No. 667,286. Patented Feb. 5, 1901.

W. F. BARTLETT & E. C. KENT.

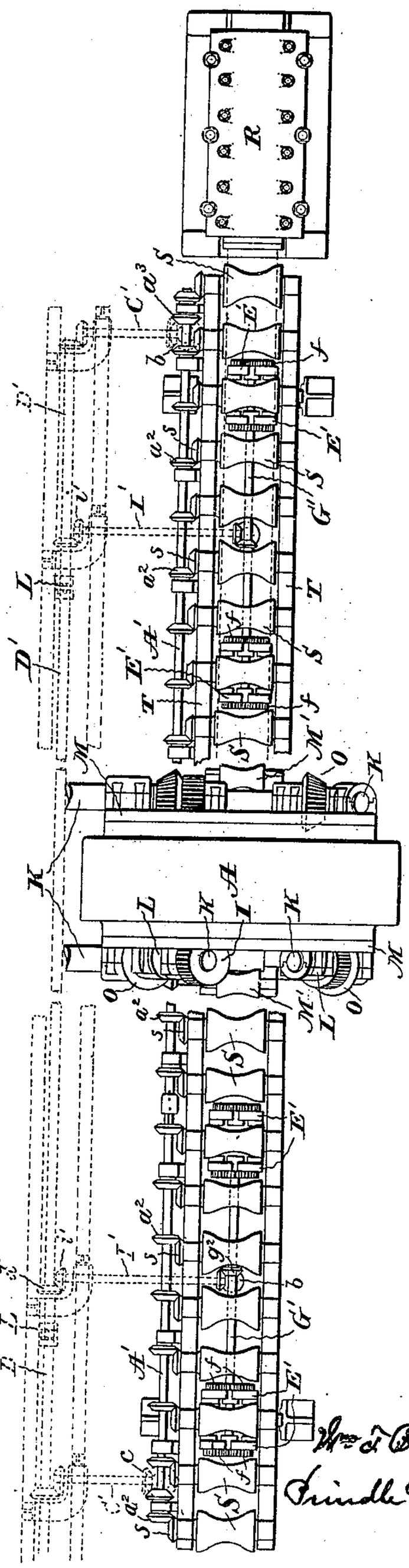
ROLLING MILL FOR MAKING PIPES.

(Application filed Nov. 27, 1899.)

(No Model.)

5 Sheets—Sheet 1.

Fig. 1.



Witnesses:
Jas. E. Hutchinson
Henry C. Hazard

Inventors
Wm. F. Bartlett and Ellis C. Kent, by
Prindle and Russell, their Attys

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Fig. 2.

