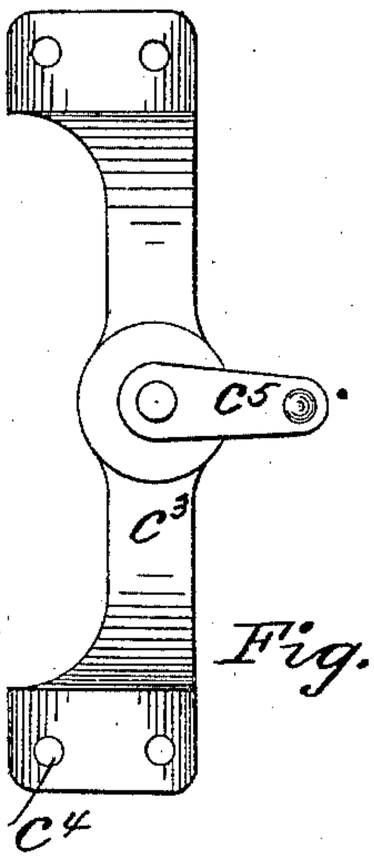

Fig. 3

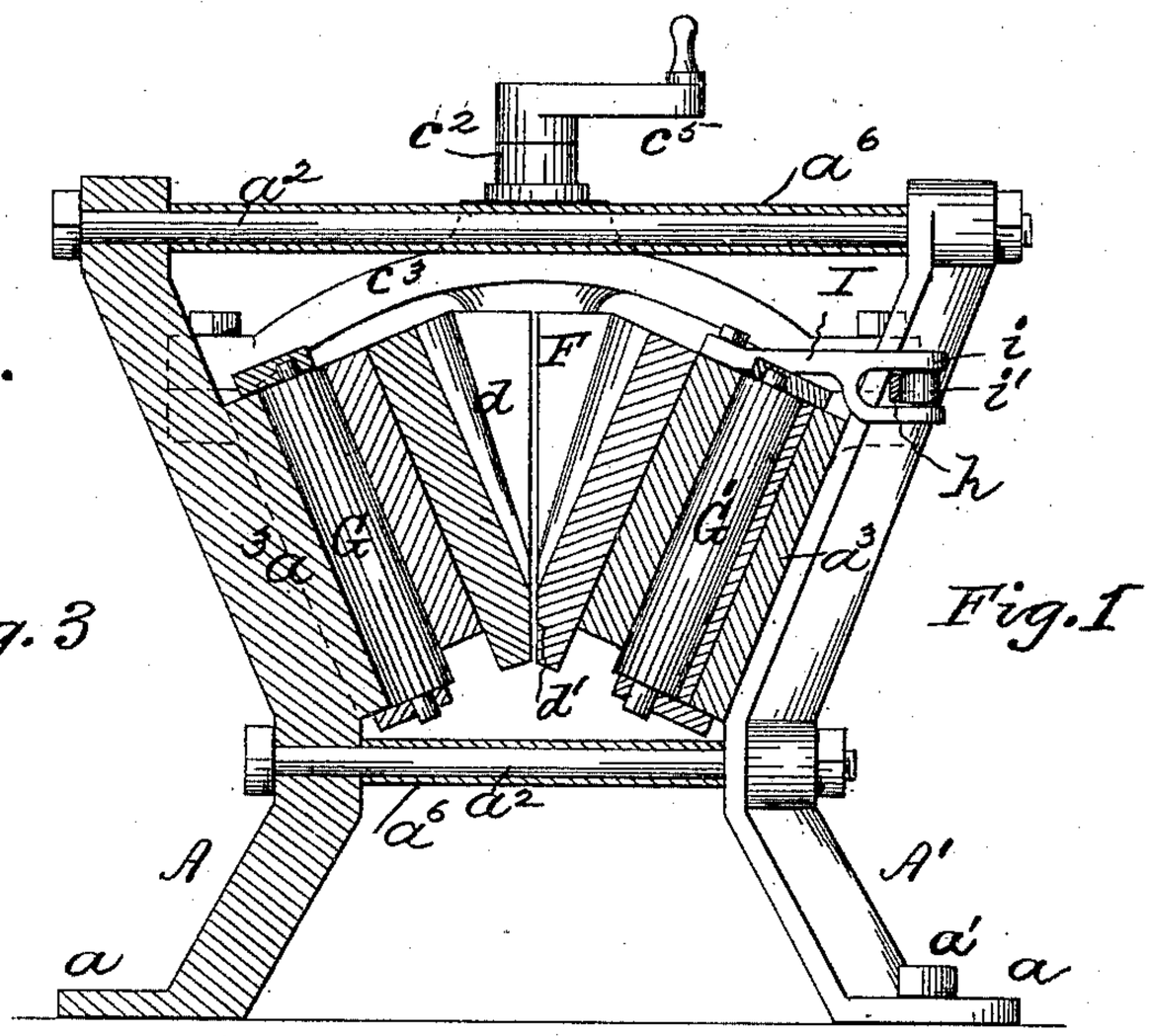

Fig. 1

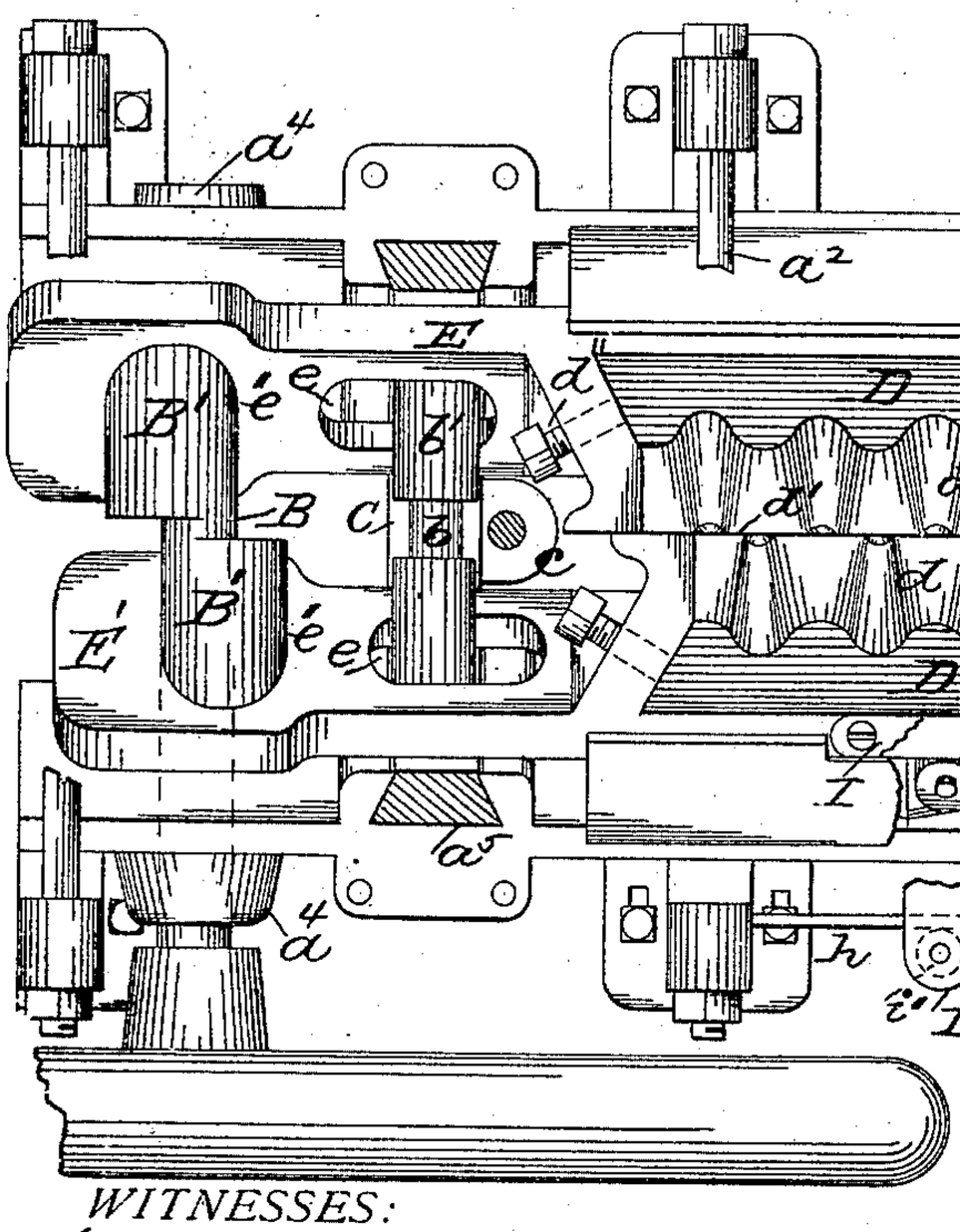

