No. 746,228. PATENTED DEC. 8, 1903.

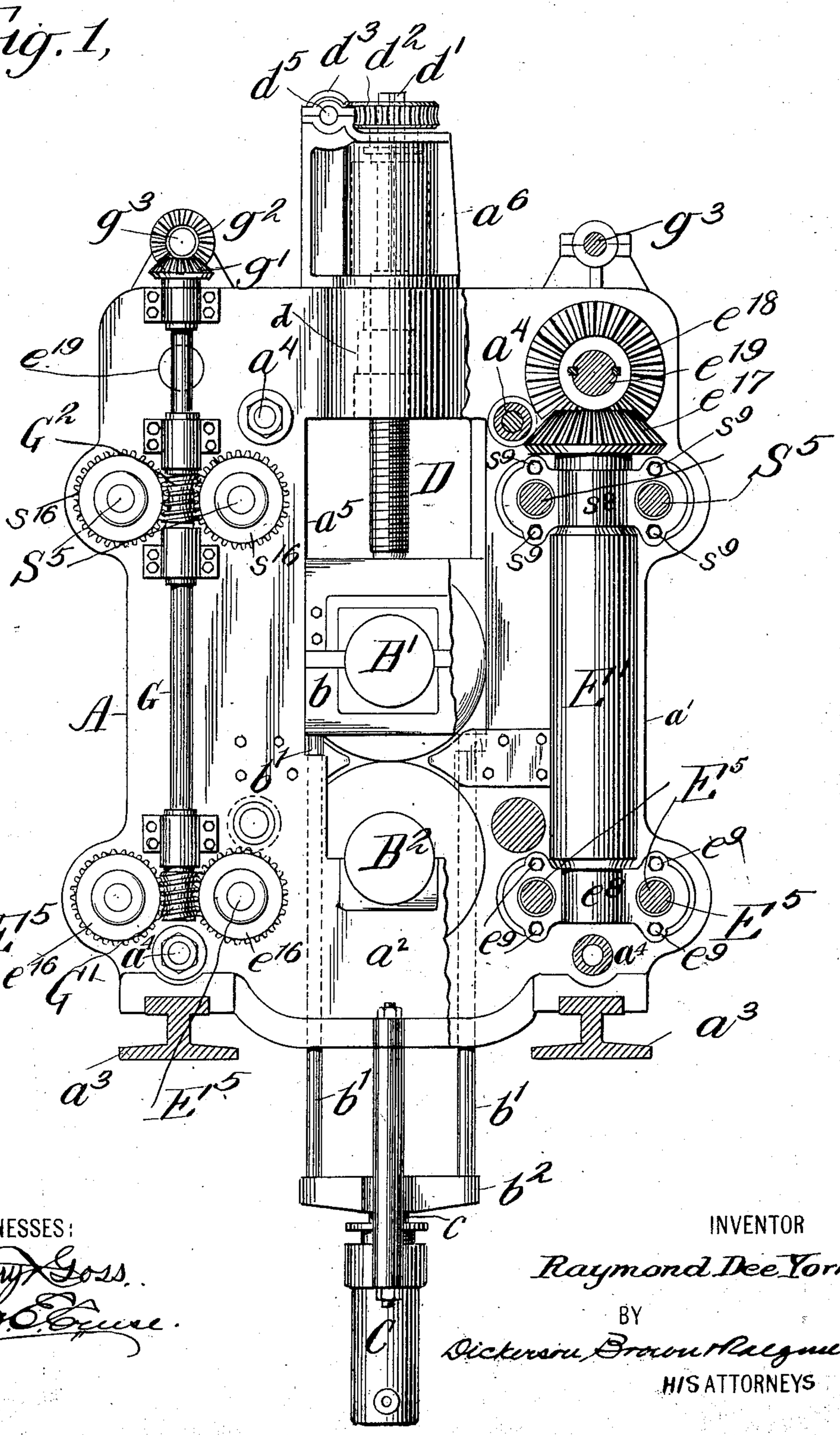
R. D. YORK.

UNIVERSAL ROLLING MILL.

APPLICATION FILED JAN. 22, 1902.

NO MODEL. 4 SHEETS—SHEET 1.

Fig. 1.



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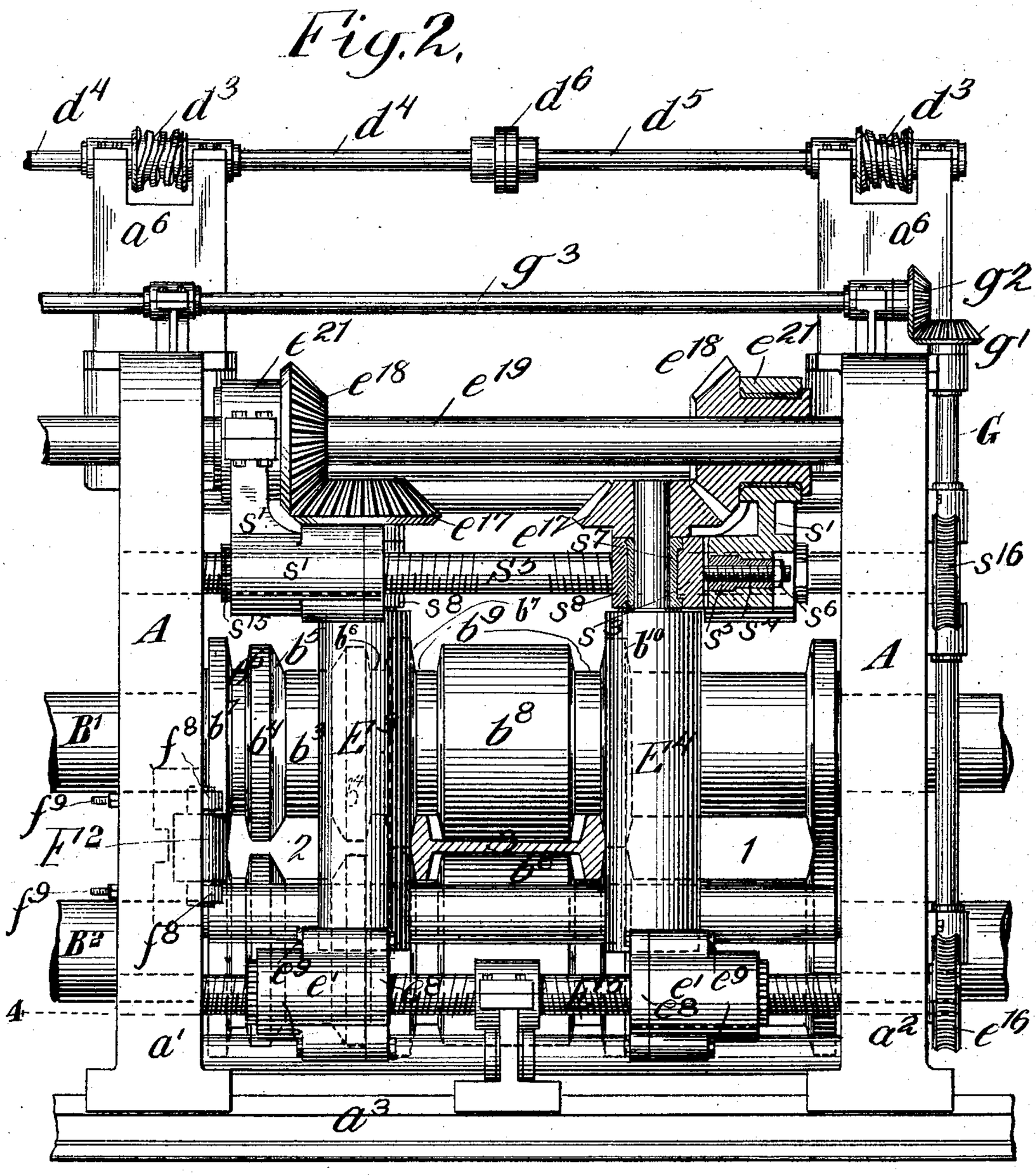
NO MODEL. 4 SHEETS—SHEET 2.

