W. SCRIMGEOUR.

MACHINE FOR ROLLING RINGS.

APPLICATION FILED MAR. 15, 1917.

1,295,614.

Patented Feb. 25, 1919.

6 SHEETS—SHEET 1.

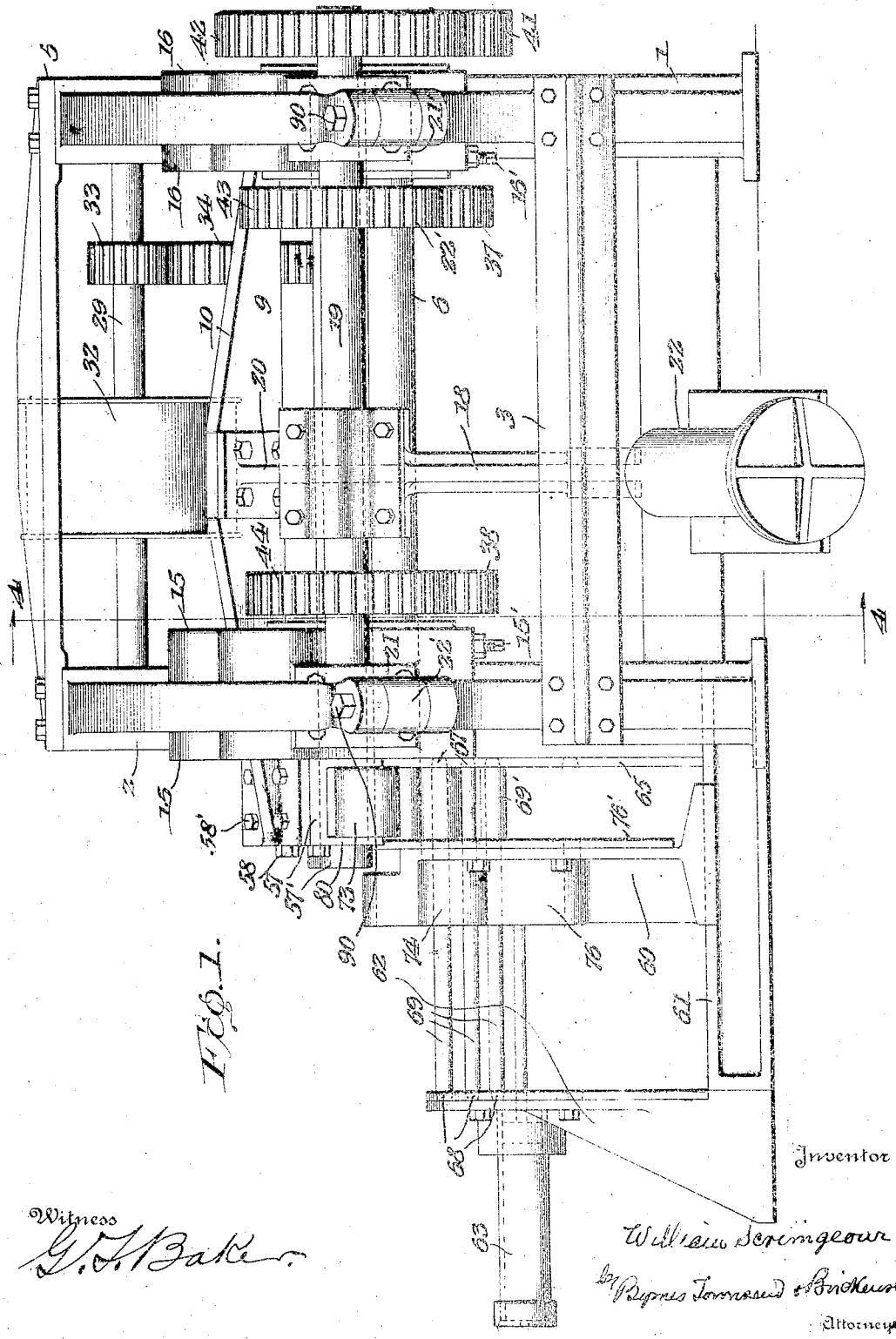


FIG. 1.

