(No Model.)

4 Sheets—Sheet 1.

J. WARRINGTON.

ROLLER MILL.

No. 277,525. Patented May 15, 1883.

Fig. 1.

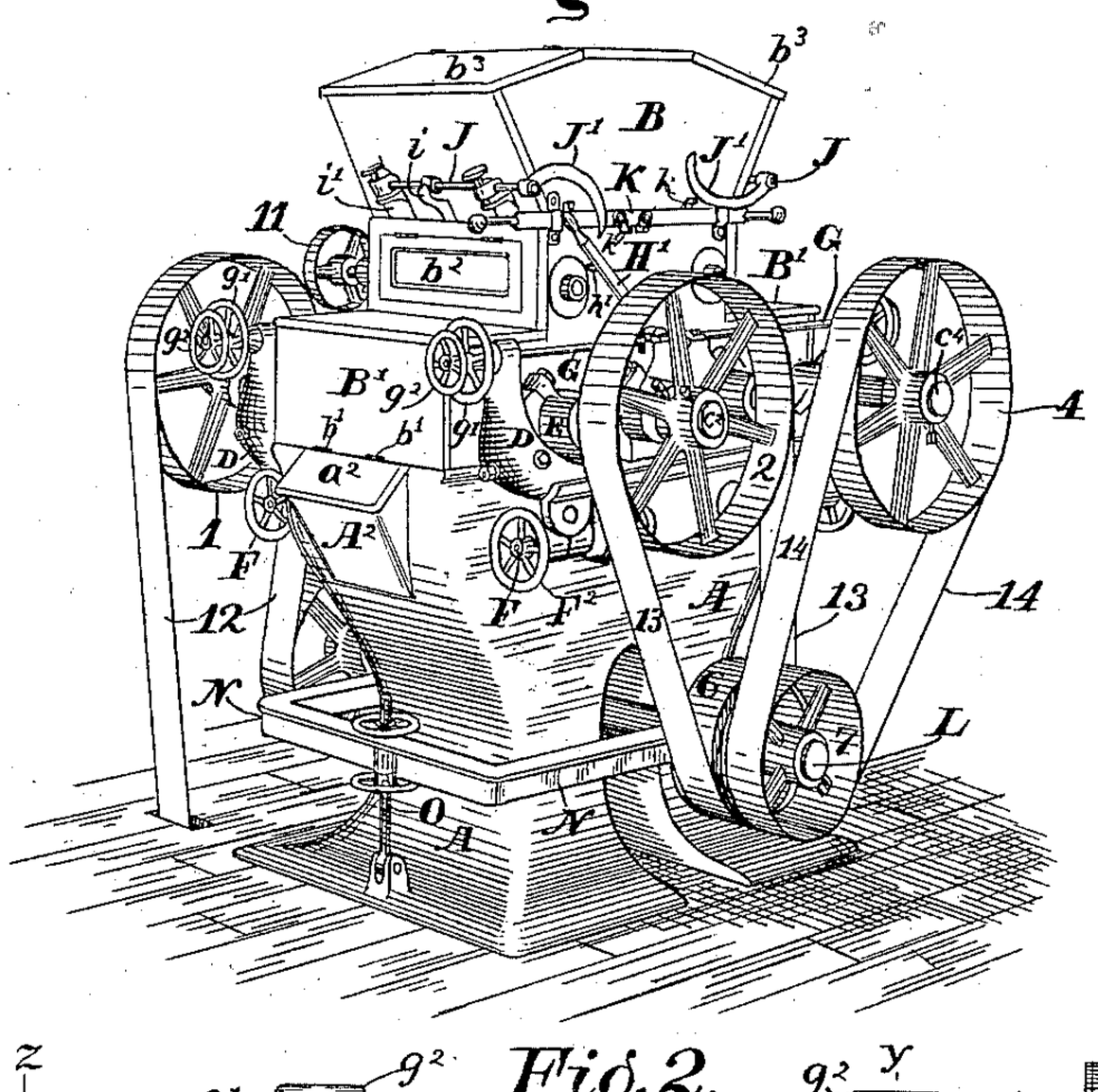
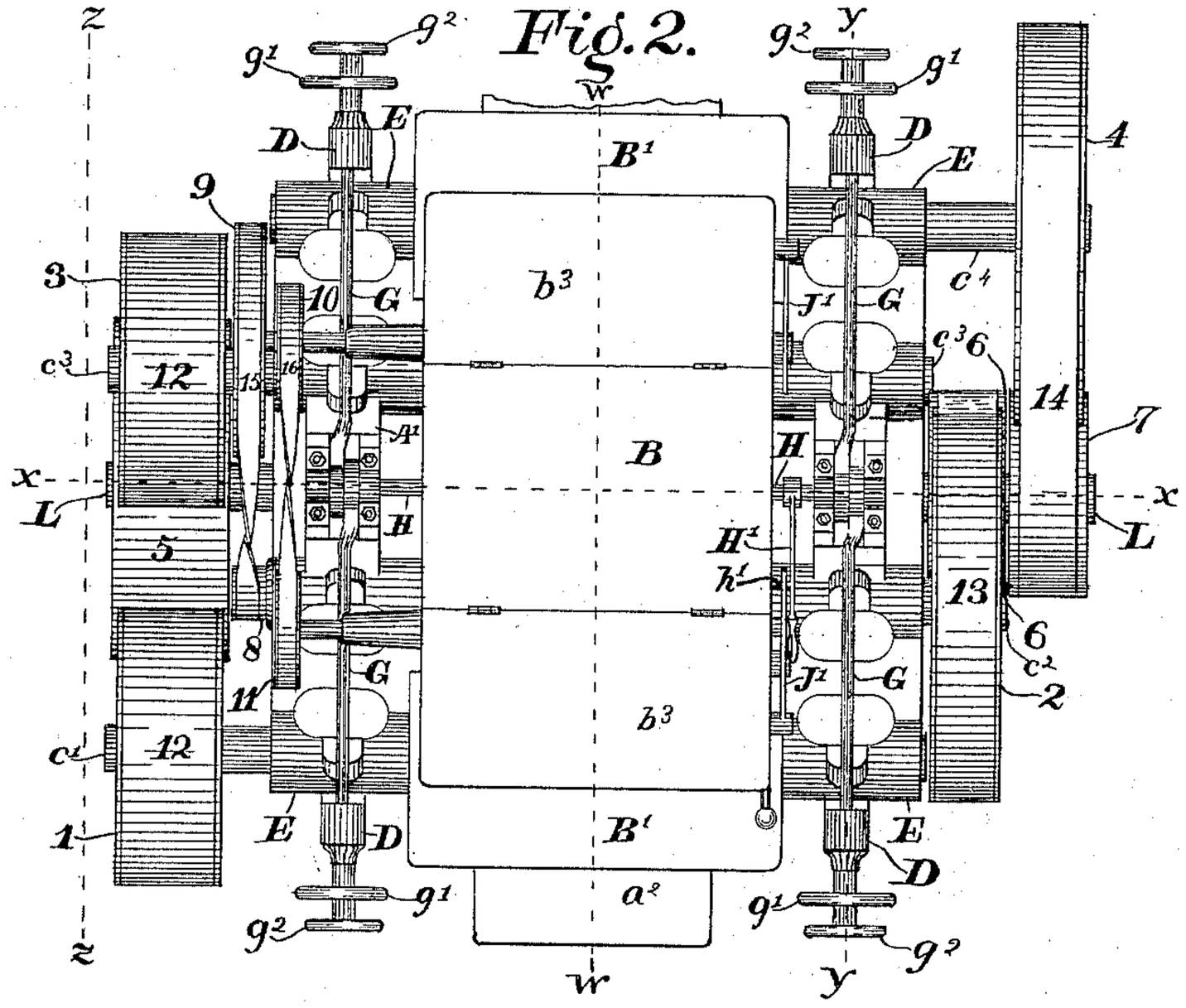