Fig. 2.



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NO MODEL. 4 SHEETS—SHEET 3.

Fig. 3,

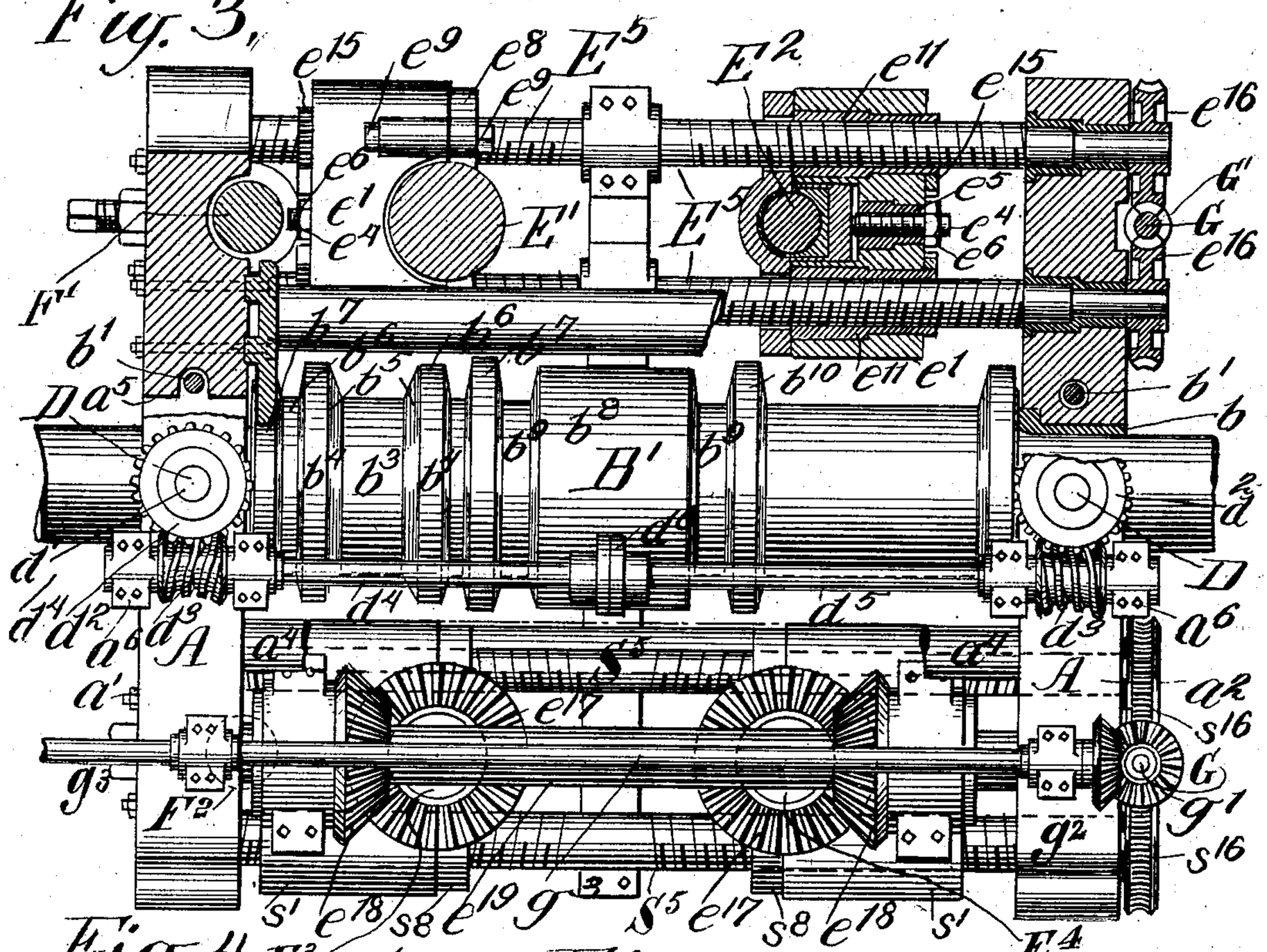


Fig. 4, E3

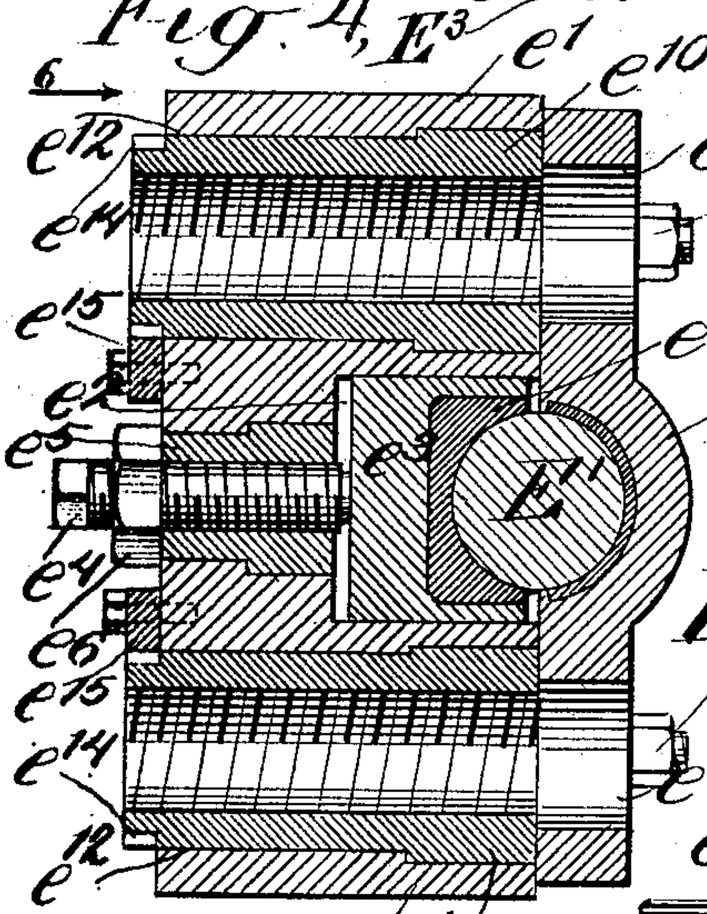


Fig. 6