Fig. 2

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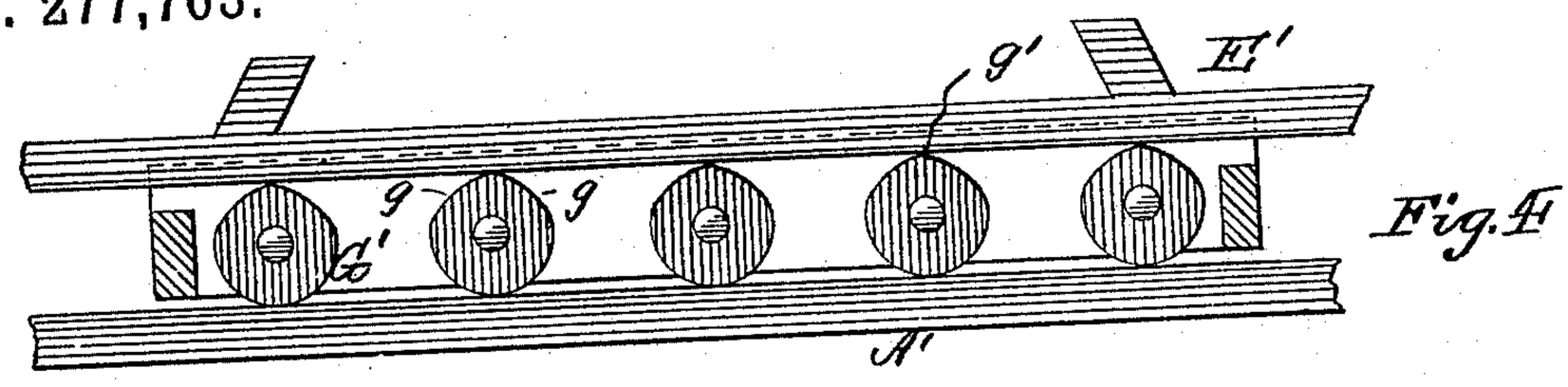