Witness

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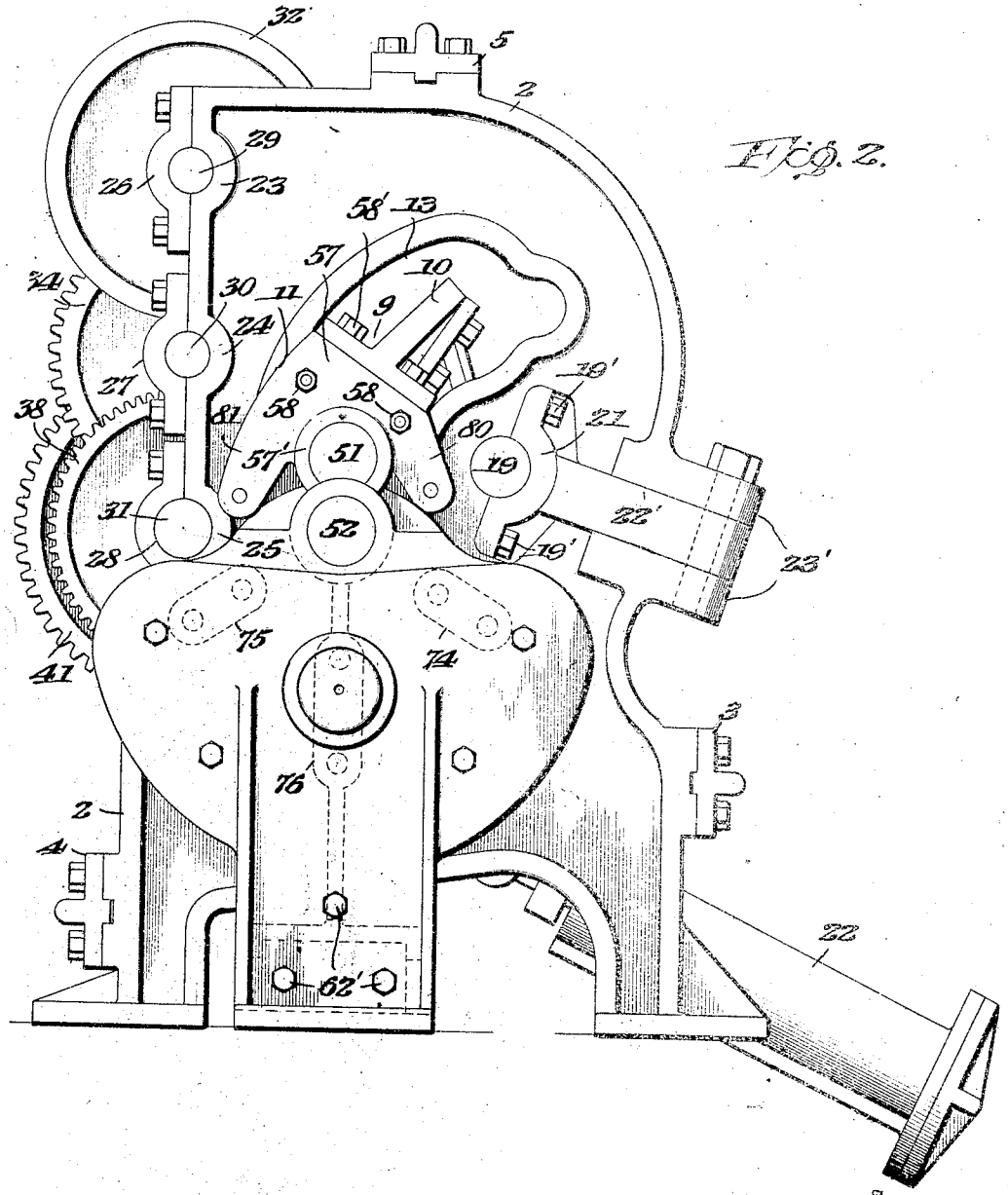


Fig. 2.