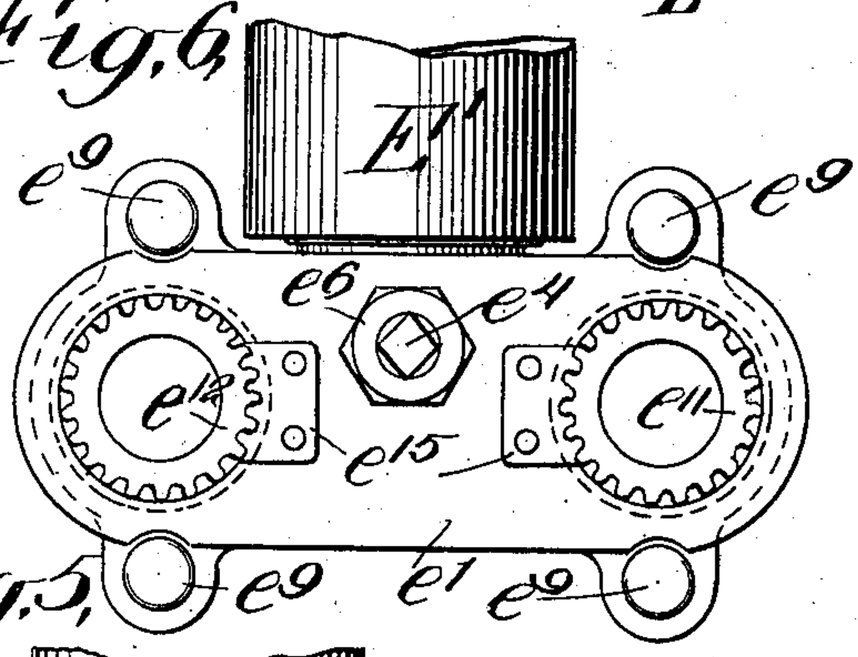
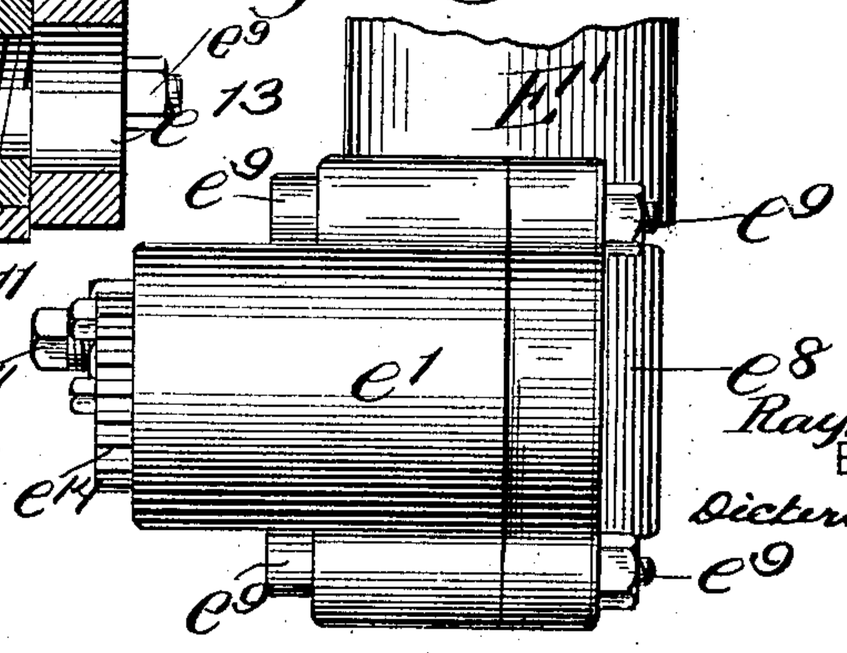


Fig. 5,



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APPLICATION FILED JAN. 22, 1902.

NO MODEL. 4 SHEETS—SHEET 4.

Fig. 7.