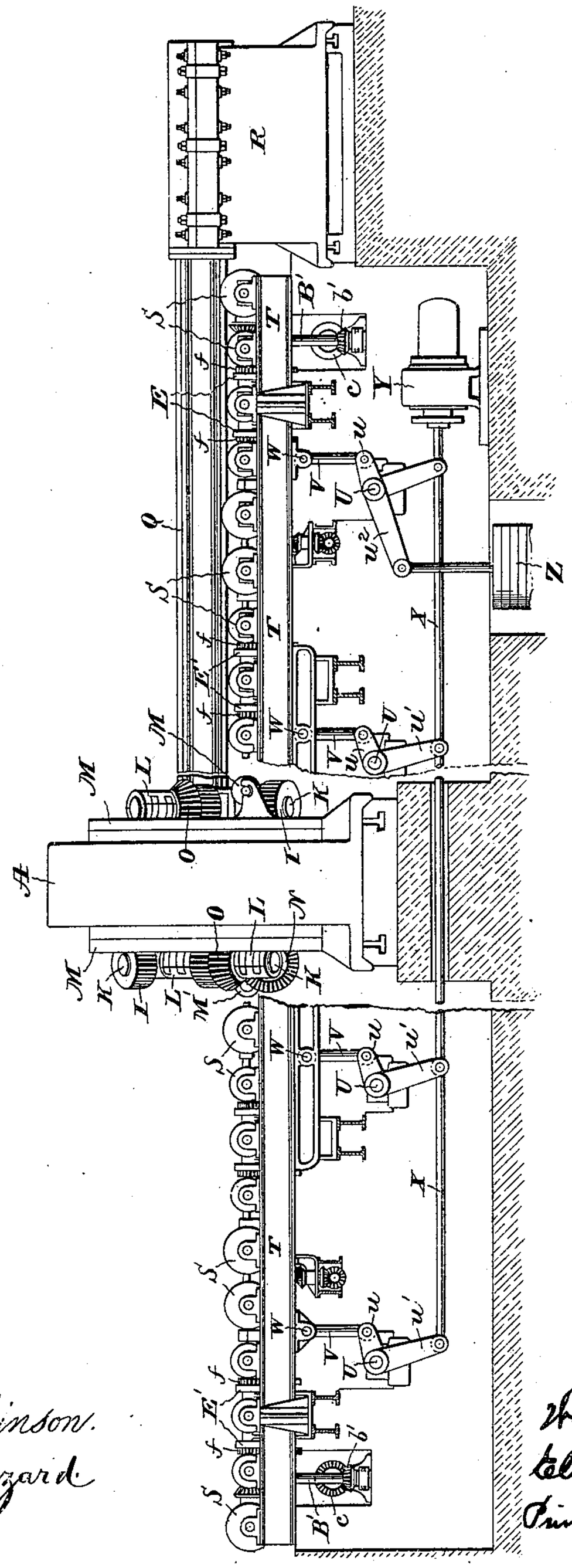

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Fig. 3.