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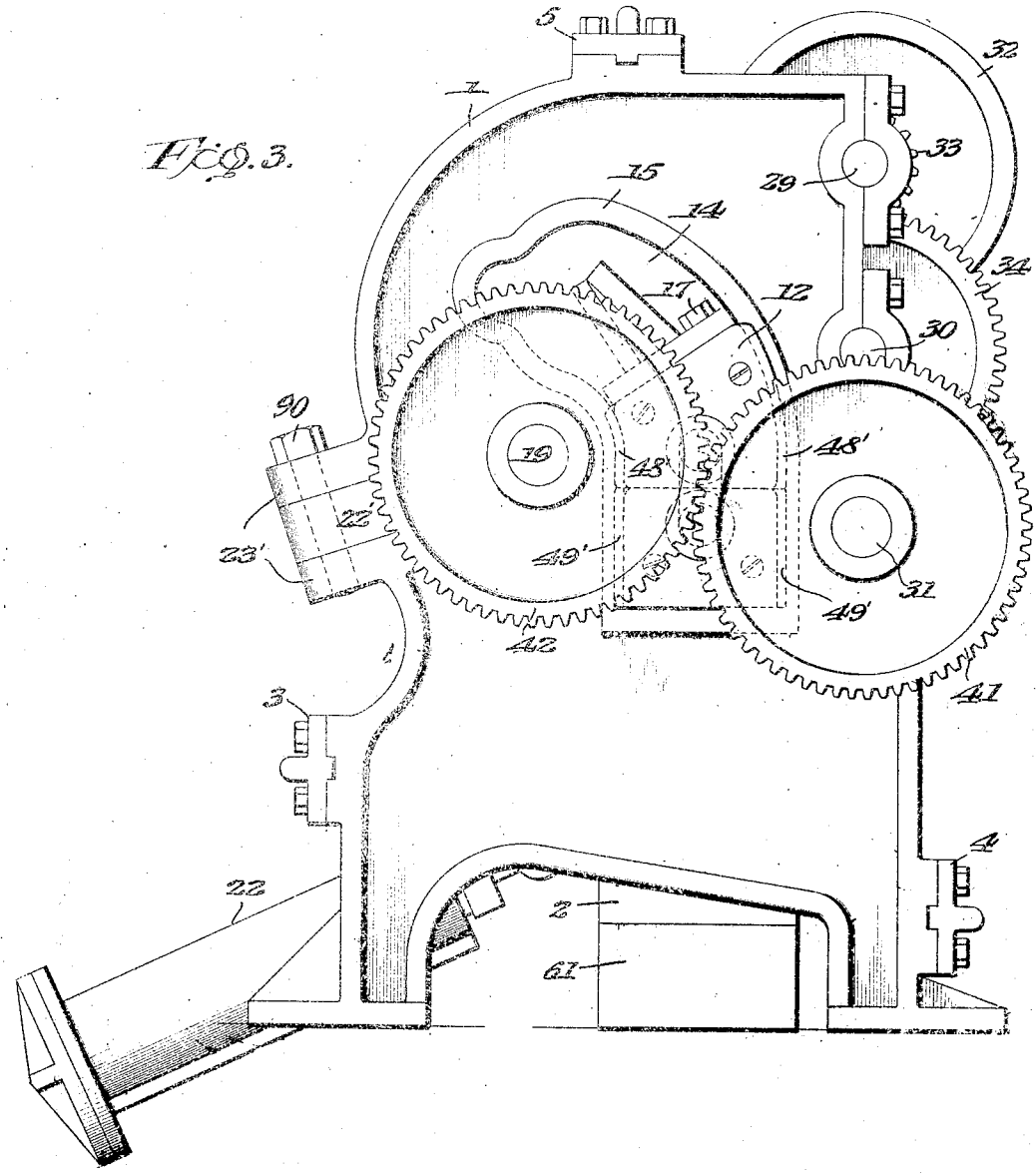
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6 SHEETS—SHEET 3.

Fig. 3.



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6 SHEETS—SHEET 4.