Fig. 2.



WITNESSES.

Chas. A. Leonard,

E. W. Bradford

INVENTOR.

Jesse Warrington,

PER

C. Bradford.

ATTORNEY.

(No Model.)

4 Sheets—Sheet 2.

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ROLLER MILL.

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Fig. 4.

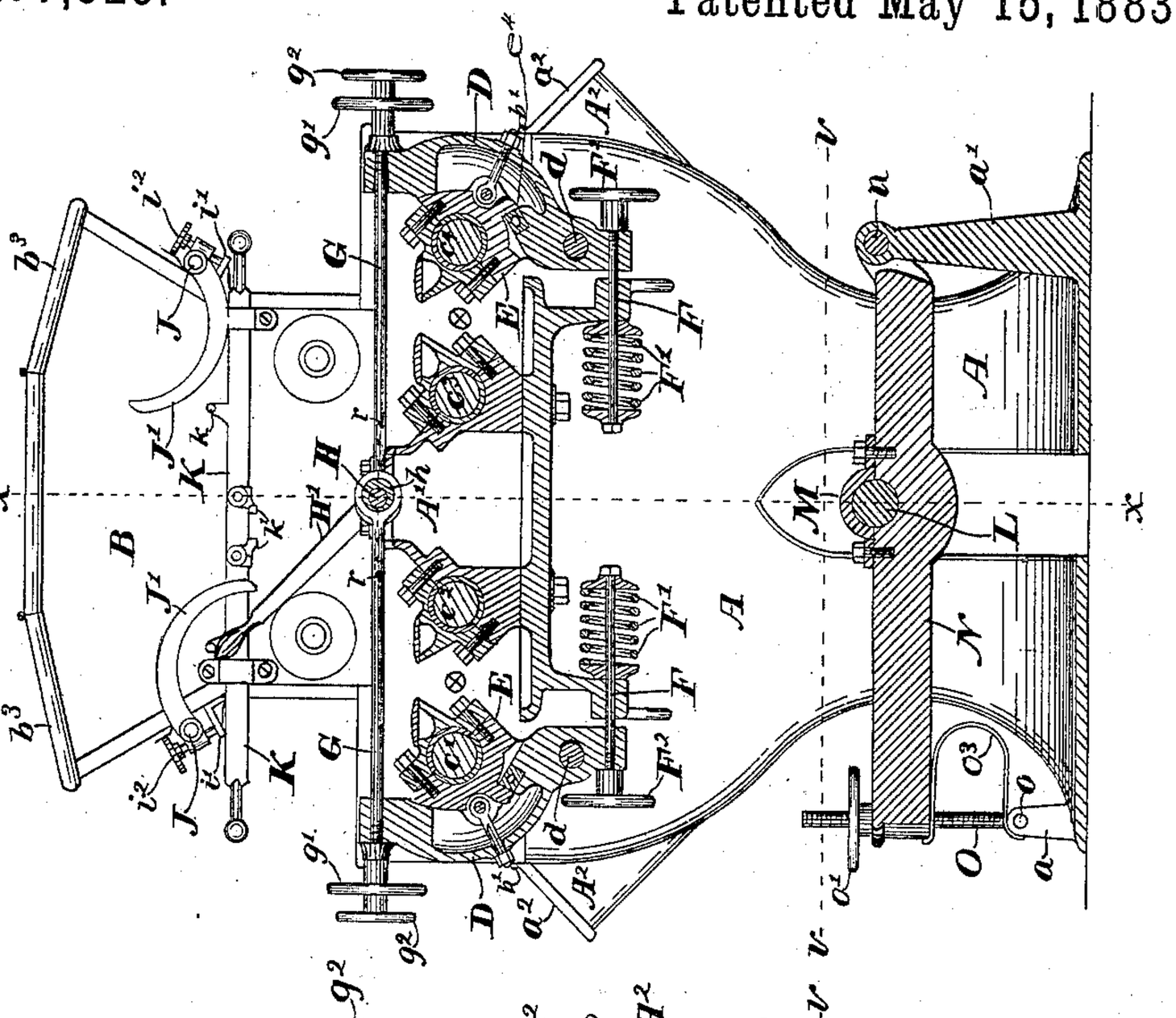
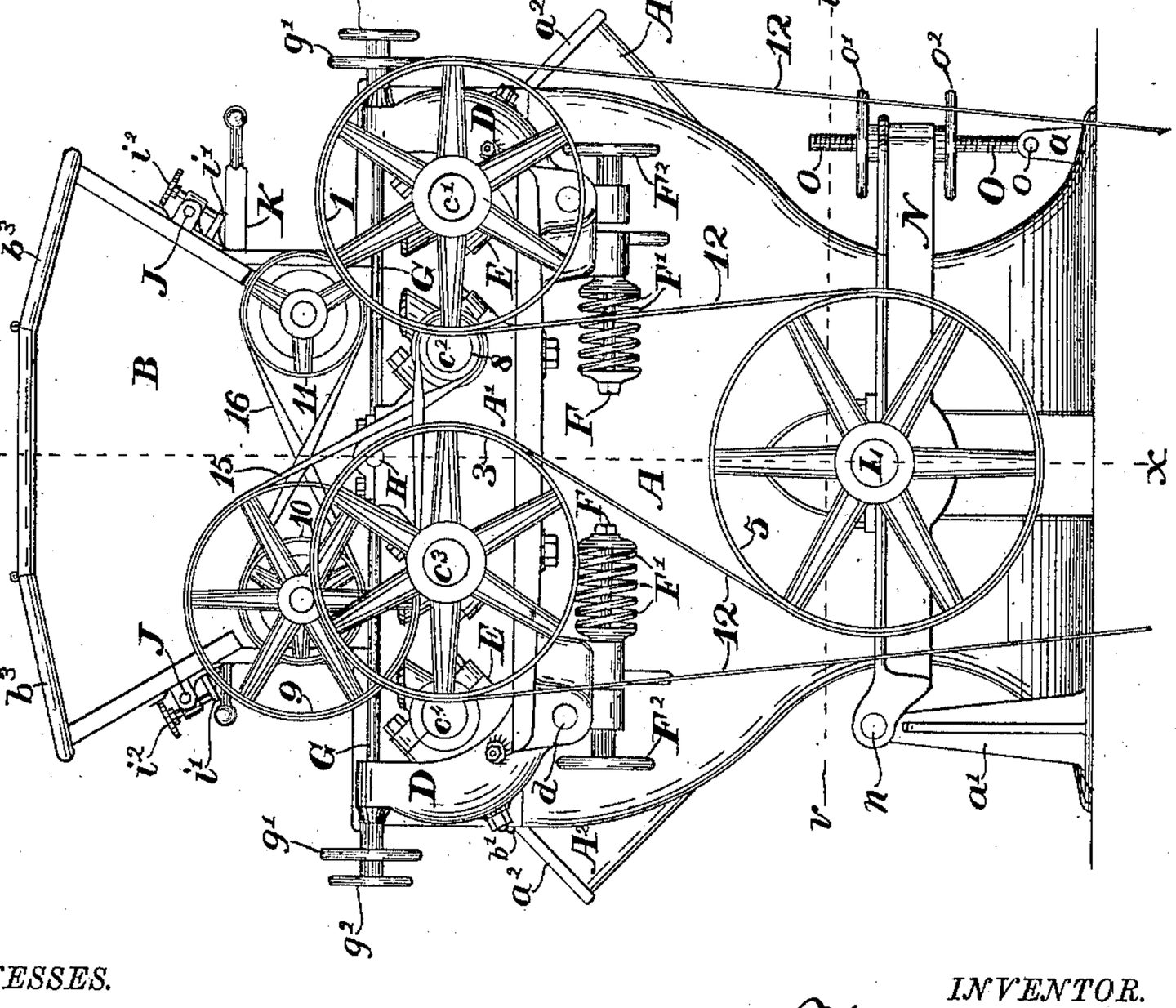