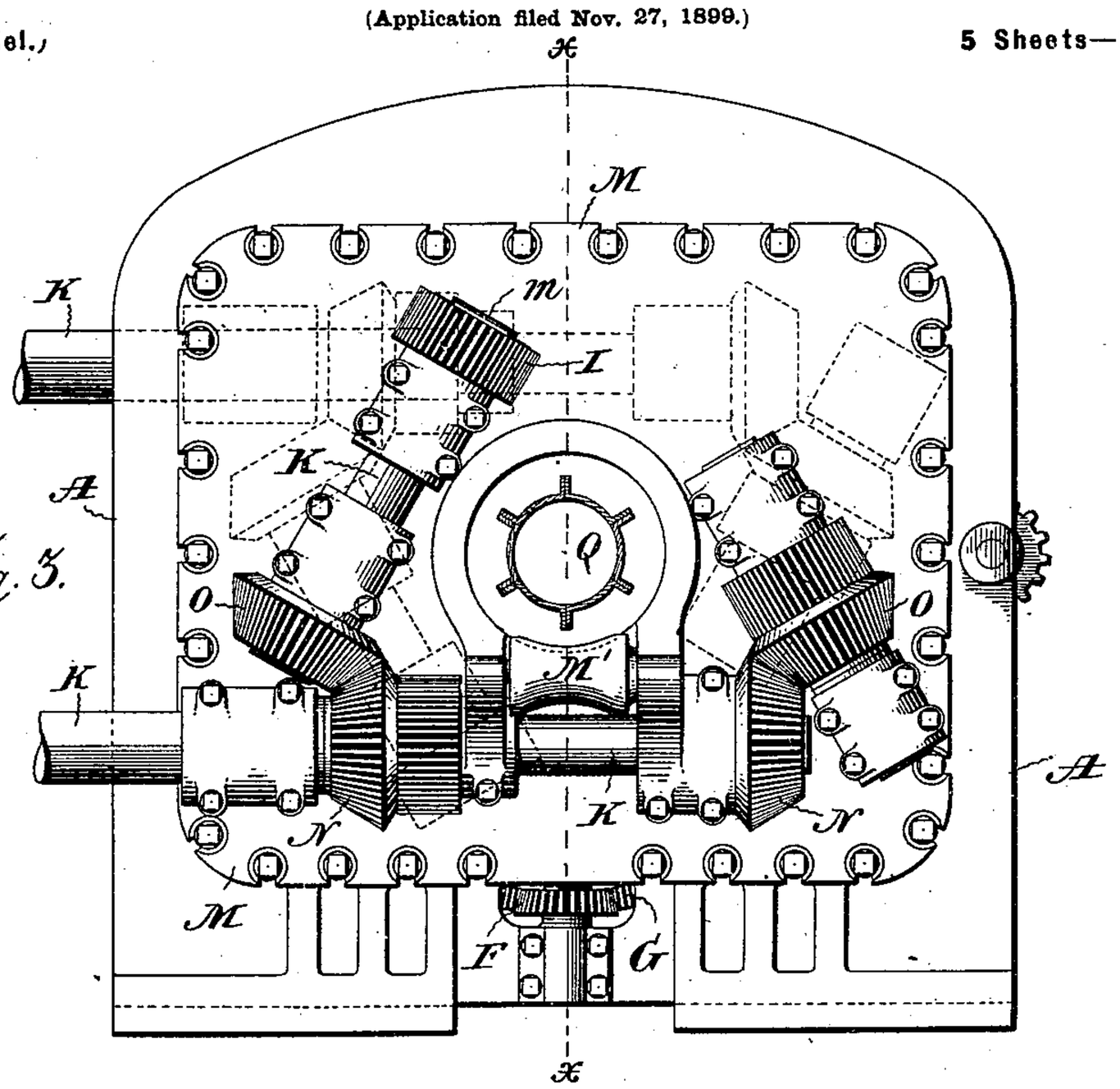
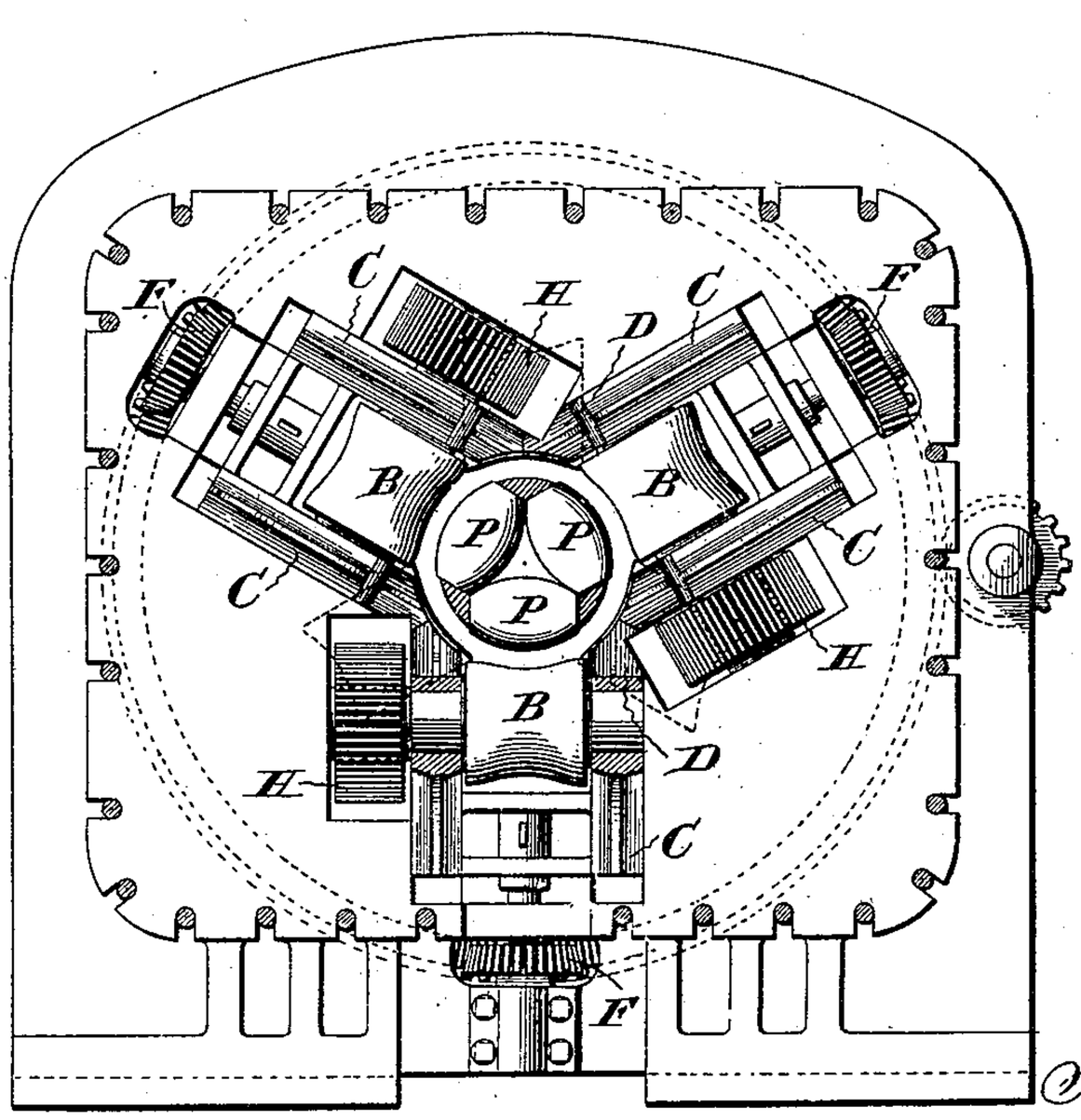


Fig. 4.



Witnesses:
Jas. E. Hutchinson.
Henry C. Hazard.

Inventors
Wm. F. Bartlett and Ellis C. Kent, by
Brindle and Russell, their Attys.