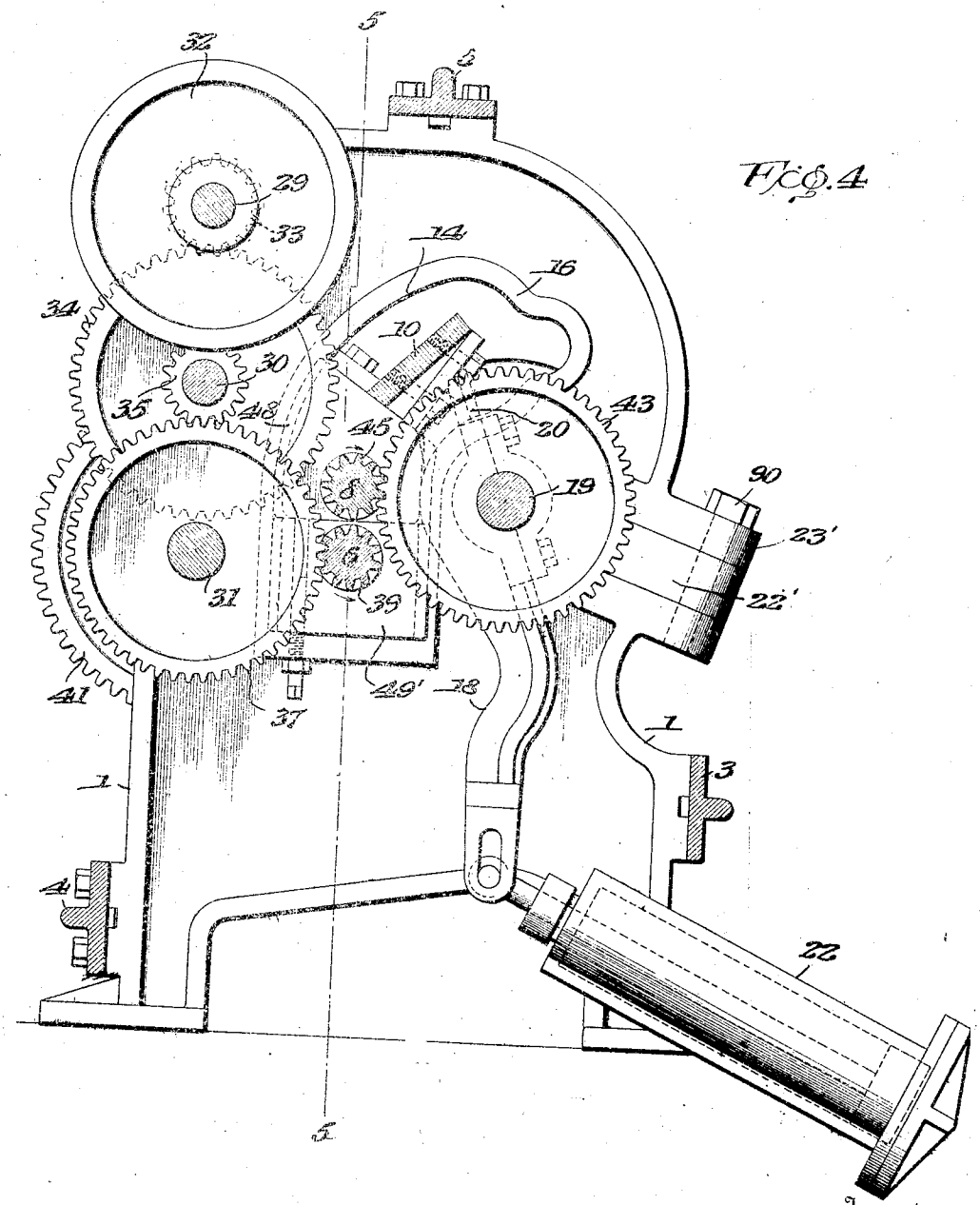


FIG. 4.

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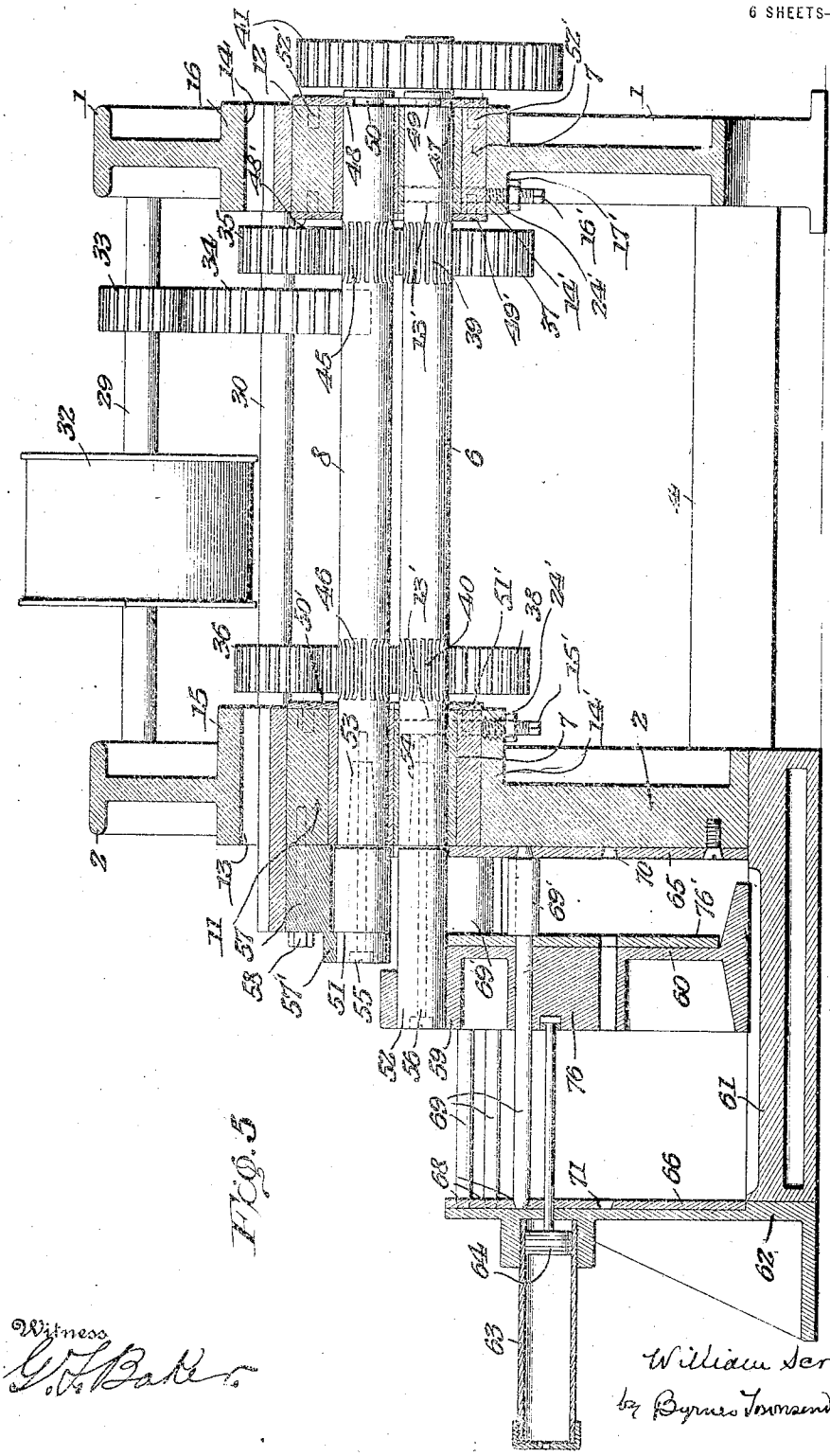


FIG. 5

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6 SHEETS—SHEET 6.