Fig. 3.



WITNESSES.

Chas. A. Leonard,

E. W. Bradford.

INVENTOR.

Jesse Warrington,

PER

C. Bradford.

ATTORNEY.

(No Model.)

4 Sheets—Sheet 3.

J. WARRINGTON.

ROLLER MILL.

No. 277,525. Patented May 15, 1883.

Fig. 6.

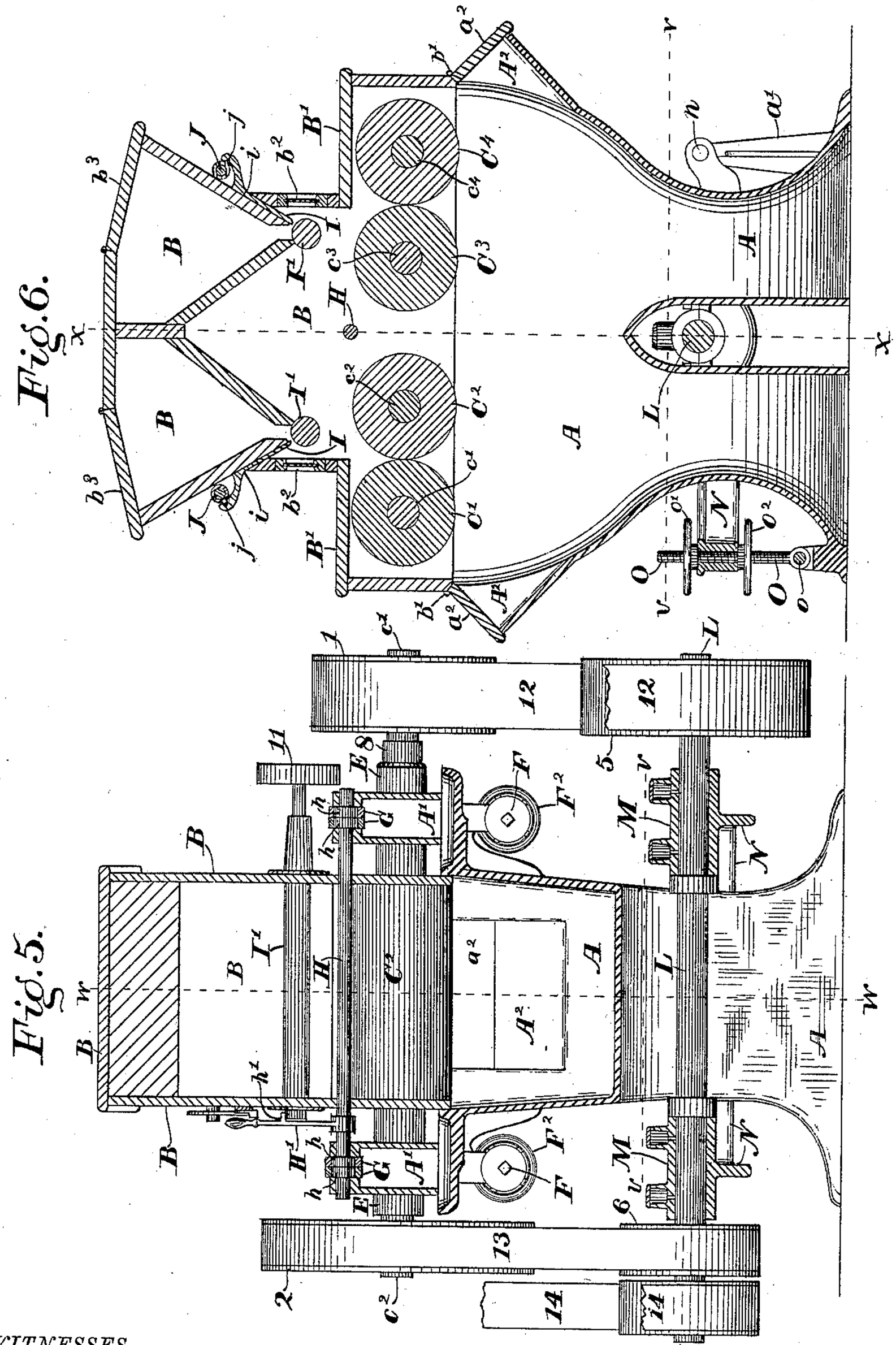


Fig. 5.