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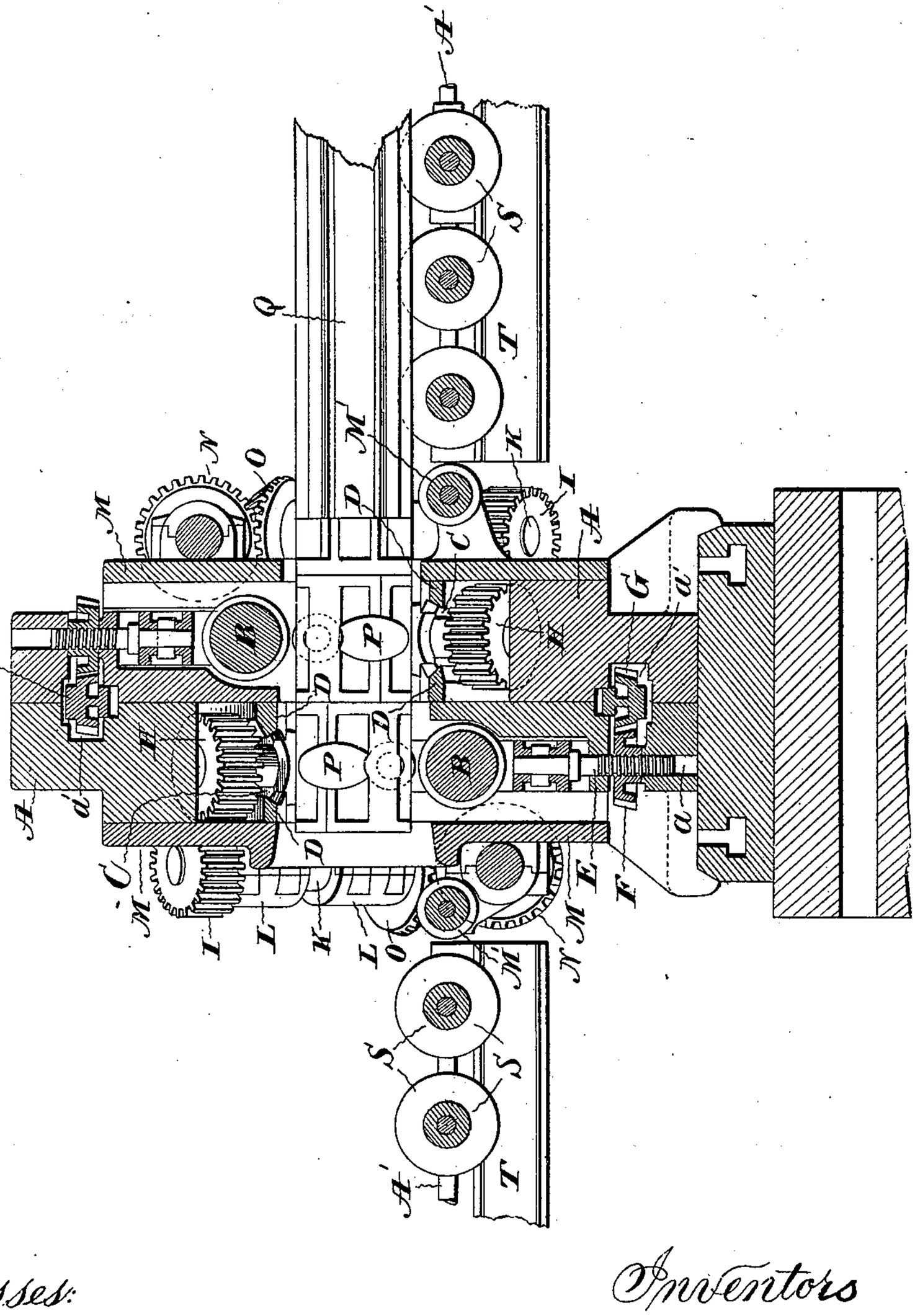
(No Model.) 5 Sheets—Sheet 4.

Fig. 5.



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Henry C. Hazard

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Wm. F. Bartlett and Ellis C. Kent, by
Prindle and Russell, their Attys