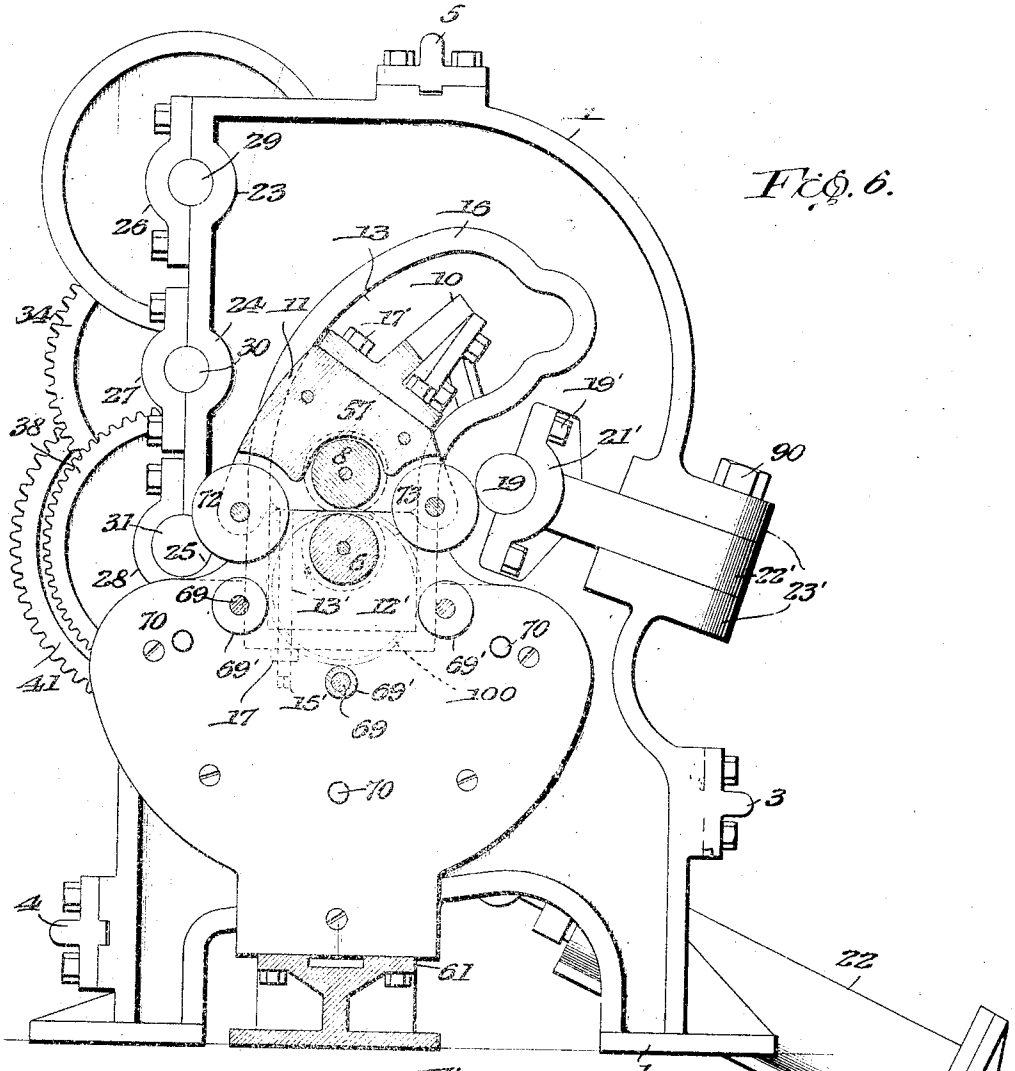


Fig. 6.

Fig. 10.

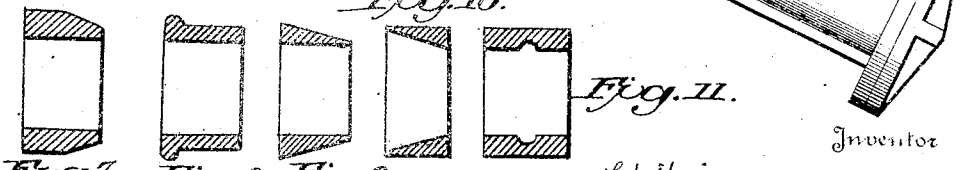


Fig. 11.

Fig. 7. Fig. 8. Fig. 9.

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UNITED STATES PATENT OFFICE.

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MACHINE FOR ROLLING RINGS.