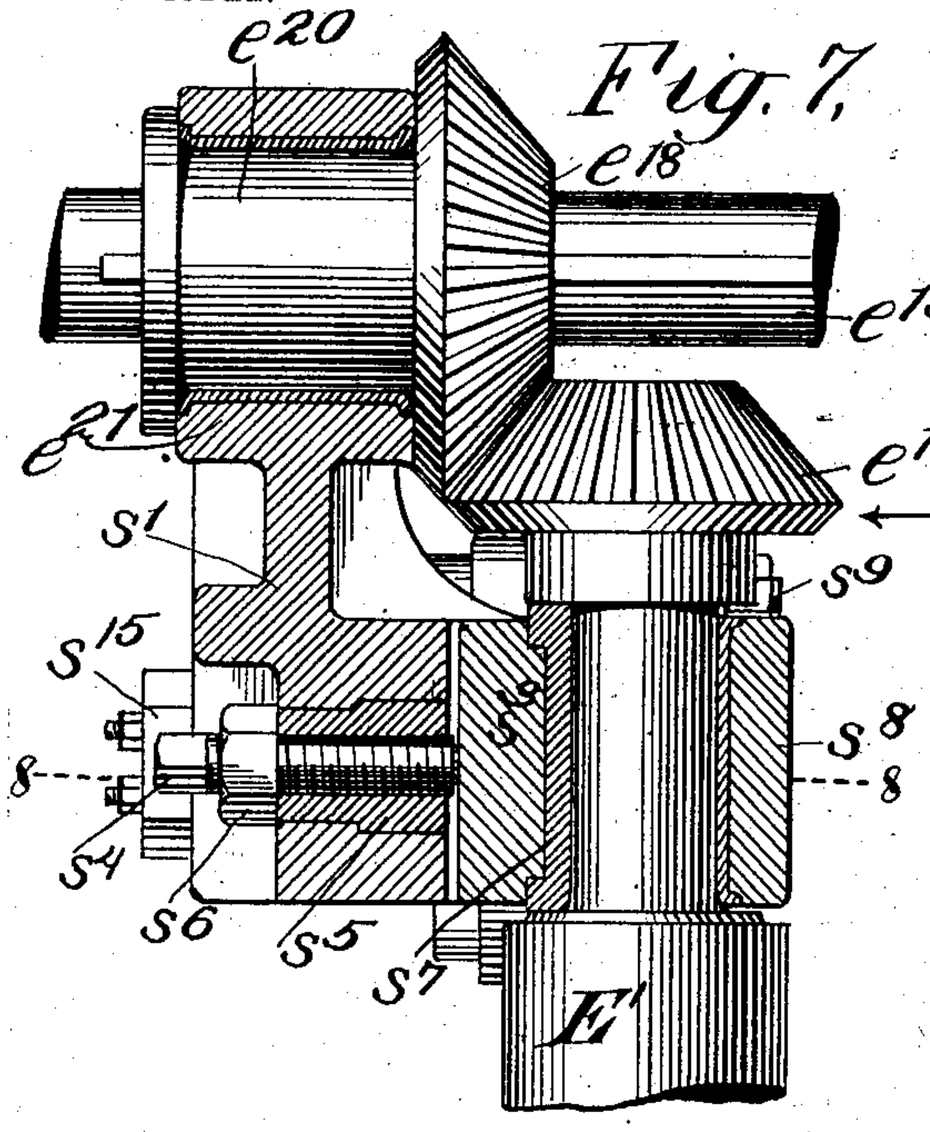


Fig. 9.