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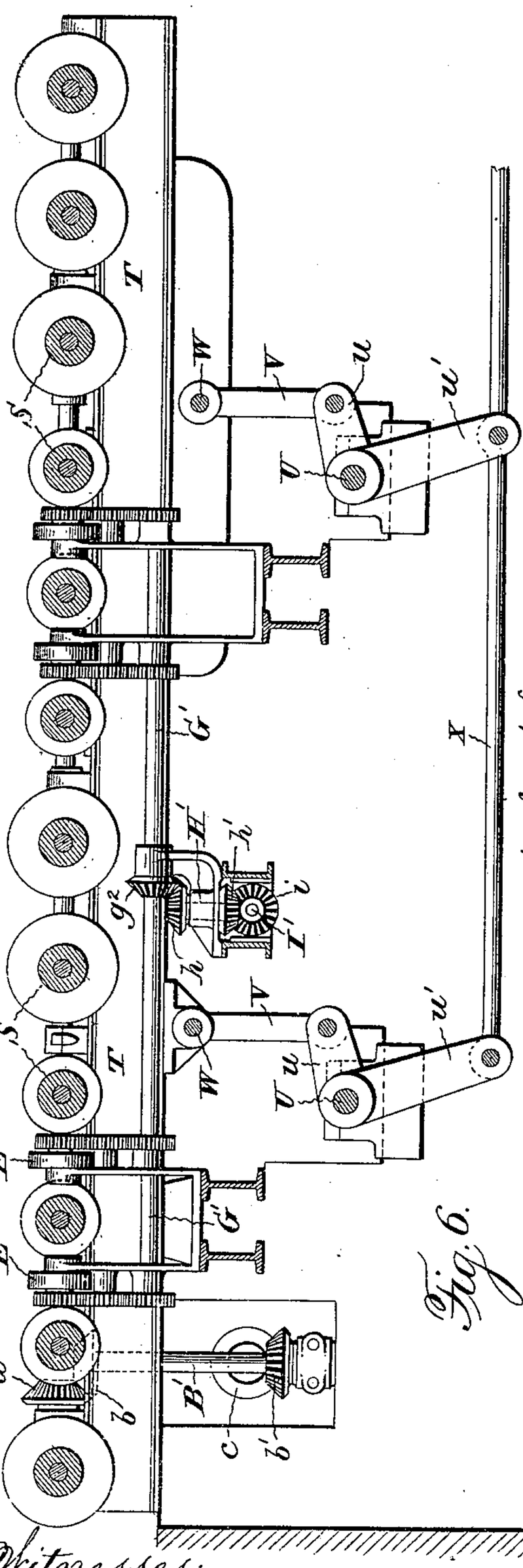

Fig. 6.

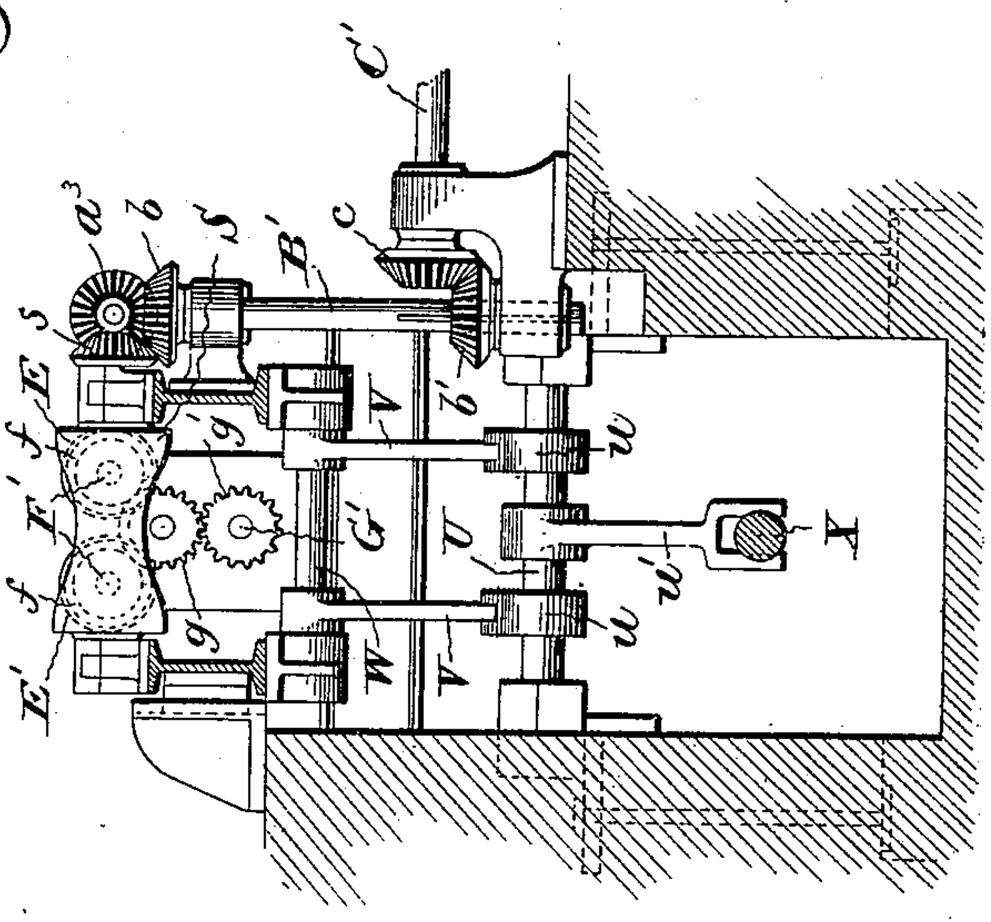

Fig. 7.