1,295,614. Specification of Letters Patent. **Patented Feb. 25, 1919.**

Application filed March 15, 1917. Serial No. 155,012.

To all whom it may concern:

Be it known that I, WILLIAM SCRIMGEOUR, a citizen of the United States, residing at Washington, in the District of Columbia, have invented certain new and useful Improvements in Machines for Rolling Rings, of which the following is a specification.

My invention relates to apparatus for rolling rings, wheel-tires or other metal hoops, of the type wherein the work is operated upon between an inner and an outer roller.

It is the object of my invention to provide an apparatus of the character described that combines compactness, simplicity of structure and operation and great efficiency.

It is the particular object of my invention to provide such easy access to the rollers for the purpose of inserting the blank and removing the finished hoop that the machine and its rolling mechanism may be in continuous operation.

It is a further object of my invention to provide means for reducing the time for the rolling operation to a minimum. To carry out this object I have made provisions for supporting the rolls against bending stress so that a great force can be brought to bear on the hoop or ring to be rolled, and have provided guiding means for the hoop or ring to hold it in a single plane of rotation. As the ring is thus prevented from wabbling or lateral shifting substantially throughout its plane of rotation, a larger force can be applied and the time for the rolling operation reduced to a minimum.

My invention further relates to the means for mounting and supporting the rolls whereby torsional strains on the roll-shaft are taken care of; and to means for counteracting transverse bending strains and insuring exact parallelism of the rolls.

My invention further relates to means for preventing longitudinal movement of the rolls, to the provision of suitable fixed and movable guide rolls, to insure the production of a perfect ring; to the provision of adequate means for supporting and moving the movable roll; to the construction of the rolls themselves; to the provision of adjusting means or stops for determining the extent of relative movement of the rolls, and to other features of construction and arrangement which will more definitely appear from the following description and claims.

In the appended drawings, which represent a preferred embodiment of my invention,—

Figure 1 is a view in elevation;

Fig. 2 is an end view from the left in Fig. 1;

Fig. 3 an end view from the right in Fig. 1;

Fig. 4 a vertical transverse section on the line 4—4, Fig. 1;

Fig. 5 a vertical longitudinal section on the line 5—5, Fig. 4;

Fig. 6 a vertical transverse section through the roller system; and

Figs. 7–11 show forms of bands, other than a plain ring.

The frame supporting the operating mechanism comprises principally two solid upright end portions or standards 1 and 2 interconnected by distance bars 3, 4 and 5 in any suitable manner.

Carried by the uprights is shaft 6 in suitable bearings 7. This shaft, as will be more clearly pointed out below, either itself constitutes the inner roll or carries a separate roll and is turned about an axis which is fixed relatively to the frame.

The shaft 8 which forms the outer roll or carries a separate roll is mounted in a shiftable frame 9 normally above the roll 6 so that the distance between the rolls may be varied as the thickness of the material pressed between them diminishes.

The shiftable frame 9, which forms a material part of my invention, comprises a cross-web 10 carrying journal-boxes 11 and 12, respectively, at its ends. The journal-boxes have cylindrical surfaces to slide along the walls of curved openings 13 and 14, in the upright frames 1 and 2. To form an extended guide for these journal-boxes, the frames 1 and 2 are formed with flanges 15 and 16, respectively. The journal-boxes 11 and 12 are preferably made in separate pieces and attached to the cross-web 10 in any suitable manner, as by bolts 17. It is thus seen

that the frame 9 and with it, shaft 8, can be shifted toward and away from the shaft 6 for the purpose above specified.

The cross-web is so designed as to effectively brace the shaft or roll 8 against bending stress. To properly limit the space between rolls 6 and 8 and thus determine the thickness of the ring to be pressed, I have provided adjustable stops. As a convenient means for that purpose I have shown bolts 15′ and 16′, as best shown in Fig. 5. These bolts extend from the underside of flanges 14′ upwardly through the bearing-blocks 7, 7 of the roller 6. Normally, they are at their upper end flush with the upper face of these bearing-blocks. When it is desired, however, to space the rolls 6 and 8 for a greater thickness of the hoop, the bolts are advanced so that they protrude above the surface of the bearing blocks 7, 7, a required amount. For the purpose of adjustment the bolts are provided with a smooth portion 13′ and a screw-threaded portion 24′ adapted to engage a screw-thread in the flanges 14′. A lock-nut 17′ is provided for each bolt to secure the bolts in adjusted position. These stops are important, as by their proper adjustment, the pressure rolling of the blank is stopped just at such time as the outer periphery of the finished ring, 100, as shown in Fig. 6, comes into engagement with the guide rolls. Distortion of the ring is thus prevented and the production of a perfect ring is insured.