Fig. 4

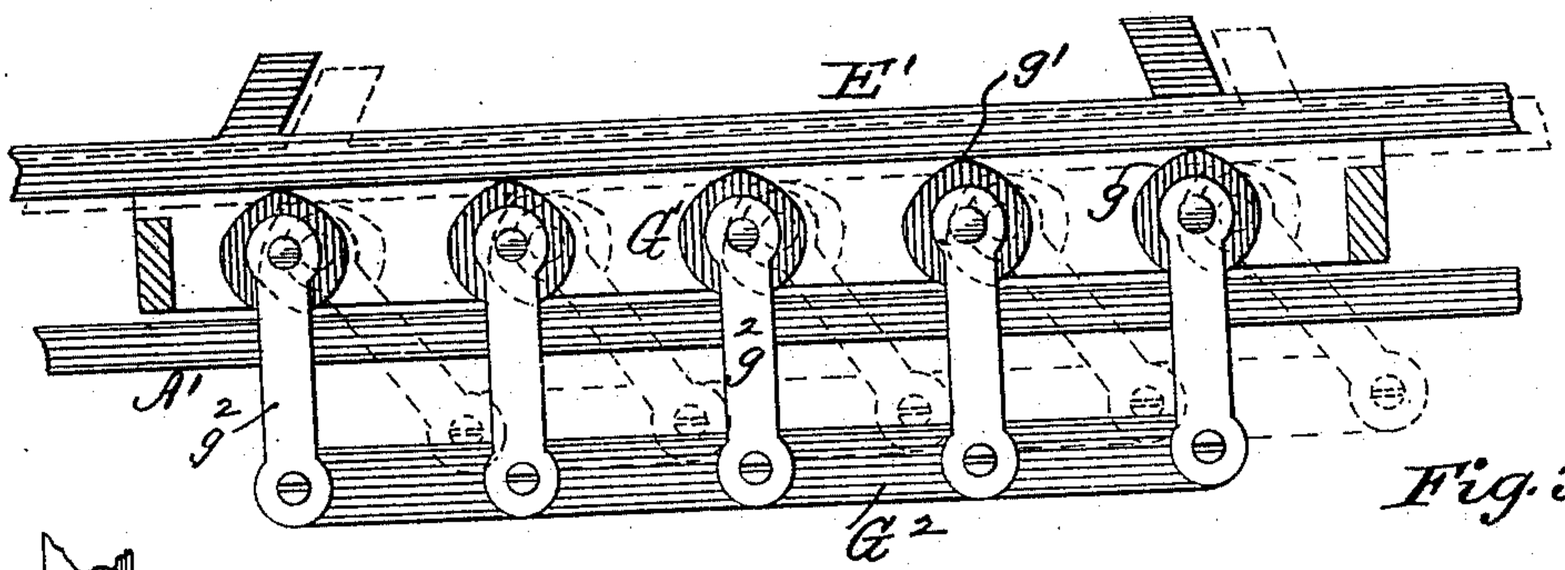

Fig. 5

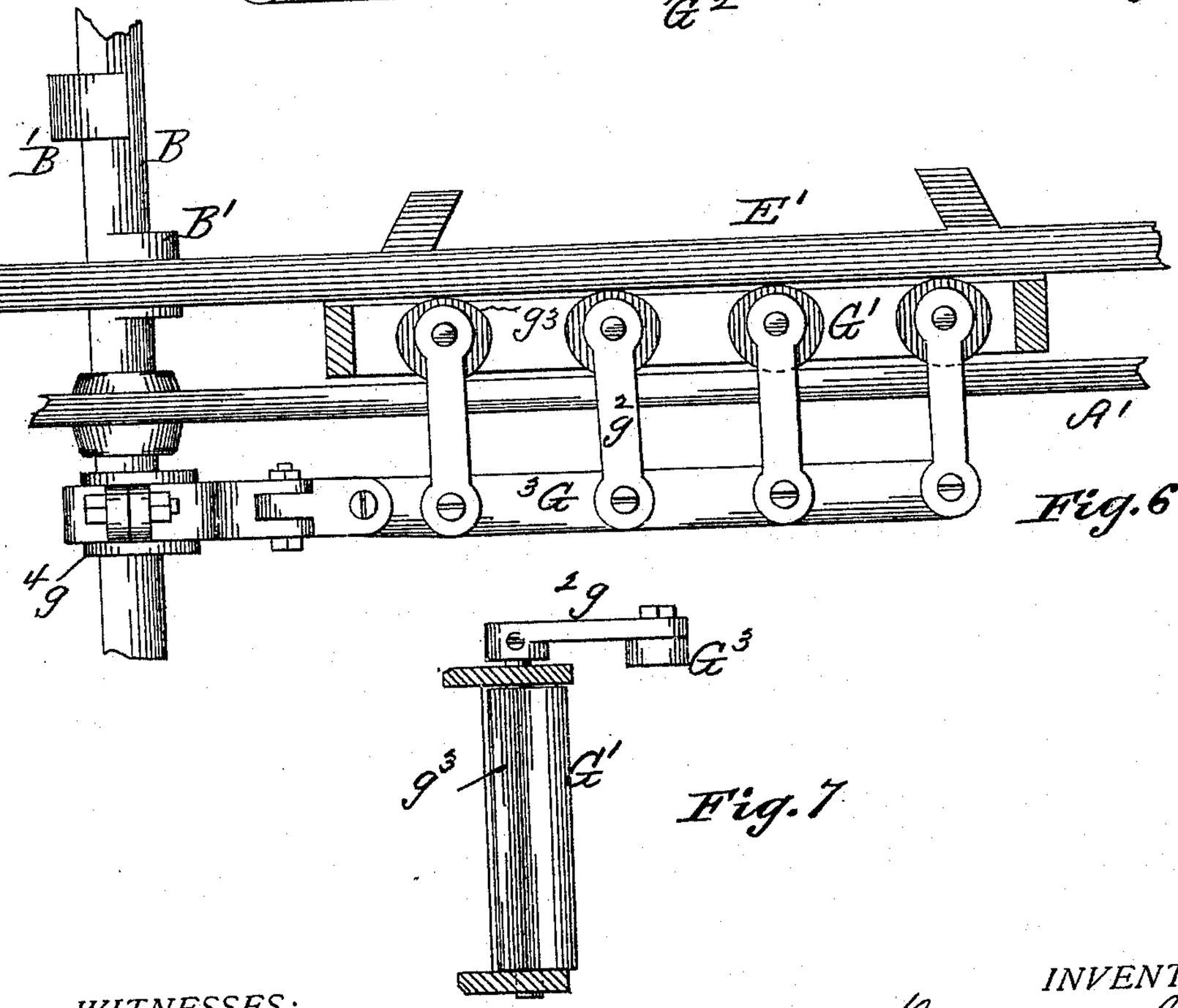

Fig. 6

Fig. 7

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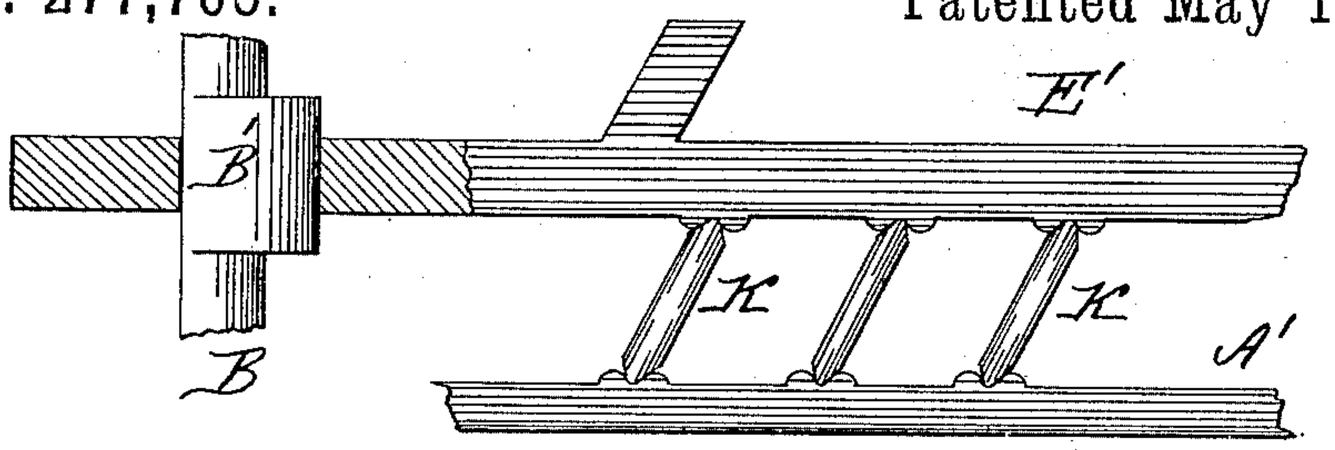