WITNESSES.

Chas. N. Leonard,

E. W. Bradford.

INVENTOR.

Jesse Warrington,

PER

C. Bradford.

ATTORNEY.

(No Model.)

4 Sheets—Sheet 4.

J. WARRINGTON.

ROLLER MILL.

No. 277,525. Patented May 15, 1883.

Fig. 7.

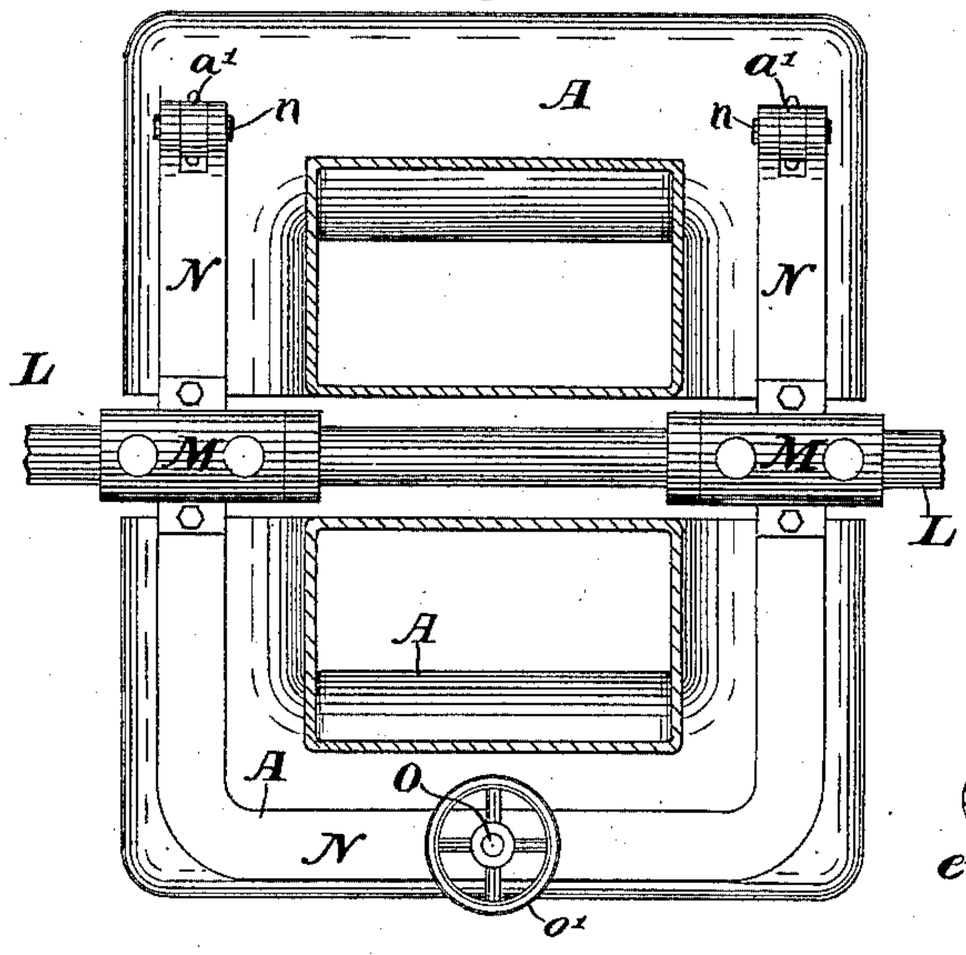


Fig. 8.

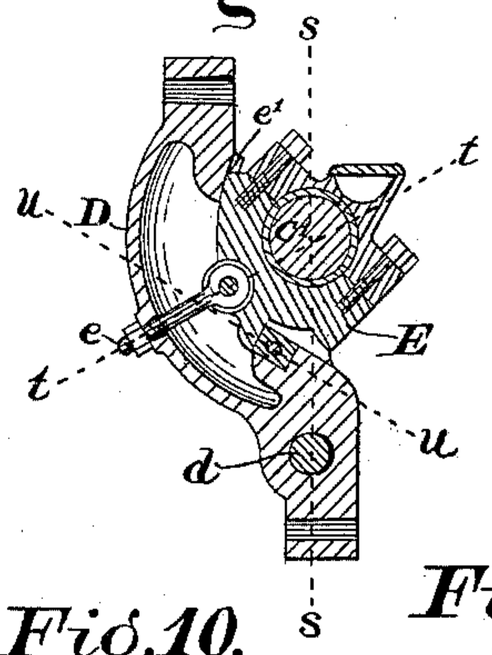


Fig. 9.

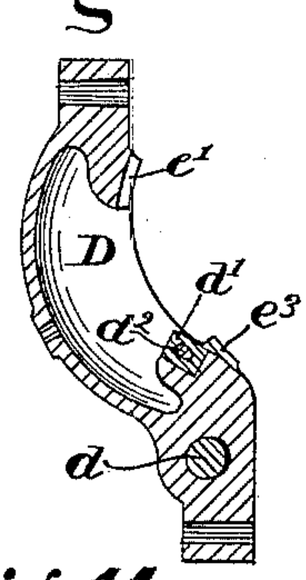


Fig. 10.

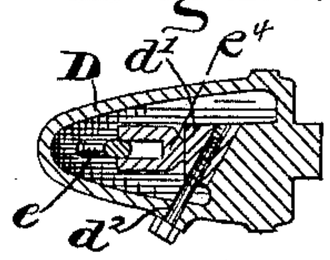


Fig. 11.

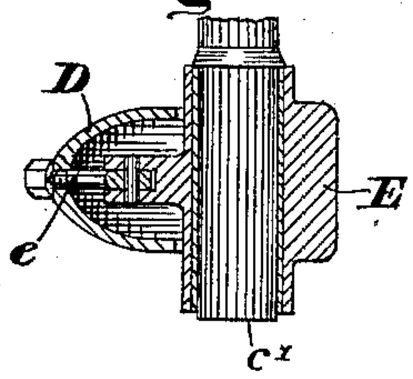


Fig. 12.