While any suitable mechanism may be resorted to for operating the journal-carrying frame 9, I have shown as a preferred form of such mechanism a lever 18 fulcrumed on a shaft 19,—which will be more particularly referred to below,—said lever having a short arm 20 connected to the cross-web 10 and its longer arm connected to a source of pressure 22. This source of pressure is preferably a hydraulic engine, but its specific form is immaterial and does not form a part of my invention. It has the function of forcing the shaft 8 toward the shaft 6 and supplying the power necessary for the rolling process. It is understood that there are means, as is customary, for releasing the pressure at will. This feature is not illustrated, since it is well understood. The lever 18 is preferably mounted on shaft 19 by means of a divided bearing, as clearly shown in dotted lines in Fig. 4, so that the lever can be attached and detached without disturbing other parts of the apparatus.

The shaft 19 is supported at its ends in the upright end portions 1 and 2 of the frame in such a manner that the wear is taken up principally by bearing caps 21 and 21′. For this purpose the caps 21 and 21′, as is seen in Figs. 2 and 6, embrace the major part of the lower bearing surface and if the wear becomes excessive, the cap may be replaced by a new cap with little expense, while the frame itself is little affected. The caps are held in position by bolts 19′ and by arms 22′ which are in turn clamped in a bifurcation 23′ of the frame, as by bolts 90. This form of mounting makes it possible to take out shaft 19, when desired, and to give access to the interior of the machine for purpose of repair.

For the power transmission for turning the shafts 6 and 8 and therewith the rolls, I have designed a simple set of gears and the particular arrangement forms an important part of my invention.

The frame presents at its left-hand edge (see Fig. 2) a substantially vertical wall. This wall is shaped to form three half bearings 23, 24 and 25. The other half for these bearings is provided in the form of detachable caps 26, 27 and 28 (see Fig. 6). These bearings are identical on each of the upright end portions 1 and 2 and accommodate shafts 29, 30 and 31.

Shaft 29 carries a fly-wheel pulley 32 for a belt drive and a pinion 33. This pinion meshes with a gear 34 on shaft 30, see Fig. 4. On shaft 30 are two pinions 35 and 36 to transmit the power from shaft 30 to shaft 31 through gears 37 and 38. Gears 37 and 38 in turn mesh with gear-teeth 39 and 40, respectively, on shaft 6, as best shown in Figs. 4 and 5.

The gear-teeth 39 and 40 are preferably cut directly into the shaft as shown. This is an important feature, since it reduces the distance between the shafts or rolls 6 and 8 to a minimum and thus makes it possible to roll exceedingly thin rings between the rolls proper. It is of course possible to reduce the distance between the rolling surfaces to any small amount desired by providing rollers larger in diameter than the shafts or rolls 6 and 8, but I have found that the increase of the rollers in diameter is not desirable, since they have a tendency, due to their high circumferential speed, to tear and disrupt the fibers and texture of the material of the ring. I have avoided this difficulty by reducing the distance between the shafts or rolls to the smallest possible amount.

From shaft 31 the power is also transmitted to shaft 8 through a gear 41 at the end of shaft 31 which projects outside the frame portion 1, the gear 41 meshing with a gear 42 keyed to shaft 19 (see Fig. 3) and through gears 43 and 44 on shaft 19 engaging gear teeth 45 and 46, respectively, on shaft 8. It will be noted that these gears 45, 46 are located close to the bearings, and that the bearings are relatively long, so that transverse and torsional strains are counteracted. The location of the gears 45, 46 in the shafts enables the shafts to be made very strong and of substantially the same

size as the rolls, while at the same time permitting the rolls to be brought into close proximity. Gears 41 and 42 are of equal size and so dimensioned as to directly engage without any intermediate gearing. Gears 43 and 44 are of the same size as gears 37 and 38 and therefore the shafts 6 and 8 are driven with the same speed.

Shafts 6 and 8 are held against axial shifting by plates 47 and 48 engaging in annular grooves 49 and 50, respectively, as shown in Fig. 5.

These plates 47 and 48 and in conjunction therewith plates 48′, 49′, 50′ and 51′ are of such size as to overlap slightly the edges of flanges 16 and 15, respectively, as best seen in Fig. 3, and thus confine the bearing-blocks in the apertures 13 and 14 against lateral shifting. The plates are preferably attached to the bearing-blocks by screws 52′.

It has been found that the rolls wear out comparatively rapidly and in order to minimize the loss due to such wear I provide separate rolls 51 and 52, detachably connected to the shafts 6 and 8. Roll 51 is attached to the shaft 8 and roll 52 to the shaft 6 by Morse tapers 53 and 54 and screw bolts 55 and 56, respectively. The roll 51 is held in a bearing 57′ extending from the bearing portion 57 which is detachable from the journal-box 11 and normally fixed thereto by bolts 58, this bearing portion 57 being secured to bar 9 by bolts 58′, see Fig. 1. Roll 52 is held in a bearing 59 which is part of a laterally shiftable standard 60. This standard is adapted to slide on a base rail 61 which forms a part of the general frame. At the free end of this base rail 61 is attached by bolts 62′ a fixed standard 62. This standard 62 carries a device for shifting the standard 60. As a convenient means for that purpose I have shown a fluid pressure device 63 and a piston 64 connected to the standard 60. It is understood that other means may be used for shifting the standard. 65 and 66 are plates bolted to the frame 2 and standard 62, respectively. These plates have apertures 67 and 68 to receive the ends of rods 69 which pass loosely through standard 60. These rods 69 have the dual function of guiding the standard 60 when it is shifted and also of supporting guide rolls or gage rolls 69′ for delimiting the size of the ring to be pressed, as clearly indicated in Fig. 6.