Witnesses:
Jas. E. Hutchinson
Henry C. Hazard.

Inventors.
Wm. F. Bartlett and Ellis C. Kent, by
Crindle and Russell their Attys

UNITED STATES PATENT OFFICE.

WILLIAM F. BARTLETT AND ELLIS C. KENT, OF PHILADELPHIA, PENNSYLVANIA; SAID KENT ASSIGNOR TO SAID BARTLETT.

ROLLING-MILL FOR MAKING PIPES.

SPECIFICATION forming part of Letters Patent No. 667,286, dated February 5, 1901.

Application filed November 27, 1899. Serial No. 738,370. (No model.)

To all whom it may concern:

Be it known that we, WILLIAM F. BARTLETT and ELLIS C. KENT, of Philadelphia, in the county of Philadelphia, and in the State of Pennsylvania, have invented certain new and useful Improvements in Rolling-Mills for Making Pipes; and we do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, in which—

Figure 1 is a top plan view of the pipe-mill embodying our invention; Fig. 2, a view of the same in side elevation; Fig. 3, an elevation of the roll-operating mechanism; Fig. 4, a like view of the same with the follower-plate removed; Fig. 5, a vertical section on the line *xx* of Fig. 3; Fig. 6, a longitudinal vertical section through the ingot supporting and turning rolls, and Fig. 7 a cross-section thereof.

Letters of like name and kind refer to like parts in each of the figures.

The object of our invention is to provide a practical mill for rolling pipes or tubes; and to this end said invention consists in the pipe-rolling mill having the construction substantially as hereinafter specified.

Our invention pertains to pipe-machines in which a tube-form ingot is passed between concentric series of rolls that operate on both the inner and outer surfaces of the ingot, the outer rolls being moved inwardly from time to time, resulting in the radial compression of the walls of the ingot and its elongation until the pipe with the desired thickness of walls is produced.

In the embodiment of our invention illustrated in the drawings we employ a housing A, having a horizontal opening for the passage of the ingot, around and within which opening are placed the reducing-rolls. The rolls B and B, which are those that act on the exterior of the ingot, are arranged in two sets of three, the rolls of a set being equidistant and the two sets being relatively so disposed that the rolls of one set are opposite the spaces between those of the other set. Each roll B is journaled on an axis that is at right angles to a plane radial to the center of the housing-opening, being supported in a head C, that is slidably mounted on a pair of parallel guides D and D in the housing A, which lie parallel with a plane radiating from the center of the housing-opening. Swiveled to each head C is the inner end of a screw E, whose outer threaded portion passes through the correspondingly-threaded opening of a pinion F, confined within a recess *a* in the housing, so as to be restrained from movement in an axial direction. Located within an annular recess *a'* in the housing A at a point midway between the pinions F and F of the two sets of head-moving mechanisms is a ring G, having upon each side gear-teeth that mesh with the teeth of the pinions, so that by the rotation of said ring or annular gear the pinions will be revolved and the screws E and E and their heads moved simultaneously in directions radial to the center of the housing-opening. The threads of the screws of the two sets of heads are respectively right and left, so that the action of the ring-gear is to cause all of the heads to move in the same direction, as well as simultaneously. The periphery of the ring G is provided with spur-teeth for engagement by a pinion which is revolved by hand or power controlled means to effect the rotation of the ring G.

The periphery of each roll B corresponds in form with the peripheral portion of the pipe which it is to make, being in the instance shown concave, because the pipe to be made is cylindrical.

One of the journals or shafts of each roll B is extended, and upon it is secured a spur-gear H, that meshes with the teeth of a like gear I upon a shaft K, which is journaled in bearings L and L upon the outer side of a follower-plate M, that is removably fastened by bolts to the side of the housing A, a slot *m* being provided in said plate to permit the meshing of the gears. One of the shafts K of each set is a continuation of or is connected with a driving-shaft, and upon it are two bevel-gears N and N, that respectively mesh with similar gears O and O upon the respective shafts K and K. The teeth of the spur-gears have such construction that those of the gears that intermesh remain in mesh during the movements of the rolls B and B with their carrying-heads.

It will be perceived that by means of the shafts K and K and their gears each of the

rolls of a set is geared directly to the driving-shaft, so that the objectionable construction is avoided by having to transmit the power to one roll wholly through the other. Also larger and heavier gears are possible with the employment of the shafts K and K and their gears, interposed between the driving-shaft and the rolls, than is the case when the driving-shaft is connected directly to one of the roll-shafts and the latter are geared together. When such a construction as that just mentioned is employed, the parts must be so cramped or crowded that it is impracticable within the unavoidable limitations to use gears between the shafts of sufficient size and strength to perform their work. Another important advantage resulting from our manner of driving the rolls is that all of the gears are rigidly fixed or keyed to their respective shafts, it being unnecessary to slidably mount any on account of the adjustment of the rolls. When the demands in rolling-mill practice as to strength and rigidity of structure are taken into account, it will be evident that the advantages which accrue from our mode of gearing the rolls are of great moment.