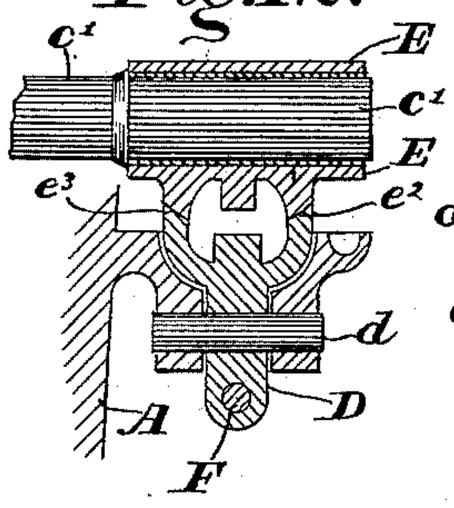


Fig. 13.

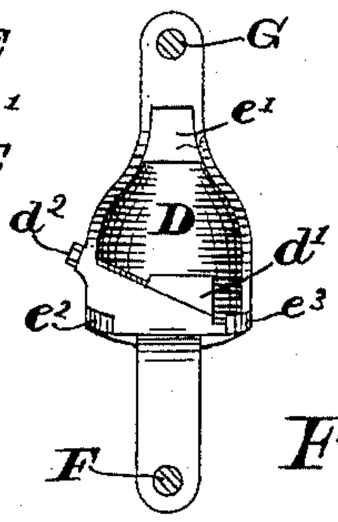


Fig. 14.

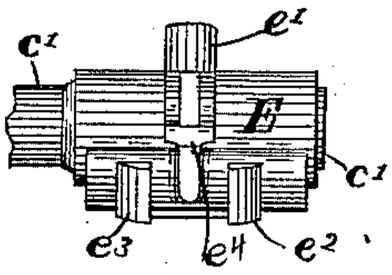


Fig. 15.

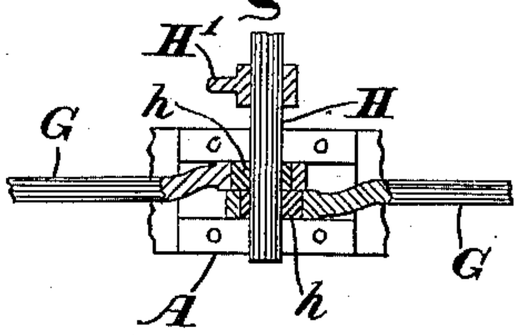
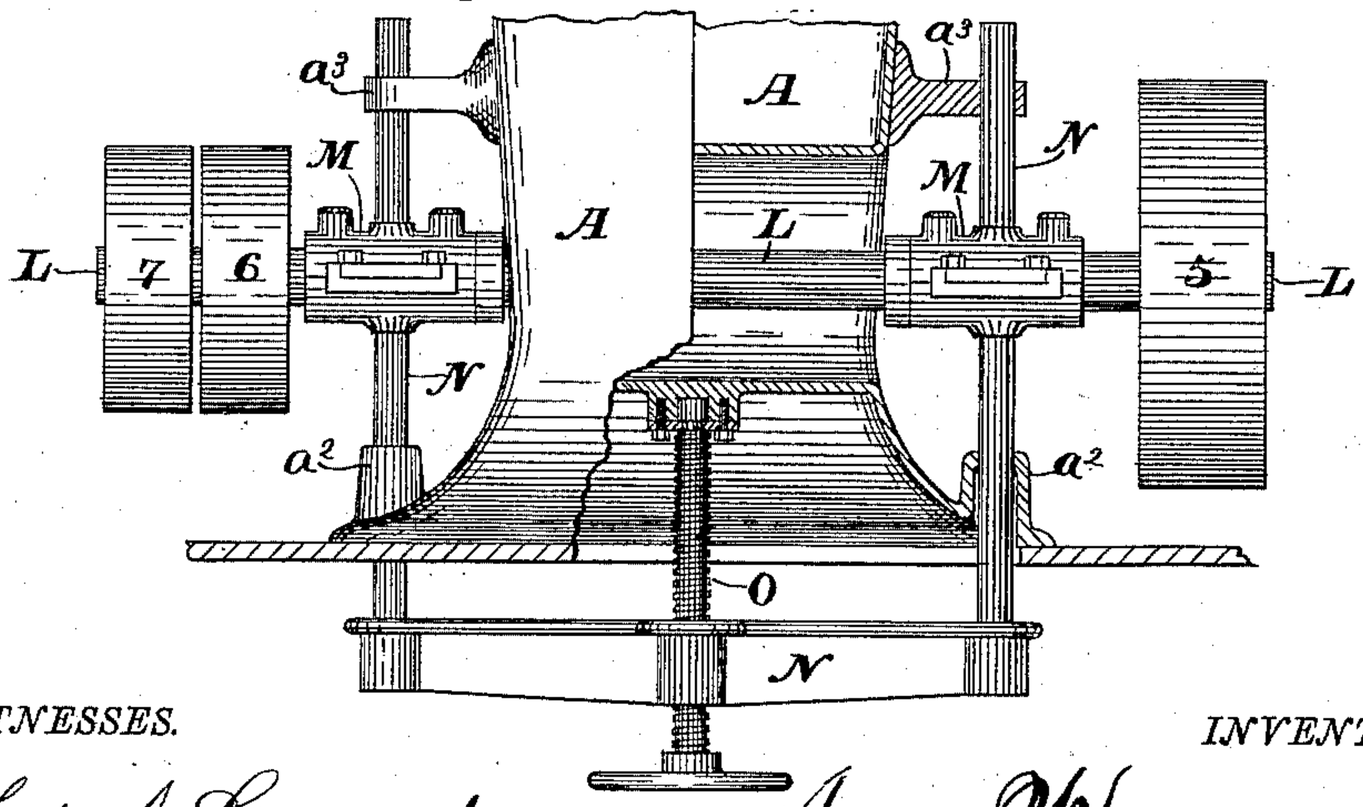


Fig. 16.



WITNESSES.

Chas. N. Leonard,

E. W. Bradford

INVENTOR.

Jesse Warrington,

PER

C. Bradford.

ATTORNEY.

UNITED STATES PATENT OFFICE.

JESSE WARRINGTON, OF INDIANAPOLIS, INDIANA, ASSIGNOR TO THE NORDYKE & MARMON COMPANY, OF SAME PLACE.

ROLLER-MILL.

SPECIFICATION forming part of Letters Patent No. 277,525, dated May 15, 1883.

Application filed February 13, 1883. (No model.)

To all whom it may concern:

Be it known that I, JESSE WARRINGTON, of the city of Indianapolis, county of Marion, and State of Indiana, have invented certain new and useful Improvements in Roller-Mills, of which the following is a specification.