Fig. 8

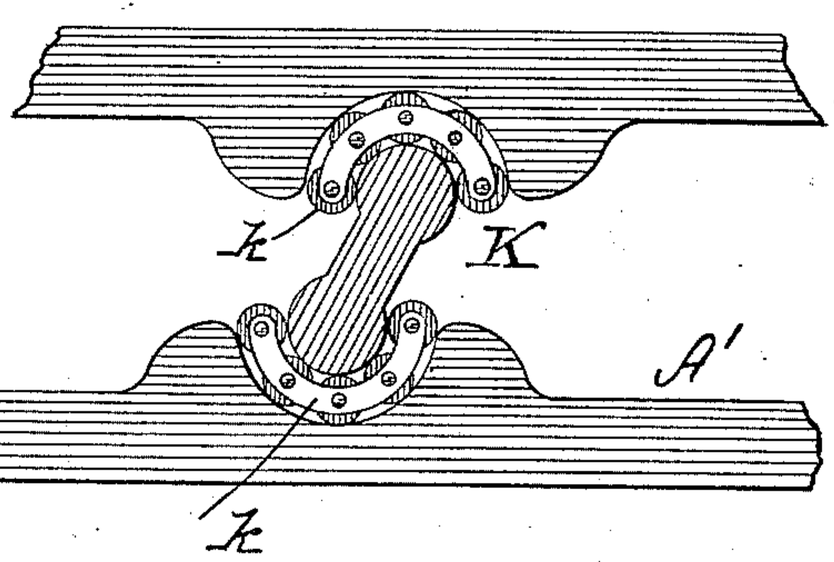

Fig. 9

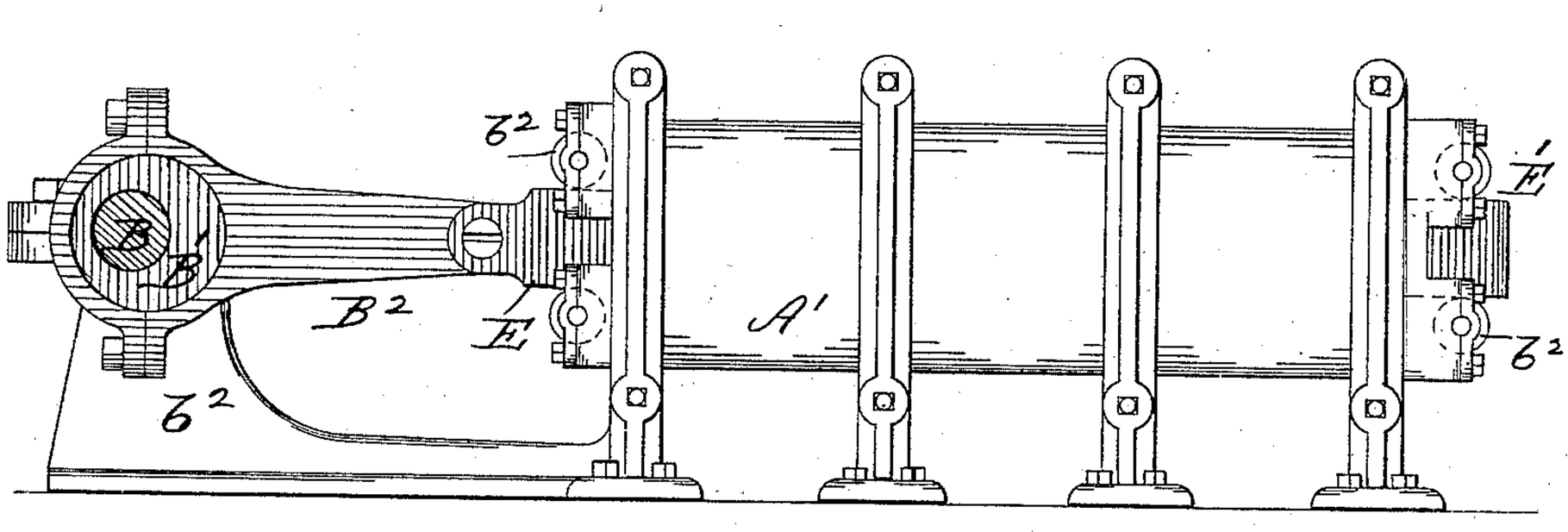

Fig. 10

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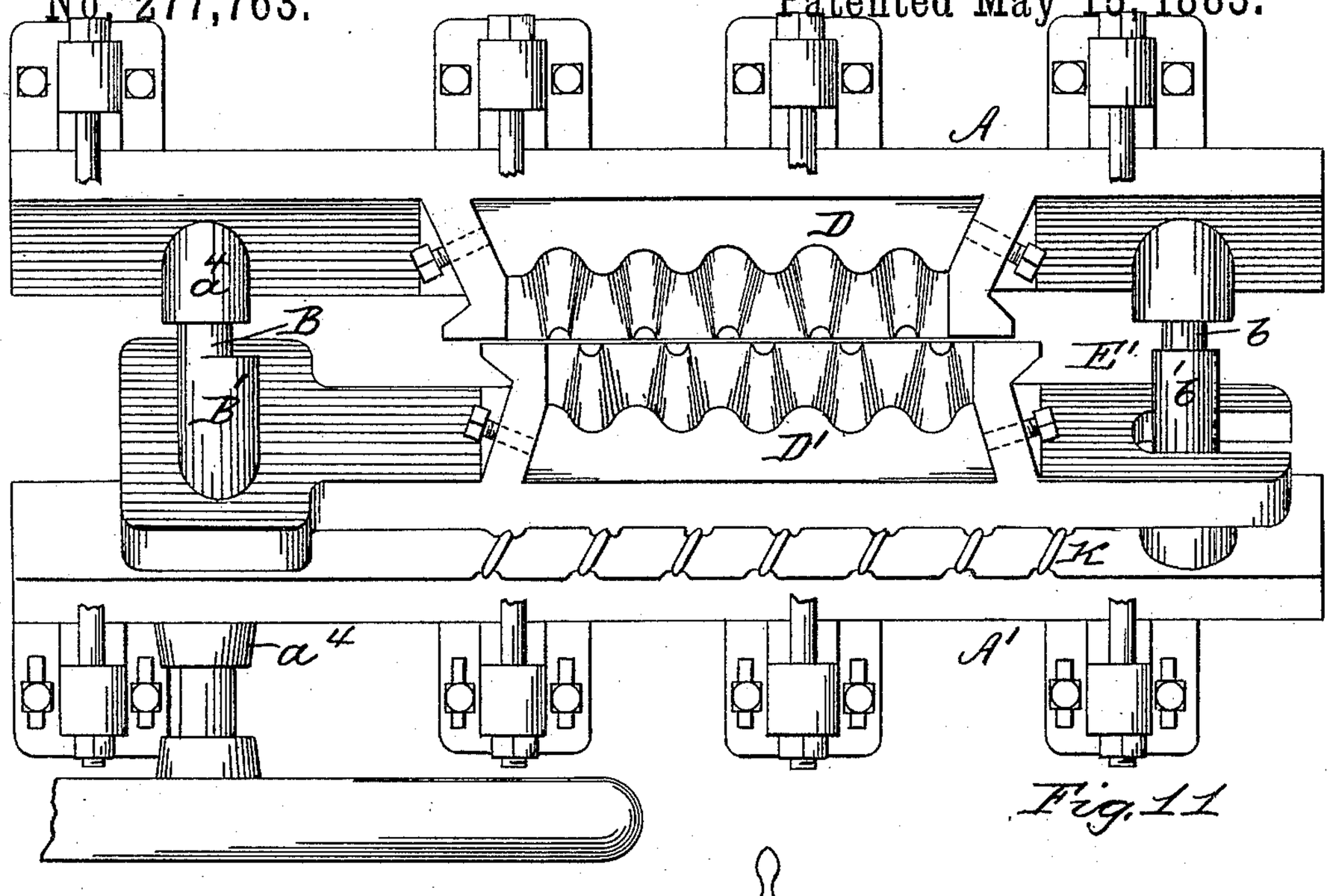