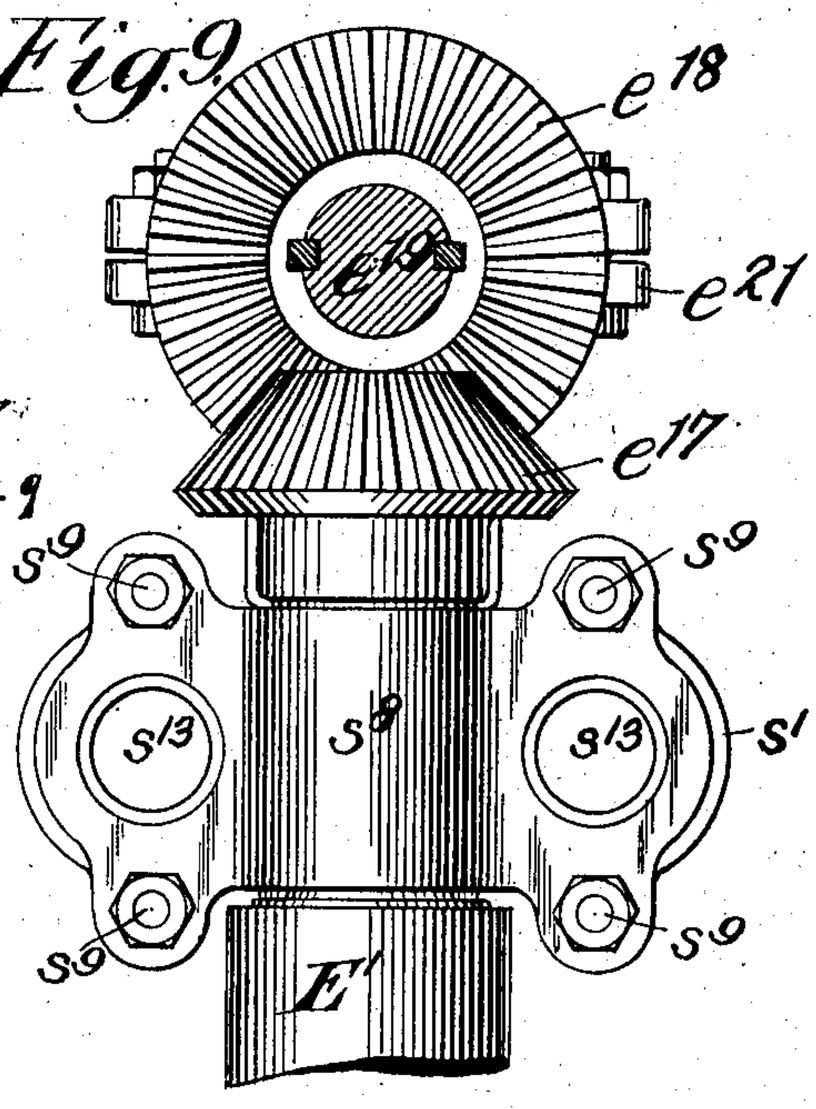


Fig. 10,

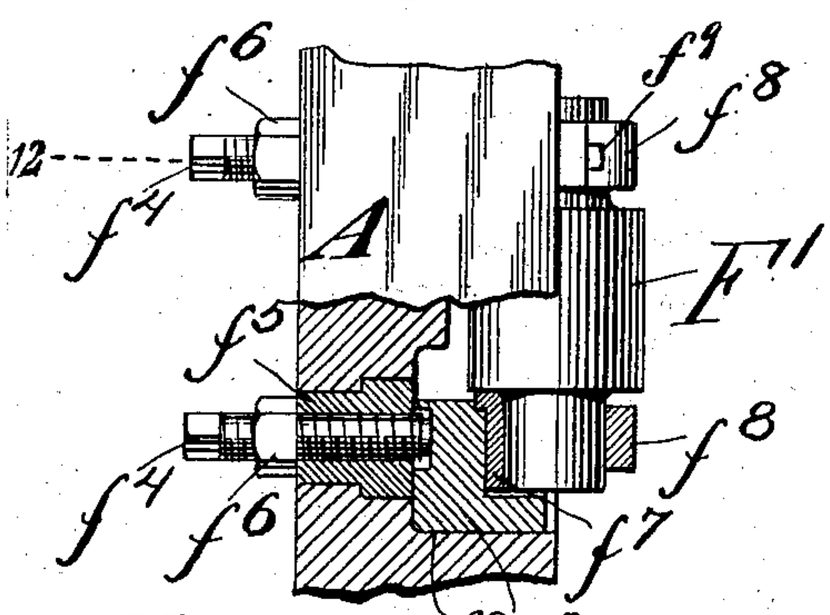


Fig. 12.

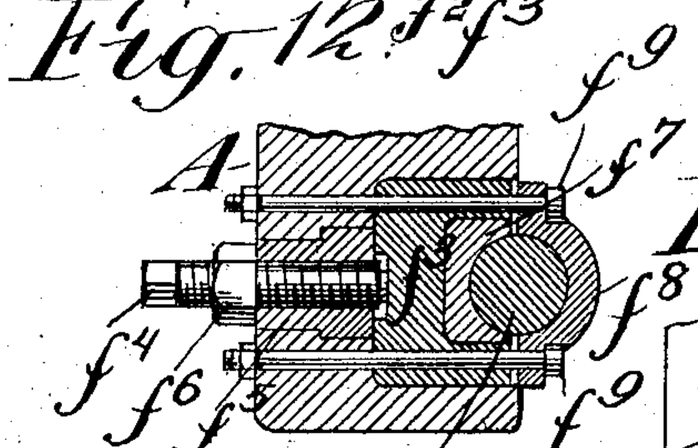


Fig. 8.

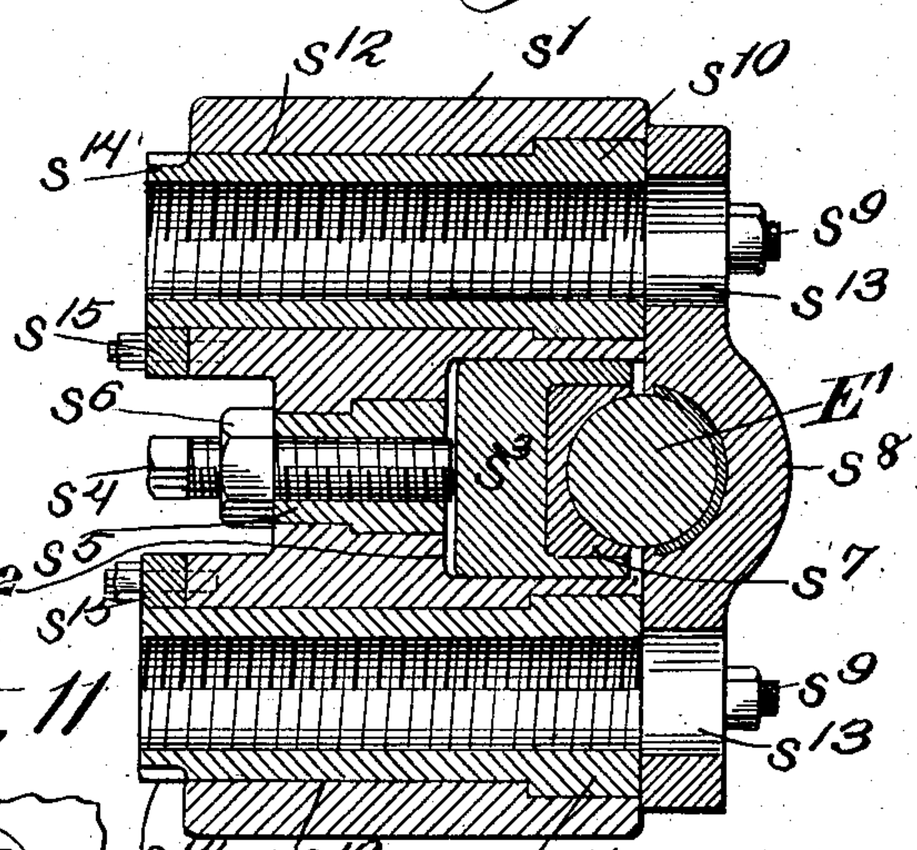
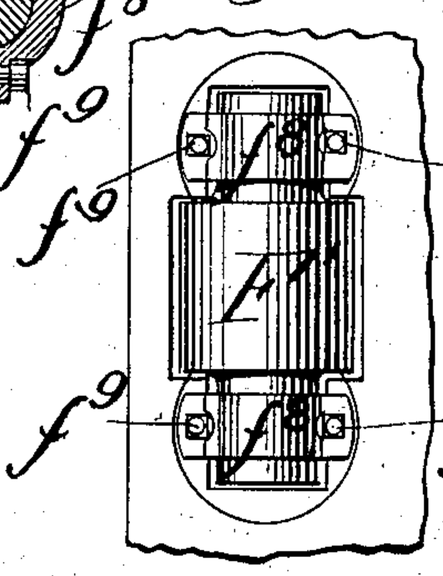


Fig. 11



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No. 746,228. Patented December 8, 1903.

UNITED STATES PATENT OFFICE.

RAYMOND DEE YORK, OF PORTSMOUTH, OHIO.

UNIVERSAL ROLLING-MILL.

SPECIFICATION forming part of Letters Patent No. 746,228, dated December 8, 1903.

Application filed January 22, 1902. Serial No. 90,733. (No model.)