My said invention consists in certain improvements in the construction and arrangement of parts in that class of machinery for the reduction of grain known as "roller-mills," whereby a machine is produced having many new and desirable features, as will hereinafter be more fully described and claimed.

Referring to the accompanying drawings, which are made a part hereof, and on which similar letters of reference indicate similar parts, Figure 1 is a perspective view of a machine embodying my said invention; Fig. 2, a top or plan view of the same; Fig. 3, a side elevation thereof, as seen from the dotted line *z z* at the left of Fig. 2; Fig. 4, a transverse vertical sectional view thereof, as seen when looking toward the left from the dotted line *y y* in Fig. 2; Fig. 5, a longitudinal vertical sectional view, as seen when looking downwardly from the dotted line *x x* in Fig. 2, and to the right and left from the corresponding lines in Figs. 3 and 4, respectively; Fig. 6, a transverse vertical sectional view on the dotted line *w w* in Figs. 2 and 5; Fig. 7, a horizontal sectional view, looking downwardly from the dotted line *v v* in Figs. 3, 4, 5, and 6; Fig. 8, a sectional view of the swinging arm and box mounted thereon, similar to a portion of Fig. 4, but on an enlarged scale; Fig. 9, a similar view of said arm separately; Figs. 10, 11, and 12, sectional views on the dotted lines *u u*, *t t*, and *s s*, respectively, in Fig. 8; Fig. 13, a face view of the arm when the box is removed; Fig. 14, a view of that side of the box which rests upon the arm; Fig. 15, a detail sectional view on the dotted line *r r* in Fig. 4; and Fig. 16, a view of the lower portion of the machine, partly in front elevation and partly in section, illustrating an alternate construction of the yoke supporting the counter-shaft.

In said drawings, the portions marked A A′ represent the supporting frame-work of the mill; B B′, the hopper and other covering portions; C′ C² C³ C⁴, the grinding-rolls; D, swinging arms in which one of each pair of rolls is mounted; E, adjustable boxes mounted on said arms; F, tempering rods or screws for adjusting the maximum force of the grinding-pressure; G, distance or adjusting rods for regulating the position of the arms; H, a through-shaft, bearing eccentrics, to which said rods are attached, and by which they are operated; I, the feed-gates; J, the shafts for operating them; K, a bar for operating said shafts; L, a counter-shaft; M, the journal-boxes therefor; N, the yoke or frame upon which said journal-boxes are mounted; O, a screw or similar device, whereby said yoke or frame may be adjusted; and the numerals 1 to 16, inclusive, the several pulleys and belts by which the machine is driven.

The frame A A′ is mainly a large hollow casting, adapted to support the machinery of a roller-mill. In general outline it is substantially a well-known form. It has been usual to provide a tunnel through this frame for the counter-shaft L. Instead of this tunnel, I prefer to form an archway, this being permitted by the substitution of a swinging yoke for the vertical rods heretofore used; but in the alternate construction shown in Fig. 16 the tunnel is shown as heretofore used. Spout-like projections A^2 on the sides of the frame form openings into the sides of the mill. Other projections or lugs are formed upon or attached to this frame, and serve as supports or bearings for various portions of the mechanism.

The hopper and covers B B′ are preferably constructed of wood. The main portion B is intended to be substantially stationary, and should have doors b^2 and covers b^3. The side portions, B′, are simply covers, and are removable in the ordinary manner, so that the grinding-rolls may be removed without disturbing the hopper or main portion B. The covers a^2 of the openings into the sides of the mill are connected to the sides of these portions B′ by hinges b'.

The several rolls, C′ C² C³ C⁴, are the crushing or grinding rolls common to roller-mills. They are respectively mounted upon the shafts c' c^2 c^3 c^4, and are driven by the pulleys 1 2 3 4—the first and third by the main belt 12, run-

ning under the pulley 5 on the counter-shaft L, and the second and fourth by separate belts 13 and 14, running from the pulleys 6 and 7 on said counter-shaft to said pulleys 2 and 4. It is essential that the two rolls of each pair have their axes in the same plane; but from unequal wear of journals, journal-boxes, or other causes, they may, after use, vary from this plane. To correct this variation from a common plane I raise or lower the journal-boxes of either one or the other roll. As the arms D have only a movement substantially to or from the fixed roll, the boxes E are secured to them, so as to move the roll up or down on this arm, as will be presently more fully described. Preferably I move the journal box or boxes of the roll supported on the swinging arms D, but do not confine myself to the adjustment of these boxes, as I may arrange to adjust the boxes of the fixed roll.

The arms D are mounted upon pins *d*, which pass through their lower ends and through lugs or bosses on the frame A. The holes in these arms through which said pins pass are elongated, (see particularly Figs. 4, 8, and 9,) which allows the arms to move slightly on said pins, or, in other words, permits the lower ends of said arms to be crowded outwardly somewhat by the roll supported thereby, when necessary, as in case a substance too hard to be crushed or ground should come between said roll and its fellow. Preferably the boxes E are secured to the arms D, so as to rest thereon at the three points e' e^2 e^3, (see Figs. 8, 9, 12, 13, and 14,) and are held in position by the bolts *e* and by the wedges *d'*, which pass between projections e^4 on said boxes and inclined faces on the inside of said arms. (See Figs. 4, 8, and 10.) The points e' e^2 e^3 are small spherical surfaces struck from a common center, ⊗, situated in front of center of the roll. The form of the spherical surface at point e' is shown in Figs. 4, 8, 9, and 13, and the point, ⊗, from which it is struck is shown in Fig. 4. The points e^2 e^3 (shown most plainly in Figs. 9, 12, 13, and 14) are struck from the same point. This point ⊗ is situated on or near a direct line from the center of the roll-journal, and lines drawn from said point to the points e' e^2 e^3 would diverge similarly to lines drawn from the center to or toward the surface of a sphere. As will be readily seen by an examination of Fig. 10, the boxes may be raised or lowered by adjusting the wedges *d'* by means of screws d^2, the movement of the box being the same as if pivoted at point ⊗, thereby also preventing any twisting or binding action on the roll-journals. When the adjustment is completed, the box is securely held in position by tightening up the nut on the bolt *e*, which clamps the box to its seat, and also forces it firmly against the wedge *d'*. The portions of the casting A' which form the boxes for the journals c^2 and c^3 of the rolls might have a formation similar to that of the faces of the arms D, in which case said boxes might be like the boxes E and be adjustable in the same manner.