Fig. 11

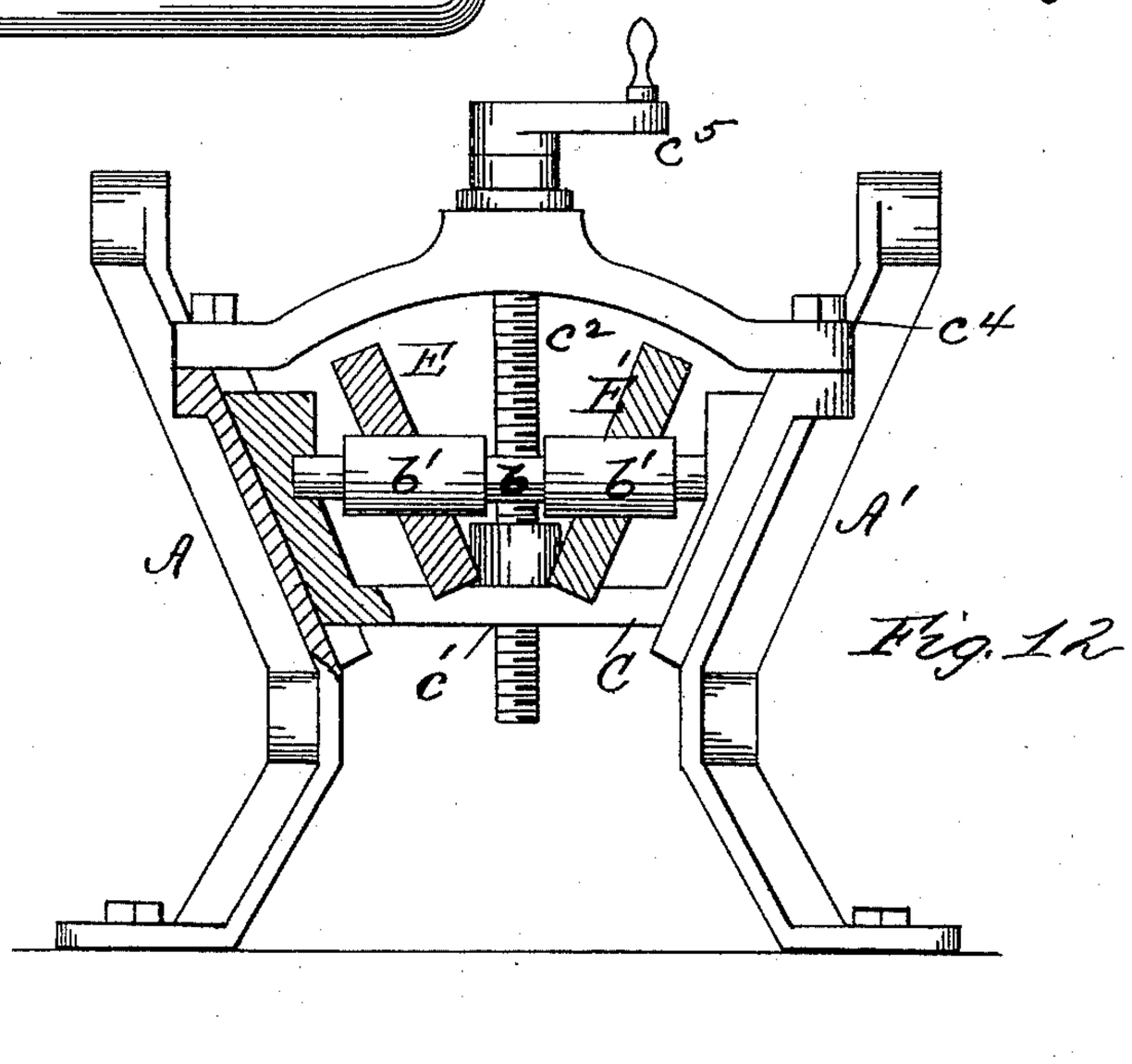

Fig. 12

WITNESSES:
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(No Model.)

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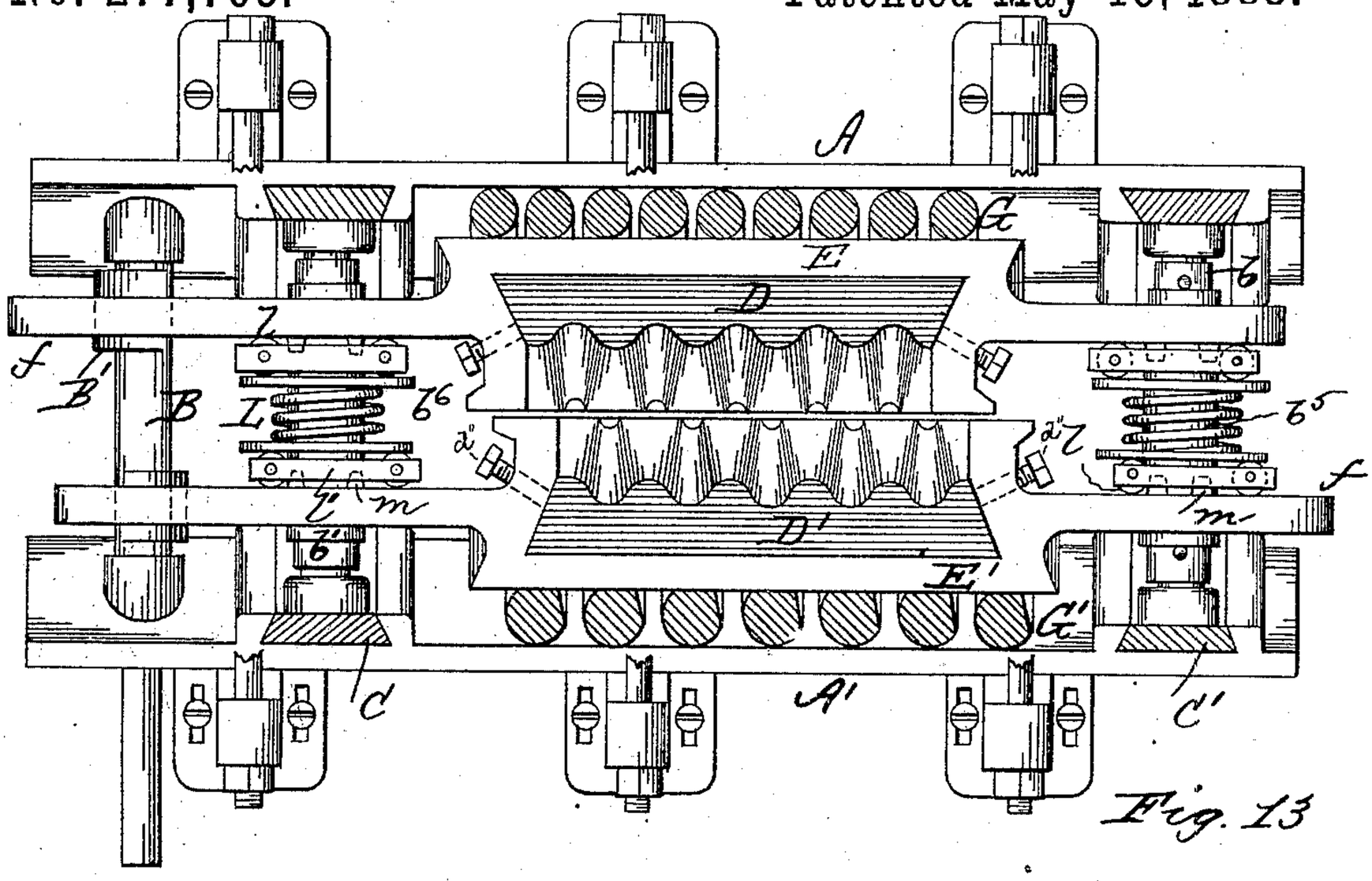