The internal rolls P and P, which operate on the interior of the ingot and are the anvils or supports therefor under the pressure of the outer rolls, are ellipsoidal in form and are arranged in two sets of three, one set being arranged so that the axes of the rolls thereof are in the same vertical plane as the axes of the rolls of one of the outer sets and a roll P of each set being placed with its axis parallel with the axis of a roll B of the outer set. The radius of the periphery of each roll P is the same as that of the interior of the pipe to be constructed, and each roll has such angular length that the three combined form substantially a complete circle.

The rolls P and P are journaled and supported by a hollow mandrel Q, each roll being situated in an opening formed in the mandrel-wall so as to project outside of said wall. The mandrel Q extends upon but one side of the housing A and is supported at its outer end by a head R.

With our mill no necessity exists for positively driving or rotating the internal rolls, and we have therefore been enabled to discard the rack-and-gear devices heretofore employed for this purpose and make provision of no other means for this object.

On each side of the housing A is a series of spool-shaped ingot-carrying rolls S and S, that have their peripheries formed longitudinally upon curved lines which correspond roughly to the curvature of the ingot to be worked. A number of said rolls at suitable intervals are of larger diameter at their ends than the others to furnish ample support laterally for the ingot. The rolls S and S are journaled in bearings upon parallel horizontal beams T and T, that extend parallel with the axis of the mandrel and are mounted upon a supporting mechanism by which they and the rolls thereon can be bodily raised and lowered. Said mechanism comprises for each pair of beams preferably two rock-shafts U and U, journaled below and crosswise of the beams T and T, each of which shafts has two crank-arms u and u, that are respectively connected by rods or bars V and V with a shaft W, mounted in bearings on the under side of the beams. For rocking the shafts T and T each has a crank-arm u', that is connected to an operating-rod X, which is moved longitudinally in one direction by a motor Y and in the opposite direction by a weight Z, that is hung from a crank-arm u^2 on one of the rock-shafts. It will be seen that by the mechanism described the entire series of rolls of both sets may be simultaneously raised or lowered.

For positively driving the rolls S and S each has a bevel-pinion s upon one of its journals, which meshes with and receives motion from a similar pinion a^2 upon a shaft A', running alongside of and supported in bearings upon the adjacent beam T. Upon the shaft A' is a bevel-pinion a^3, meshing with a like pinion b upon the upper end of a vertical shaft B', upon whose lower end is splined a bevel-pinion b', that meshes with a similar pinion c upon a horizontal shaft C'. The latter by means of bevel-pinions is geared to and receives motion from a drive-shaft D'. By reason of the splining of the bevel-pinion b' upon the vertical shaft B' the latter, with the pinion b, may rise and fall with the like movements of the series of rolls and said rolls be kept in gear with the source of power.

At several points along each series of rolls S and S, preferably at two points, there are devices for turning the ingot around on its axis, which, as shown, comprise two pairs of rollers E' and E' upon shafts F' and F', that are arranged with their axes parallel with that of the ingot, the two shafts being on opposite sides of and equidistant from a vertical plane passing through the longitudinal center of the rolls S and S and the pairs of rollers E' and E' being in spaces between adjacent rolls S and S. Upon each of the shafts F' and F' is a spur-gear f, and meshing with the two gears f and f to cause the rollers to revolve in the same direction is a pinion g in gear with a pinion g' upon a shaft G'. Meshing with a bevel-pinion g^2 on the latter is a bevel-pinion h on a short vertical shaft H', having a second bevel-pinion h', which meshes with a like pinion i upon a horizontal shaft I'. The latter by a bevel-pinion i', which meshes with a bevel-pinion d' on the drive-shaft D', receives power from the drive-shaft, a clutch L' being provided to enable the two shafts to be connected or disconnected at will. The rollers E' and E' have no movement vertically, and when it is desired to place the ingot upon the turning-rollers the rolls S and S are lowered sufficiently to place them out of contact with

the ingot, leaving the latter to rest wholly upon the turning-rollers.

On each side of the housing A in the space between the latter and the series of rolls S and S is an idler-roll M', journaled in brackets secured to the housing.

It is thought the manner of operating with the mill will be readily seen from the description already given, so that no extended description thereof is required. It is enough to say that after each pass of the ingot between the two series of rolls the outer rolls are adjusted inward to compensate for the decreased diameter of the ingot, that by the carrying-rolls on the opposite sides of the housing the ingot is moved longitudinally, such rolls being adjusted vertically, as found necessary, and that when required the ingot is turned on its axis by resting it upon the turning-rollers.