The tempering-rods F pass through the lower ends of the arms D below or beyond their pivots, through lugs or projections on the casting A, and through coiled springs F'. One end of each of said rods is screw-threaded, and some sort of nut (preferably a hand-wheel, F^2) is placed thereon. These hand-wheels are turned up until the desired amount of strain for an effective grinding-pressure is brought on the arms, which holds the rolls in proper position, the tension of the springs being at all times greater at the pivots or fulcrums in one direction than the grinding resistance is in the other direction, except when a hard substance passes between the rolls, in which case the hard substance parts the rolls, forcing a further compression of the springs, the arms being permitted to move on their pivots *d* by reason of the slots in said arms. After the hard substance is discharged the return travel of the arms is stopped by said arms coming in contact with the pivots or fixed stops *d*, as shown most plainly in Fig. 4. The springs, while acting to draw the lower ends of the arms supporting the movable roll inwardly toward the fixed roll of the pair, (until the arms come in contact with the pivot-pins *d*,) also operate to hold said movable roll away from the fixed roll by reason of being on the opposite sides of the fulcrums or pivot-pins from said movable roll. This spring force on the arms D, which moves their upper or roll bearing ends away from the fixed roll, acts in the same direction as the force exerted by the resistance of the material passing between the rolls. Thus the tension on the adjusting-rods G is always in the same direction, and all "lost motion" or play in the joints of the swinging arms, adjusting-rods, &c., is taken up in the same direction, both by the action of the machine itself and the grinding strain.

The adjusting-rods G are for the purpose of moving the upper ends of the arms D back and forth, and thus positioning the individual rolls of the pairs nearer to or farther from each other. Each is attached at the inner end to an eccentric, *h*, on the shaft H, and as said shaft is rotated said eccentrics operate to move said rods in or out, and the grinding-rolls are thus held into grinding relation or permitted to part therefrom. The preferable method of making the attachment is to enlarge the ends of the rods G and form eyes therein which will fit over the eccentrics *h*. (See Fig. 4.) Each rod should be provided with a hand-nut, *g'*, and a hand lock-nut, g^2, by which the arms may be adjusted to proper position and there secured from accidental variation. The grinding-rolls supported by said arms are thus positioned nearer to or farther from their fellows, or brought into parallelism therewith.

The shaft H extends through the machine from end to end and through the eyes in the inner ends of the rods G. Four eccentrics, *h*,

are mounted on this shaft, and one of the rods G is connected to each cam. As will be seen by an examination of Figs. 2 and 4, when the shaft H is in the position shown therein, the arms D are drawn inwardly, and the rolls are thus held in grinding relation. When it is desired to part the rolls the shaft is partly rotated, which permits the arms D to move back, carrying the movable rolls with them. A handle, H′, is mounted on the shaft H, and is the means whereby the desired movement is imparted to said shaft. This handle has a projection, *h′*, thereon, which is adapted to engage with and operate the bar K as said handle is thrown back and forth, and thus open or close the feed-gates as the feed-rolls are brought into grinding relation or parted therefrom.

The feed-gates I are thin blades which run along near the feed-rolls I′, and each has upwardly-projecting arms *i* and *i′*. One of these arms, *i*, on each gate engages with a projection, *j*, on the corresponding shaft, J, and the gate is thus raised and lowered by the partial rotation of said shaft. The other arms, *i′*, are arranged to come in contact with stops i^2, and the gate is thus thereby prevented from opening too far. These stops i^2 are preferably in the form of thumb-screws, (which may be mounted in projections on the bearings for the shafts J, as shown,) so that the distance to which the gates may open may be adjustably regulated. It will be understood that the bar K can be applied to a mill having a single set of grinding-rolls, and consequently only one feed-gate. In such case the construction shown need not be departed from, one of the gates being simply omitted, and the above description, when changed to the singular form, is equally as applicable to such an arrangement as to that shown, and I desire to be understood as claiming the combination of devices described as a means of operating either one or two feed-gates.

The shafts J have upon them, preferably at or near their centers, projections *j*, which engage with the arms *i* on the feed-gates, and are thus adapted to open said feed-gates or allow them to close as said shafts are partially rotated in one or the other direction. These shafts have arms J′, the weight of which operates to rotate the shafts in one direction. Said shafts are rotated in the other direction by the bar K through the medium of the lugs *k k* thereon, which lift the arms J′ as said bar is moved, so that said lugs come in contact therewith.

The bar K is provided with lugs *k k*, which come in contact with and operate the arms J′, and with catches *k′ k′*, by means of which the handle H′ is enabled to operate said bar. Said bar is thus adapted to be moved independently of the handle H′ to operate the feed-gates, or by means of the lug *h′* to be moved by said handle, and thus caused to operate said feed-gates simultaneously with the opening or closing of the grinding-rolls.

The counter-shaft L is mounted in journal-boxes M, and runs through from end to end of the machine parallel or substantially parallel with the roll-shafts. When said counter-shaft is raised or lowered it loosens or tightens the several belts employed to run the grinding-rolls, as will be readily understood by an examination of the drawings. As will also be readily understood, this counter-shaft runs in the opposite direction from that in which the rolls C′ C^3 run, and thus drives the rolls C^2 C^4 also in the opposite direction to said rolls C′ C^3. This causes the adjacent faces of the individual rolls forming each pair to run in the same direction, instead of oppositely, as would be the case if the rolls themselves ran in the same direction.

The journal-boxes M for the counter-shaft are attached to or form part of the frame N, and move therewith.

The frame N is in the form of a yoke, and extends around from one journal-box to the other. In the preferred form (shown in the principal figures) it is essential that it extend somewhat beyond said boxes, and it is desirable that it also extend beyond them in the other forms, as shown in Fig. 16. This frame or yoke may be either pivoted or mounted in slides, and may be operated by screws, as shown, or by toggles, cams, levers, racks, or any device or combination of devices whereby it may be moved or adjusted and secured in the desired position, the counter-shaft thus adjusted, and the belts thereby tightened or loosened. In the principal figures this frame is shown as adapted to swing on pivots *n*, by which it is attached to the projections *a′* on the frame A, and in Fig. 16 it is shown as adapted to slide in bearings in the lugs a^2 a^3 on said frame.

The screw O is a convenient means of raising and lowering the yoke N, and thereby adjusting the counter-shaft. In Figs. 1, 3, and 6 this screw is shown pivoted by a pivot, *o*, to a boss, *a*, on the frame A, and provided with two hand-nuts, *o′* o^2, one above and the other below the portion of the yoke through which it passes. It is obvious that by turning these hand-nuts properly the yoke N may be secured at any position thereon that may be desired, and moved from one position to another at pleasure. Instead of the lower hand-nut, o^2, a spring, o^3, might be used, if desired, as shown in Fig. 4, which, while not so rigid as the nut, is more convenient, and will probably answer all purposes in ordinary mills, especially the smaller sizes. In the alternate construction shown (see Fig. 16) the screw is secured to a portion of the frame A of the mill, or to the floor or frame-work, either by caps, as shown, or in such other manner as may be desired by the builder, which will prevent endwise movement, while permitting it to revolve freely, and thereby move the yoke up and down, the hole in said yoke through which said screw passes being threaded or tapped to receive it. As before stated, various other constructions may

be used without departing from my invention, there being many well-known devices which would serve substantially the same purpose.