Fig. 13

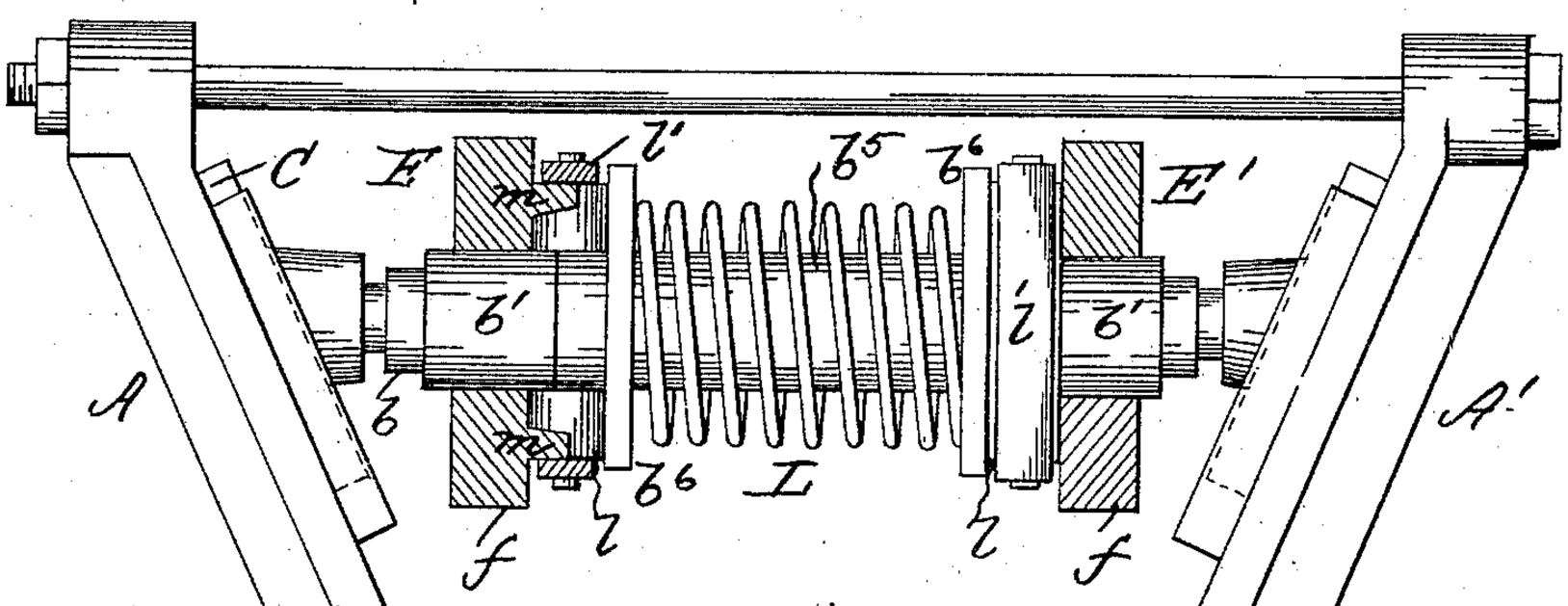

Fig. 14

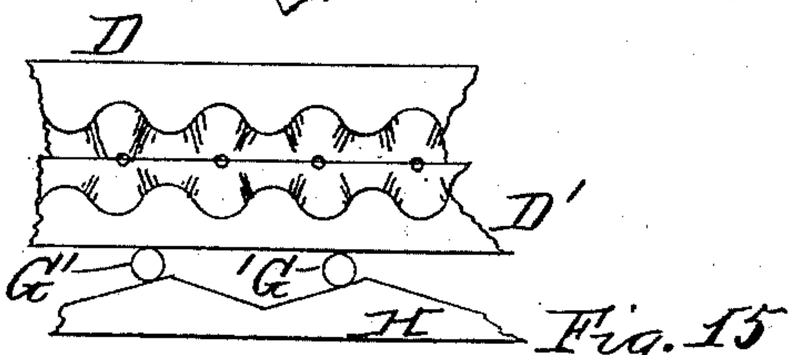

Fig. 15

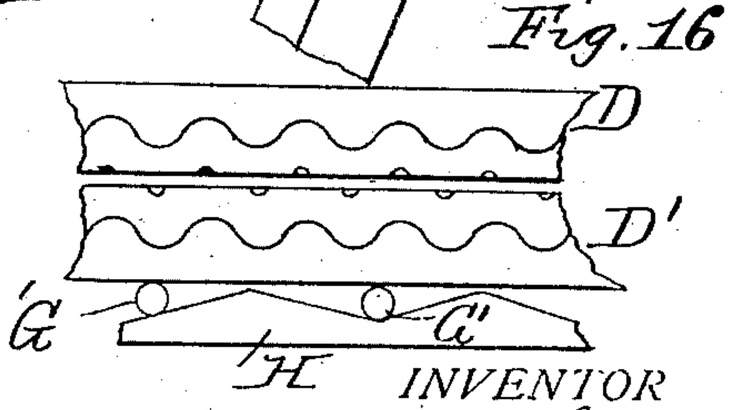

Fig. 16

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Wm. Ramsey

INVENTOR

Robert McCully

UNITED STATES PATENT OFFICE.

ROBERT McCULLY, OF PHILADELPHIA, PENNSYLVANIA.

ORE CRUSHER AND PULVERIZER.

SPECIFICATION forming part of Letters Patent No. 277,763, dated May 15, 1883.

Application filed September 20, 1881. (No model.)