To all whom it may concern:

Be it known that I, RAYMOND DEE YORK, of Portsmouth, Scioto county, Ohio, have invented a new and useful Improvement in Universal Rolling-Mills, of which the following is a specification.

I will describe a mill embodying the improvement and then point out the novel features in the claims.

In the accompanying drawings, Figure 1 is partly a front elevation and partly a vertical section of a universal mill embodying the improvement and especially constructed for a blooming-mill. Fig. 2 is partly a side elevation and partly a vertical section of this mill. Fig. 3 is partly a plan and partly a horizontal section of the mill. Fig. 4 is a horizontal section at the plane of the line 4, in Fig. 2, illustrating the lower bearing for an upright roll comprised in the mill. Fig. 5 is a side elevation of parts shown in Fig. 4 the plane of this figure being the same as that of Fig. 2. Fig. 6 is an elevation of the parts shown in Fig. 5, this elevation being in a vertical plane which is indicated by the arrow 6 in Fig. 4 and is at right angles to the vertical plane of Fig. 5. Fig. 7 is partly an elevation and partly a vertical section of the upper bearing for the same upright roll and parts related thereto, which, except for the fact that this view is partly in section, corresponds in plane of elevation with Fig. 5. Fig. 8 is a horizontal section at the plane of the dotted line 8 in Fig. 7. Fig. 9 is an elevation of certain parts and a transverse section of a shaft which is combined with said parts, all being in a plane indicated by the arrow 9 in Fig. 7. Fig. 10 is partly an elevation and partly a section of another upright roll with bearings therefor and other related parts, the plane of this view being parallel with the planes of the front and rear of the machine. Fig. 11 is an elevation of the parts shown in Fig. 10 and is at one of the sides of the mill. Fig. 12 is a horizontal section at the plane of the line 12 in Fig. 10. Figs. 1, 2, and 3 are drawn to one scale, and Figs. 4, 5, 6, 7, 8, 9, 10, 11, and 12 are all on another scale, which is considerably larger than the scale of Figs. 1, 2, and 3.

Similar characters of reference designate corresponding parts in all the figures.

The framework A of the mill may be of any suitable character. It consists, essentially, of two side frames a' a^2, connected by bed-pieces a^3, to which they are bolted, and also by tie-bolts a^4 or other suitable tie-pieces.

B' B^2 are horizontal rolls arranged one above the other and provided with a number of passes. The lower roll B^2 is shown as being journaled in fixed bearings, whereas the upper roll B' is journaled in bearing-boxes b, which are capable of moving vertically in housings a^5 of the side frames a' a^2. Each of the bearing-boxes b has connected with its lower portion downwardly-extending rods b', which at their lower extremities are secured to a yoke b^2. This yoke b^2 is connected with an engine C. Preferably this will be a hydraulic engine, and its plunger c will be directly connected with the yoke b^2. Upward adjustments of the upper roll B^2 are effected by the two engines C, and these engines serve to support this roll. Downward adjustments of the upper roll cannot, of course, occur until permitted by the engines C. They are facilitated by screws D, coöperating with the bearing-boxes b. There is one of these screws for each of the bearing-boxes b. These screws also prevent the upper roll from being moved upwardly, except when it is to be adjusted into a new position. The screws D coact with nuts d, arranged in the upper portions of the side frames a' a^2. The stems or shanks d' of the screws D extend into worm gear-wheels d^2, supported by brackets a^6, erected upon the tops of the side frames a' a^2. The engagement of the stems or shanks d' of the screws D, with the worm gear-wheels d^2, is of such character as to permit of an independent vertical movement of the screws without any independent rotary movement of the worm gear-wheels. The worm-wheels d^2 engage with worms d^3, secured to shafts d^4 d^5, journaled in the brackets a^6. These shafts d^4 d^5 are arranged in line and are connected at adjacent ends by means of a coupling d^6, which will permit of their disconnection and rotary adjustment into different relations to secure a proper adjust-

ment of the screws D relatively to each other, and consequently of the upper roll B^2. The shafts d^4 d^5 may be driven by an engine applied to either of these shafts—as, for instance, to the shaft d^4—and such engine may advantageously be an electromagnetic engine or motor.

The rolls B' B^2 are shown as having three passes 1, 2, and 3. The pass 1 is of ordinary configuration and is adapted to produce a reduced slab or ingot having parallel top and bottom and sides bulging outwardly to points about midway of the top and bottom. The pass 2 comprises a central cylindric portion b^3. At the sides of this central cylindric portion b^3 are two adjacent collar or flange-like portions b^4, having adjacent sides b^5, which are inclined so as to diverge toward their peripheries. At the other sides of the collars or flange-like portions are cylindric portions b^6, which may be of approximately the same diameter as the central cylindric portion b^3, although this is not essential. Beyond the cylindric portions b^6 are collar or flange-like portions b^7. The adjacent sides of each pair of collar or flange-like portions b^4 b^7 are inclined so as to diverge toward their peripheries. The collar or flange-like portions b^7 of the two rolls B' B^2 are shown as of such diametrical size that when the rolls are properly adjusted those of each roll contact with those of the other; but this is not an essential feature. The collar or flange-like portions b^4 are diametrically smaller. Hence a space is left between those portions of the two rolls. It will be seen that this pass 2 is adapted to transform the reduced ingot or slab resulting from the operation of pass 1 into a blank or partly-formed I-beam or girder having, as usual, flange-like portions, but having in addition to these flange-like portions a web which is thickened longitudinally along its middle portion on both sides. The pass 3 has a central cylindric portion b^8, which is quite large diametrically. On each side of this cylindric portion are cylindric portions b^9, which are diametrically smaller. Beyond one of the cylindric portions b^9 is one of the collar or flange-like portions b^7 already mentioned, and beyond the other cylindric portion b^9 is a collar or flange-like portion b^{10}, which not only forms part of pass 3, but also part of pass 1. The collar or flange-like portion b^{10} is shown as of the same diametrical size as the collar or flange-like portion b^7. The sides of the cylindric portion b^8 and adjacent sides of the collar or flange-like portion b^7 b^{10} are inclined so as to diverge toward their peripheries. The blank produced by pass 2 facilitates the subsequent shaping by pass 3. In the latter operation the central thickened portion of the blank produced by pass 2 is thinned down to the proper dimension, and this results in widening the web and forcing the flanges of the I-beam or girder apart to the proper distance for a finished I-beam or girder blank. In Fig. 2 the shape of this blank and its position in pass 3 is indicated. The strain exerted on the metal in passes 2 and 3 is materially less, especially at the flanges of the I-beam or girder blank, by reason of the fact that in pass 2 there is left in the blank a thickened central portion, which is the principal part operated upon in pass 3.