The several pulleys and belts operate as follows: The main belt 12 drives the pulleys 1, 3, and 5, and thus the rolls C′ and C³, in one direction and the counter-shaft M in the other direction. The counter-shaft, through the pulleys 6 and 7 and belts 13 and 14, running therefrom to the pulleys 2 and 4, drives the rolls C² and C⁴ in the opposite direction to that in which the rolls C′ and C³ are driven. The roll C² has on its shaft the small pulley 8, which, through the belt 15, drives the pulley 9 on one of the feed-rolls 1′ and the pulley 10 on the same shaft therewith, and this pulley 10, through the belt 16, drives the pulley 11 and the other feed-roll.

The various principal operations of my said invention may be recapitulated as follows: The grain is fed through the hopper by means of the feed-gates I and feed-rolls 1′ to the grinding-rolls, which reduce or grind it in the ordinary manner. These rolls are adjusted vertically by the movement of the boxes E on the arms D and laterally by the adjusting-rods G. When it is desired to vary the relations of the rolls, it may readily be accomplished by turning either the screws d^2 or the hand-nuts g^2, or both, according to the variation desired. When it is desired to temporarily part the rolls (thus stopping the grinding) and shut off the feed, it is done by partly rotating the shaft H by means of the handle H′, which so changes the relation of the eccentrics *h* to the eyes in the rods G as to permit said rods, and with them the arms D, to move back from the center, and the rolls to part. The projection *h′* on the handle H′ at the same time operates the bar K, which moves the arms J′, thus partially rotating the shafts J, and causing the gates I to close down against the feed-rolls 1′ and shut off the flow of grain. A reversing of this motion brings all of said parts back into exactly their former positions, and the grinding proceeds.

Some of the devices and combinations shown and described herein are the invention of D. W. Marmon, or the joint invention of Marmon and myself. They are therefore, of course, not claimed in this application, but are made the subject-matter of other applications for Letters Patent, either granted, pending, or in course of preparation.

Having thus fully described my said invention, what I claim as new, and desire to secure by Letters Patent, is—

1. The combination, in a roller-mill, of the swinging roll-supporting arms, means for holding said arms inwardly at both the top and the bottom, springs which, when compressed, permit said arms to swing outwardly, and pivots or stops located between the upper and the lower devices for holding the arms inwardly, which limit the inward movement of the arms, substantially as set forth.

2. The combination, in a roller-mill, of roll-supporting arms D, movable bearings therefor, the rods F and G, provided with adjusting-screws, and springs F′, said bearings being located between said rods, substantially as set forth.

3. The combination, in a roller-mill, of swinging arms supporting one of the rolls of a pair, rods at both ends thereof, which hold said arms and the roll supported thereby toward the other roll of the pair, and springs on the rods at the ends of the arms opposite to the ends which support the roll and beyond the supporting-pivots of said arms, which springs operate to throw the ends of said arms which support the roll and the roll supported thereby outward, thus forcing said roll away from its fellow as far as the rods which hold it inwardly will permit, substantially as set forth.

4. The combination, in a roller-mill, of the swinging roll-supporting arms D, having elongated pivot-openings, the pivot-pins *d*, the adjusting-rods G, the rods F, and the springs F′, whereby said arms are adjusted to position and held in said position against fixed stops, and the roll supported thereby is held forward with all the force needed for a grinding-pressure, and is at the same time permitted to swing back slightly when any hard substance comes between it and its fellow, all substantially as set forth.

5. The combination, in a roller-mill, of supporting-arms for the bearings for the rolls, the boxes forming said bearings, and means for moving said boxes on said arms, said boxes having portions with spherical surfaces fitting spherical surfaces on the arms, said surfaces having a common center horizontally removed from the center of the rolls, whereby a vertical adjustment of said boxes may be had by a shifting of the box on its seat, these spherical surfaces at the same time obviating any binding action of the boxes on the roll-journals, substantially as set forth.

6. In a roller-mill, the combination of the journal-boxes and supporting-surfaces therefor, said surfaces being struck from a common center, as at ⊗, and said boxes being formed to fit said surfaces, whereby a moving of said boxes on said surfaces will vary the relation of said rolls on the plane which passes through both without causing a binding on the roll-journals, substantially as set forth.

7. The combination of the feed-gates I, the shafts J, having arms J′, and the sliding bar K, whereby both gates can be moved at once, substantially as set forth.

8. In a roller-mill feed-gate and feed-gate-operating mechanism, the combination of the feed-gates, the shafts, and the operating-bar, each feed-gate having an arm provided with a notch, and each shaft having a lug adapted to engage with said notch, and an arm which said bar is adapted to operate, substantially as set forth.

9. The combination of the feed-gates I I,

having arms *i i*, with a notch in each, the shafts J J, having projecting lugs *j j* secured thereto, the arms J′ J′, and the bar K, adapted to operate said arms and move both said gates, substantially as set forth.

10. The combination of the feed-gates, shafts for operating the same, arms J′ J′ on said shafts, and a bar, K, having lugs *k′ k′*, whereby said arms, shafts, and feed-gates are operated simultaneously, substantially as set forth.

11. The combination, in a roller-mill, of the roll-shafts, the counter-shaft, pulleys thereon, belts on said pulleys, a yoke or frame-work extending from one of the journal-boxes of the counter-shaft to the other and supporting said boxes, and means for adjusting said yoke or frame-work, substantially as described, and for the purposes specified.

12. The combination of the counter-shaft L, the boxes M, the yoke or frame-work N, and means of adjusting said frame-work, substantially as set forth.

13. The combination of the counter-shaft L, mounted on the yoke or frame-work N, said frame-work, and a screw whereby the position thereof can be adjusted, substantially as set forth.

14. The combination of the counter-shaft L, the yoke N, mounted on pivots *n*, and the screw O, provided with hand-nuts *o′* o^2, substantially as shown and described, and for the purposes specified.

In witness whereof I have hereunto set my hand and seal, at Indianapolis, Indiana, this 10th day of February, A. D. 1883.

JESSE WARRINGTON. [L. S.]

In presence of—
D. W. MARMON,
CHAS. E. TEST.