To all whom it may concern:

Be it known that I, ROBERT MCCULLY, a citizen of the United States, residing at the city and county of Philadelphia, in the State of Pennsylvania, have invented certain new and useful Improvements in Ore Crushers and Pulverizers, of which the following is a specification, reference being had to the accompanying drawings, wherein—

Figure 1 is a transverse vertical section of a pulverizer and crusher embodying my improvements. Fig. 2 is a plan partly in section. Fig. 3 is a detail plan. Fig. 4 is a detail plan of modification of roller mechanism for effecting the transverse movement of the jaws. Fig. 5 is a like view of the same, showing said rollers provided with arms connected to a bar common to all said arms. Fig. 6 is a similar view, showing the bar connected to eccentric mechanism on the driving-shaft. Fig. 7 is a vertical section of the rollers and frame shown in Fig. 6. Fig. 8 is a plan of toggle mechanism for effecting the transverse movement of the jaws. Fig. 9 is a like view of such toggle mechanism, provided with anti-friction-roller bearings. Fig. 10 is a side elevation of a slight modification in construction of my improved crusher and pulverizer. Fig. 11 is a plan of my improved mill wherein one of the jaws is stationary. Fig. 12 is a transverse vertical section on the line *x x*, Fig. 2. Fig. 13 is a plan, partly in section, of a modification in construction of my improvements. Fig. 14 is an enlarged broken elevation of the same, partly in section. Figs. 15 and 16 are diagrams illustrating the preferable mode of setting the crushing and pulverizing jaws to obtain the best working results.

My invention has for its object to provide an ore crusher or pulverizer of extreme durability and great effectiveness, and so constructed that it will crush and pulverize an increased quantity of ore in a given time with less expenditure of power than can be accomplished with such class of machines as heretofore constructed.

My invention accordingly consists of the novel construction, combination, and arrangement of parts hereinafter described and claimed.

Referring to the accompanying drawings, A A′ represent the housings or frames of my improved crusher and pulverizer, having feet *a a*, through which pass screws or bolts *a′ a′*, by means of which said housings or frames are rigidly secured to suitable foundations or otherwise, as desired. Said frames are connected together by transverse bolts a^2 a^2, which pass through tubes or nuts a^6 a^6 inside of or between the lugs on the frames for the purpose of adjustment of the said frames. The latter have inclining sides a^3 a^3, as shown. They are also formed with bearings a^4 a^4 for the cam or eccentric shaft B, and with dovetail slots a^5 a^5, into which pass and have movement therein the frames C C′. The latter form bearings for rods or shafts *b*, upon which are mounted the friction-rollers *b′ b′*.

D D′ represent the crushing or working jaws, secured by screws or keys *d″ d″* in supports or holders E E′. The latter are formed with longitudinal slots *e e*, through which pass the friction-rollers *b′ b′*, so that said supports will rest and partially move on said rollers. *e′ e′* are slots, elongated vertically, formed in one of the ends of said supports, and through which pass the cams or eccentrics B′ B′, formed on shaft B, whereby when the latter is rotated the jaws D D′ are reciprocated longitudinally. The jaws D D′ are formed with flaring corrugated faces *d d* and straight, smooth, and partially-corrugated faces *d′ d′*, or the latter faces may be smooth and flat throughout their entire surface. The faces *d d* being the crushing-faces and *d′ d′* the pulverizing-faces, the flaring of the faces *d d* provides for a hopper, F, as shown, and, if desired, an extended hopper may be attached thereto.

Between the inclined sides a^3 a^3 of the frames and jaw holders or supports E E′ are placed anti-friction rollers G G′. The rollers G are sustained in a frame and roll, during the movement of the jaws, against the adjacent surfaces of the incline a^3 and of jaw-holder E. The rollers G′ rest against the surface of jaw-holder E′ and upon a series of double-inclining plates, H, secured to the frame A′, as shown. The object whereof is as follows: As the jaw D′ is reciprocated longitudinally the rollers G′ move up and down the incline H, and thereby cause said jaw to be reciprocated transversely or to and from the jaw D. This transverse move-

ment of jaw D′ allows said jaws to separate slightly, so that the ore will gradually drop or fall between the working-faces, and after being finely pulverized will fall out from between the jaws, thereby expediting the feeding or the movement of the ore through the machine. It is designed that the jaw D′ will be so constructed or provided with mechanism that the tendency of the same will be to keep said jaw away from or out of contact with jaw D, or hold said jaw D′ in close contact with its rollers G′. For this purpose a spring, *h*, is secured to the housing A′ in any suitable manner.

I is a bracket secured to jaw-holder E′, and is formed with a bifurcated end, *i*, embracing spring *h*, and is provided with a roller, *i′*, so arranged as to bear against said spring *h*, as shown in Figs. 1 and 2. The result whereof is that the elastic force of spring *h* is exerted against roller *i* to cause jaw D′ to hug its rollers G′ and keep it out of contact with jaw D. Such contact of the jaws will be effected only under the influence of the rollers moving up the inclines H.

To take up the wear of the jaws I provide the following means: The frames C C′ are formed with lugs *c*, having threaded openings *c′* for the reception of adjusting-screws c^2, suitably secured to transverse bars c^3, bolted at c^4 to the housings. If desired, said screws may be provided with handles or winches c^5. On turning the latter the screws c^2 operate in lugs *c* to raise or lower the frames C C′ and with them the jaw-holders E E′. If lowered, the inclining sides of the housings cause the jaws to come together, and thus the wear of the same is compensated for.

In Figs. 4, 5, 6, and 7 I have shown modifications of mechanism for effecting the transverse reciprocation of the jaw or jaws, wherein the inclines H are dispensed with; and the peripheries of the friction-rollers G′ are partially formed with sides or arcs of larger circles, as shown at *g g*, which meet and form an apex, *g′*, as shown in Figs. 4 and 5. In Fig. 4 such rollers are represented as being supported in a frame, and each roller moving independently. In Fig. 5 said rollers are each provided with a rigid arm, g^2, which connects with a bar, G^2, common to all said arms. Such connection of the rollers causes all of them to move simultaneously in whatever direction they are designed to travel. In Fig. 6 the rollers have part of their peripheries formed with a surface of larger diameter, as shown at g^3, and the bar G^3 is connected to an eccentric, g^4, on driving-shaft B, so that said rollers will be positively actuated during each reciprocation of the jaws.

In Figs. 8 and 9 I have shown toggle-levers K K, which may be substituted for the anti-friction rollers just described, to effect said transverse reciprocation of the jaws. In Fig. 9 the levers K are shown provided with anti-friction-roller bearings *k k*.

The above-described forms of roller mechanism and their modifications all accomplish the same result—viz., the lateral movement of the jaws. Such movement may be increased or diminished, so as to obtain a quick or slow feed, as desired. For instance, the length of the inclines H may be such that the rollers will pass up and down the same twice during each full longitudinal reciprocation of the jaws. Hence the latter will laterally recede or open from each other and approach or close together twice during each of such longitudinal reciprocations. The result whereof is that the ore pulverized in the mill falls out thereof during each opening of the jaws, and when the jaws open laterally twice during each longitudinal movement of the same a quick feed is obtained. Such number of openings and closings of the jaws is produced when the modifications shown in Figs. 7 to 9 are employed, with like results—viz., a quick feed; but if the inclines H be made of such length that the roller will, during each full longitudinal movement of the jaws, travel only from the base to the apex, and then back again, then only one opening and closing of the jaws takes place, and in this case a slower feed is provided for. The simultaneous reciprocation of the jaws in different directions results in an angular pressure falling upon the ore to be crushed. Consequently such ore is more readily crushed and pulverized, and with less wear and tear of the working-faces of the jaws.