E' E^2 E^3 E^4 designate upright rolls which for convenience may hereinafter be designated as "long" upright rolls. F' E^2 (see Fig. 2) are other upright rolls which for convenience may hereinafter be referred to as "short" upright rolls, which are located in proximity to the rolls E' E^3 and coact with the rolls E' E^3 upon the blank when the blank is being worked on pass 2. The long upright rolls are journaled in lower bearings, which are illustrated in detail by Figs 4, 5, and 6, and in upper bearings, which are illustrated in detail by Figs. 7, 8, and 9. The lower bearing of each of the rolls E' E^2 E^3 E^4 consists of a block e', having a recess e^2, in which is fitted a bearing-box e^3, made slightly shorter, so as to provide for horizontal adjustment by means of a screw e^4, engaging with a nut e^5, secured in a recess in the block e', a check-nut e^6 being fitted to the screw e^4 to secure it in position. Any suitable antifriction metal e^7 may be used to advantage in the bearing-box e^3. Opposite the bearing-box e^3 a cap e^8 is fitted to the lower journal and is secured by bolts and nuts e^9 to the block e'. In the block e' are two nuts e^{10} e^{11}, with which engage screws E^5. These nuts are secured in recesses e^{12}. Opposite the interiors of these nuts the cap e^8 is provided with holes e^{13} for the passage of the screws E^5. The nuts e^{10} e^{11} are restrained from rotary movement by having spur-teeth e^{14} formed upon their exteriors and combined with toothed segments e^{15}, which are bolted to the blocks e'. Thus facility is afforded for releasing either nut and adjusting it rotarily to secure a proper operation of the screws E^5. The object of adjusting the rolls horizontally is to enable their axes to be alined or brought into the same horizontal plane. One pair of screws E^5 coacts with the lower bearings of the two long rolls E' E^2, and another pair of these screws coacts with the lower bearings of the long rolls E^3 E^4. To enable the screws E^5 to thus operate for adjusting opposite long rolls, they must be reversely threaded where they engage with the lower bearings for the opposite rolls.

The upper bearing of each of the rolls E' E^2 E^3 E^4 is constructed, as shown in the drawings, like the lower bearing, and each upper bearing consists of a block s', having a recess s^2 made slightly shorter, so as to provide for the horizontal adjustment by means of a screw s^4, engaging with a nut s^5, secured in a recess in the block s^8, a check-nut s^6 being fitted to the screw s^4 to secure it in position. Any suitable antifriction metal s^7 may be

used to advantage in the bearing-box s^3. Opposite the bearing-box s^3 a cap s^8 is fitted to the lower journal and is secured by bolts and nuts s^9 to the block s'. In the block s' are two nuts s^{10} s^{11}, with which engage screws S^5. These nuts are secured in recesses s^{12}. Opposite the interiors of these nuts a cap s^8 is provided with holes s^{13} for the passage of screws S^5. The nuts s^{10} s^{11} are restrained from rotary movement by having spur-teeth s^{14} formed upon their exteriors and combined with toothed segments s^{15}, which are bolted to the block s'. Thus, as in the lower bearing, facility is afforded for releasing either nut and adjusting it to secure a proper operation of the screws S^5.

The screws E^5 S^5 are journaled in bearings provided in the side frames a' a^2. The screws E^5 have affixed to them worm gear-wheels e^{16}. These worm gear-wheels for each pair of the screws E^5 engage with a worm G', affixed to an upright shaft G, which is journaled in brackets fastened to one of the side frames of the mill. The screws S^5 have affixed to them worm gear-wheels s^{16}. These worm gear-wheels for each pair of screws S^5 engage with a worm G^2, affixed to the shaft G. The upper ends of the shafts G have affixed to them bevel gear-wheels g', which engage with other bevel gear-wheels g^2, affixed to horizontal shafts g^3. Both the shafts g^3 are intended to be driven in unison. Advantageously they may be driven by a single electromagnetic engine or motor. If desired, they can of course be driven separately.

By means of the screws E^5 S^5 and their concomitant parts, already described, provision is afforded for adjusting the long upright rolls into position for operating upon the sides of a girder-blank while it is under treatment in pass 3 of the rolls B' B^2, as shown in Figs. 2 and 3. Provision is also afforded for adjusting the left-hand long upright rolls E' E^3 into a position to coöperate with pass 2 of the rolls B' B^2. Incidentally there will at this time be an adjustment of the long upright rolls E^2 E^4, but not for any purpose. It may be here remarked that when these long upright rolls are coöperating with pass 2 the short upright rolls F' F^2 will also be coöperating with pass 2.

For rotating the long upright rolls E' E^2 E^3 E^4 their upper journals have affixed to them bevel gear-wheels e^{17}, which engage with other bevel gear-wheels e^{18}, mounted upon horizontal shafts e^{19}. There are two of these horizontal shafts, one for the front long upright rolls and the other for the rear long upright rolls. The bevel gear-wheels e^{18} have hubs e^{20}, which are journaled in brackets e^{21}, rising from the blocks s' of the upper bearings for the long upright rolls. These bevel gear-wheel e^{18} must be capable, therefore, of participating in the adjustments of the long upright rolls toward and from each other. Each shaft e^{19} may be supported by the gear-wheels e^{18} or may have additional support in the side frames a' a^2. As the bevel gear-wheels e^{18} slide lengthwise upon the shaft e^{19} when the long upright rolls are adjusted toward and from each other, they are connected with said shafts by splines or equivalent devices, so as to be incapable of independent rotary movement. The two shafts e^{19} may be driven in unison or separately, and preferably a reversing steam-engine will be employed for the purpose.