It is to be understood that though the invention is preferably embodied in an organization having the construction in detail herein shown and described it is not restricted thereto, as changes may be made in construction which will involve no departure in principle.

Having thus described our invention, what we claim is—

1. In a rolling-mill, the combination of a housing, a group of more than two rolls disposed around a common center with their axes intersecting planes radial to such center, shiftable bearings for the respective rolls, shafts equal in number to and respectively geared with the rolls, and bevel-gearing directly connecting one of said shafts with each of the others, substantially as and for the purpose described.

2. In a rolling-mill, the combination of a housing, a mandrel, a series of more than two rolls grouped around said mandrel with their axes intersecting planes radial to the mandrel-axis, shiftable bearings for the respective rolls, shafts equal in number to and respectively geared with the rolls, and bevel-gearing directly connecting one of said shafts with each of the others, substantially as and for the purpose described.

3. In a rolling-mill, the combination of a housing, a mandrel, a series of more than two rolls mounted in the housing and grouped around said mandrel with their axes intersecting planes radial to the mandrel-axis, shiftable bearings for the respective rolls, shafts on the outside of the housing equal in number to the number of the rolls, spur-gearing between each of said shafts and a roll, and bevel-gearing directly connecting one of the shafts with each of the others, substantially as and for the purpose described.

4. In a rolling-mill, the combination of a housing, a group of more than two rolls disposed around a common center, with their axes intersecting planes radial to such center, shiftable bearings for the respective rolls, shafts equal in number to and respectively geared with the rolls, bevel-gearing directly connecting one of said shafts with each of the others, a mandrel around which the rolls are grouped, and rolls supported by said mandrel, substantially as and for the purpose described.

5. In a rolling-mill, the combination of a housing, a group of more than two rolls disposed around a common center, with their axes intersecting planes radial to such center, shiftable bearings for the respective rolls, shafts equal in number to and respectively geared with the rolls, bevel-gearing directly connecting one of said shafts with each of the others, a mandrel around which the rolls are grouped, and non-driven rolls supported by said mandrel, substantially as and for the purpose described.

6. In a rolling-mill, the combination of a housing, two groups of rolls, each of which groups comprises more than two rolls with their axes at right angles to planes radial to the housing-axis, shiftable bearings for the respective rolls, shafts geared, respectively, to said rolls, and gearing directly between one of said shafts and each of the others of the same group, substantially as described.

7. In a rolling-mill, the combination of reducing-rolls, means for feeding an ingot thereto and an ingot-turning roller or rollers adapted to have peripheral contact with the ingot, whose axes extend in the same direction as the direction of longitudinal travel of the ingot, substantially as described.

8. In a rolling-mill, the combination of reducing-rolls grouped about a common center so as to act on several sides of an ingot, means for feeding an ingot to said rolls, and ingot-turning rollers that engage the ingot on opposite sides of a plane passing longitudinally of the ingot, whereby, by the revolution of the rollers, the ingot will be turned on its axis, substantially as and for the purpose described.

9. In a rolling-mill, the combination of reducing-rolls grouped about a common center so as to act on several sides of an ingot, means for feeding an ingot to said rolls, an ingot-turning roller or rollers by which the ingot may be turned about its axis, and means whereby the ingot may be placed in and removed from contact with said roller or rollers, substantially as and for the purpose described.

10. In a rolling-mill, the combination of reducing-rolls grouped about a common center so as to act on several sides of an ingot, means for feeding an ingot to said rolls, ingot-turning rollers that have peripheral contact with the ingot on opposite sides of a plane passing vertically through the ingot-axis and act to turn the ingot about its axis, and means whereby the ingot and rollers may have contact at the will of an operator, substantially as and for the purpose described.

11. In a rolling-mill, the combination of re-

ducing-rolls grouped about a common center so as to act on several sides of an ingot, a series of carrying-rolls, means for raising and lowering the latter, and an ingot-turning roller or rollers mounted in fixed bearings and extending axially in a direction that intersects the axes of the carrying-rolls, substantially as and for the purpose described.

12. In a rolling-mill, the combination of reducing-rolls, a series of carrying-rolls, an ingot-turning roller or rollers, and means for lowering and raising the carrying-rolls relative to the ingot-turning roller or rollers, substantially as and for the purpose described.

In testimony that we claim the foregoing we have hereunto set our hands this 4th day of November, 1899.

WM. F. BARTLETT.
ELLIS C. KENT.

Witnesses:
T. B. PROSSER,
F. C. MARSHALL.