In Fig. 10 I have shown a slight modification of construction of my invention, wherein the eccentric-shaft B is supported in bearings b^2, separate from the housings A A′, and is connected to the jaw-holders E E′ by a connecting rod or link B^2. The friction-rollers b^3, instead of passing through slots in the jaw-holders, as shown in Fig. 1, herein pass above and below said holders, as illustrated. Such construction permits of a solid jaw-holder throughout its entire length, there being no slots whatever formed therein.

In Fig. 11 I have shown a still further modification, wherein one of the housings A is so formed that it subserves the double purpose of a housing for the mill and a jaw-holder, the jaw D being secured directly thereto, as shown, the interposed rollers G G being dispensed with. Said housing is in other respects constructed substantially as above described, the jaw D′ only reciprocating. In such construction only one eccentric on shaft B is used and only one set of anti-friction rollers G or toggles K is employed. Such construction I deem the preferable one where cheapness of manufacturing is desirable.

In Figs. 1 and 2 I have shown the spring *h* and bracket I secured to housing A′ and jaw-holder, E′, respectively, for effecting a separation of the jaws; but such result may be accomplished by means shown in Figs. 13 and 14, wherein the jaws E E′ have their ends *f* formed in vertical lines, as shown. The rollers *b′* on shafts *b* extend thereon only a slight dis-

tance beyond said vertical sides of the jaw-holders. The middle parts, b^5, of said shafts or rods do not rotate, and on them are placed, in any suitable manner, loose collars b^6, between which and surrounding each rod or shaft is a spiral spring, L. Between the collars b^6 and the jaw-holders are placed friction-rollers l, sustained in frames l'. Said frames and rollers are held in position by means of lugs m, cast on said jaw-holders, and upon which said frames l' rest and move. The rollers l are held in close contact with the jaw-holders by the elastic force of springs L, thereby tending to keep said jaws apart. When said jaws are reciprocated the movement of the rollers l lessens the friction of such reciprocation. In all other respects the construction is substantially as heretofore described.

In setting the jaws for working I deem it a preferable plan to so arrange them that when their straight or vertical surfaces are pulverizing the ore they will be taking their feed on their upper flaring surfaces, and when crushing between their flaring parts the ore previously pulverized will then be effecting its exit from between the straight surfaces of the jaws. Such arrangement is shown in Figs. 15 and 16. In the former the jaws are represented as having completed one-half of their longitudinal reciprocation, the rollers G′ being at the apex of the inclines H. Consequently said jaws have also been moved transversely to close together. In such position their corrugations register with each other, as shown, and they then take their feed. During such movement there has been only a slight crushing action performed by the upper flaring surfaces of the jaws, but their straight or lower surfaces have more or less completely pulverized any ore that may have been in position between them. When the jaws have completed their return longitudinal reciprocation the rollers G′ are then at the bases of the inclines H. Consequently the jaws have also moved transversely to open from each other, and in such position their corrugations do not coincide with each other, as shown in Fig. 16. During such movement their flaring surfaces are then crushing the ore placed or fed between them, while ore previously pulverized by their straight lower surfaces finds its exit therefrom, and the more or less finely divided ore above then finds its way down to the said straight portions of the jaws, to be pulverized during the succeeding movements of the jaws, as above described.

Such arrangement and operation of the jaws as I have stated I consider the most available to effect the best working results; but they may be varied as desired. In case it is designed to use the mill for crushing purposes only, the jaws are set the desired distance apart by manipulating the cranks c^5.

I have stated that the foregoing-described machine may be used for crushing purposes only. So, too, if desired, it may be employed only for pulverizing, in which case the various parts of the machine will be made lighter in construction.

It will be noticed that the slots in the frames E E′ fit the rollers b', but the shafts upon which the rollers are placed have their bearings in the frames C C′, as shown in Fig. 12. Hence when adjustment is made to take up the wear of the jaws the screws a' a' of frame A′ are loosened, thereby permitting the frames C C′ to descend and push frame A′ farther apart from frame A. The more the frame A′ so moves the greater will be the descent of frames C C′. As the latter so move the jaws automatically come together by reason of their resting upon the inclined rollers G G′.

What I claim as my invention is—

1. In an organized machine for crushing and pulverizing ore, a jaw, a supporting-frame therefor, and a movable jaw, in combination with a driven shaft and mechanism interposed between said shaft and jaw and between the latter and its supporting-frame, substantially as shown and described, whereby said jaw is positively actuated so as to have a simultaneous longitudinal and transverse movement with respect to the length of the machine, as set forth.

2. In an ore crusher and pulverizer, the combination of the following elements: a frame or support, a fixed and a movable jaw provided with upper flaring and lower straight crushing or working surfaces corrugated vertically, a driven shaft, and mechanism interposed between said shaft and movable jaw and between the latter and its supporting-frame, substantially as shown and described, and for the purpose set forth.

3. In an ore crusher and pulverizer, the combination of the following elements: a supporting-frame, two crushing-jaws provided with two working-faces corrugated vertically, one of said jaws being a movable jaw, a driven shaft, mechanism interposed between said shaft and jaw and between the latter and its supporting-frame, for imparting to such jaw a simultaneous lateral and longitudinal movement with respect to the length of the machine, and mechanism in engagement with said jaw, constructed, substantially as shown and described, for taking up the wear of said jaw, as set forth.

4. In an ore crusher and pulverizer, the combination of the following elements: a supporting-frame, a fixed and a movable jaw, mechanism designed and adapted to reciprocate the movable jaw longitudinally, means interposed between said jaw and frame for moving the jaw laterally, and suitable elastic means for holding said jaws out of contact, as and for the purpose set forth, substantially as shown and described.

5. In an ore crusher or pulverizer, the combination of a frame, crushing or pulverizing jaws, a driving-shaft, cam or eccentric mechanism thereon for moving the jaws longitudinally, elastic means for holding said jaws apart, and

mechanism for moving said jaws transversely, substantially as shown and described.

6. In an ore crusher or pulverizer, the combination of a fixed jaw, a longitudinally-movable jaw, operating mechanism therefor, elastic means for holding said jaws apart, and mechanism for reciprocating the movable jaw toward the fixed jaw, substantially as shown and described.

In testimony that I claim the foregoing I have hereunto set my hand this 15th day of September, 1881.

ROBERT McCULLY.

Witnesses:
FRANK BLAYNEY,
WM. RAMSEY.