The short upright rolls F' F^2 are journaled in bearing-boxes f^3, fitted in recesses in the side frames a' a^2 of the framework A, suitable recesses f^2 being provided for them in said side frames. With these boxes are combined the screws f^4, nuts f^5, check-nuts f^6, antifriction metal f^7, cap f^8, and bolts and nuts f^9, which correspond in construction, relative arrangement, and function to the parts designated in connection with the upper and lower bearings for the long rolls, except that the bolts and nuts f^9 have to be slackened or tightened in connection with the turning of the screws f^4 in order to effect adjustments of the bearing-boxes f^3. These short upright rolls F' F^2 are not shown as being capable of any other adjustment than that afforded by the bolts and nuts f^9 in conjunction with the screws f^4, nor are they shown as being positively driven.

It will thus be seen that according to my invention means are provided in a rolling-mill for rolling and forming at least partially one or more flanges and the web of the blank, leaving one or more thickened portions on the web, which, it will be observed, are not adjacent to the flange or flanges, and means are provided for rolling down said thickened portions, whereby these portions may be reduced separately from the flange portions and with decreased resistance. The rolling means provided leave the thickened portion of the web of the blank separated by channels from the flange portions, and according to my invention the rolling-mill is constructed to roll down the said thickened portions of the web and expand or widen out the web, whereby the lateral flowing of the metal of the web is facilitated independently of the metal in the flanges.

It will be seen that the main rolls in my rolling-mill are provided with reduced portions for forming thickened portions on each side of the web of a blank and parallel to the flanges thereof. Collars are provided at each side of the central reduced portions of the rolls, and there are grooves outside of said collars for forming the flanges of the blank, whereby the longitudinal strains on the flanges in rolling and forming the blank are reduced. The main rolls are constructed to produce a blank for an I-beam or girder, having thickened portions on the web, disposed longitudinally thereof and parallel to the flanges of the blank, the said rolls also being provided with means for rolling down the

said thickened web portion of the blank, or, in other words, the rolls are constructed to first produce a blank for an I-beam or girder having thickened portions on the web of the same disposed longitudinally thereof and parallel to the flanges of the blank, and the rolls are so constructed that the blank thus produced may be rolled down to the finished form.

Obviously some features of my invention may be used without others, and my invention may be embodied in widely-varying forms, and I therefore do not limit myself to the construction shown and described.

What I claim as new, and desire to secure by Letters Patent, is—

1. In a rolling-mill the combination of main rolls, upright rolls arranged in movable bearing-boxes, nuts connected to impart movement to said bearing-boxes and provided with peripheral teeth, toothed segments for engaging with said teeth to secure the nuts in different positions, screws for adjusting the bearing-boxes and gearing for rotating said screws.

2. In a rolling-mill, the combination of main rolls formed to have a plurality of passes, movable upright rolls arranged in pairs on each side of the main rolls and adapted to coact with each other in operating upon a blank passing through one of said passes, stationary short upright rolls and means for moving said long upright rolls whereby one pair of said upright rolls will coact with said stationary short upright rolls in acting upon a blank passing through a second pass in said main rolls.

3. In a rolling-mill, the combination with the frame, of main rolls, upright rolls adapted to change the width of a blank as it passes through the same and arranged in pairs on each side of said rolls and journaled at their upper and lower ends in movable boxes, each box having a plurality of screws extending through the same, the said screws being journaled in the frame and stationary relative thereto and provided with right and left threads, the rotation of said screws being adapted to cause a movement of said boxes, and gearing for rotating said screws, substantially as set forth.

4. In a rolling-mill, the combination with the frame, of main rolls, upright rolls arranged in pairs on each side of the main rolls, a movable journal-box for the upper and lower end of each upright roll, said boxes being provided with internally-threaded nuts secured thereto, screws journaled in the frame and extending through said nuts and supporting the upper and lower boxes of each pair of rolls, and gearing for operating all of said screws.

5. In a rolling-mill, the combination with the frame, of main rolls, upright rolls, a movable journal-box for the upper and lower end of each upright roll, said journal-boxes being provided with internally-threaded nuts secured thereto, screws journaled in the frame and extending through said nuts and supporting the upper and lower boxes of the upright rolls, a worm-wheel on each screw, and a shaft carrying worms adapted to mesh with said worm-wheels.

6. In a rolling-mill, the combination of main rolls formed to have a plurality of passes, long vertical rolls, and short vertical rolls which coact with the long vertical rolls, each of said short vertical rolls comprising journals, bearings for the journals and means for moving the bearing for adjustment of the rolls.

7. In a rolling-mill, the combination of main rolls, formed to have a plurality of passes, one or more upright rolls arranged at the ends of said main rolls, and one or more additional upright rolls arranged each between two passes in position to each coact with one of said upright rolls at the ends of the main rolls, to act upon a blank passing through either of the passes contiguous to said additional upright rolls.

8. In a rolling-mill, the combination of main rolls each comprising a central cylindrical portion adapted to roll upon the web of a blank, two cylindric portions of reduced diameter, one arranged at each side of said central portion and adapted to receive flanges of said blank, and two flanges one arranged at the outer edge of each said reduced portion and at a distance from said central portion greater than the thickness of said flanges of said blank.

9. In a rolling-mill, the combination of main rolls, upright rolls, movable boxes for the upper and lower ends of said upright rolls, right and left threaded screws extending through said boxes and adapted upon rotation to move the boxes, and bearings carried by the boxes, said bearings being constructed for horizontal adjustment independently of the boxes, thereby affording provision for alining the upright rolls in the boxes.

10. In a rolling-mill, a combination of main rolls, upright rolls arranged in pairs at each side of the main rolls, a movable journal-box containing a horizontal adjustable bearing for the upper and lower ends of each upright roll, screws extending through the upper box of each pair of rolls, screws extending through the lower box of each pair of rolls, and gearing for operating all of said screws.

11. In a rolling-mill, the combination with an upright roll, of movable journal-boxes for the upper and lower ends of said upright roll, a plurality of screws extending through each of said upper and lower boxes and supporting the same, and means for rotating said screws.

12. In a rolling-mill, the combination with two or more upright rolls, of movable jour-

nal-boxes for the upper and lower ends of each upright roll, a plurality of screws extending through each of said upper and lower boxes and supporting the same, and adapted upon the rotation of said screws to cause a movement of said boxes, and a gearing for rotating said screws.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

RAYMOND DEE YORK.

Witnesses:
L. D. YORK,
JOHN H. LANGE.