There is another set of apertures in the plates 65 and 66 indicated by the numerals 70 and 71, respectively. If it is desired to press rings of larger size, the rods 69 are removed from apertures 67 and 68 and placed in the openings 70 and 71. A similar number of additional apertures is provided in standard 60 to coöperate with the rods 69 in the second position. 74, 75 and 76, shown in dotted lines in Fig. 2 are bosses on the outer face of standard 60 to afford an extended bearing for the rods 69. 76′ is a bearing-plate attached to the inner side of standard 60. This plate, like plate 65, is subject to considerable wear and is made detachable so that it may be removed when necessary.

Referring to Figs. 1 and 2, the detachable bearing portion 57 is provided with bifurcated arms 80 and 81 to support two gage rolls 72 and 73. These rolls are designed to coöperate with the other guide rolls 69′, to guide and determine the size of the ring. Their location on the swinging frame 9, whereby they are raised upwardly when the roll 8 is raised, enables easy removal of the ring after it has been rolled.

It will thus be seen that all parts which are subject to unsual wear are made separate and detachable from the frame and may be replaced quickly and cheaply without disrupting the apparatus in other respects. The rolls are located for easy access at one side of the apparatus and the work may be inserted and taken out conveniently and rapidly.

It is to be noted that substantially all structural elements are separately detachable and replaceable, so that any particular part can be taken out and replaced without either dismantling the whole machine or without the necessity of discarding the whole machine or any considerable part thereof. The disposition of the various elements is made with this idea in view, since the wear and tear due to the stresses arising during the rolling operation is great.

The operation is as follows: When it is desired, assuming the machine is in operation, to insert a blank ring between the rollers, the shiftable frame 9 is lifted and the standard 60 drawn out. Then the blank ring is placed on the end of roll 52, the standard 60 brought back to its normal position and the pressure applied to the frame 9. When the ring has been expanded to its predetermined size according to the location of the gage rolls 69′, 72 and 73, the frame 60 is again drawn out, the finished ring removed and a new blank ring inserted.

As shown in Fig. 6, the guide rolls 69′, 72 and 73 are in proper relation to make a ring of the size shown. If a larger ring is to be made, the rods 69 are located in the openings 70, and other guide rolls of suitable diameter are substituted for rolls 72 and 73. A larger number of guide rolls may be provided if necessary.

The whole tendency of the rolling pressure exerted upon the blank is to cause circumferential flow or displacement of the metal with a gradual thinning of the ring and a corresponding enlargement of its diam-

eter. There is very little tendency for lateral or sidewise metal-flow, so that the width of the ring remains substantially the same. Any slight irregularities which tend to be produced on the edges of the rings are however prevented by the fact that the ring as it is rolled is kept with its axis parallel to the axis of the rolls, because of the fact that its edges bear against the plates 65 and 76′, which also prevent any sidewise wabbling of the ring being rolled. The massive structure of the standard 60 and the support 2, together with the ample bearings afforded for both ends, and particularly the outer ends of each of the rollers insure the production of a substantially perfect ring with its inner and outer faces in parallelism.

It will be noted that the upper roll 51 is slightly larger in diameter than the lower roll 52 and this feature has been purposely adopted, as it has been found that a slightly greater circumferential speed of the outer or pressure roll causes more effective and uniform distribution of the metal.

It will also be noted that in my machine the pressure is applied to the outside roll and this is done for the reason that I have found in practice that a greatly superior result is obtained by this arrangement.

While I have shown a machine adapted for rolling a plain or parallel-sided ring, it is obvious that many other forms may be rolled, by suitable changes in configuration of the rolls. Examples of such forms are shown in Figs. 7–11.

It is understood that the apparatus, as shown and described, may be modified in various ways within the scope of my claims.

I claim:—

1. In a ring-rolling machine, the combination of a frame, rolls extending from one side thereof, one of said rolls rotatable in fixed bearings, the other roll mounted to rock about a shaft on said frame, journals for the outboard end of each roll, means for positively driving both rolls, and means for applying pressure to the rocking roll.

2. In a ring-rolling machine, the combination of a frame, rolls extending from one side thereof, one of said rolls rotatable in fixed bearings, the other roll mounted to rock about a shaft on said frame, journals for the outboard end of each roll, one of said journals being movable, means for positively driving both rolls, and means for applying pressure to the rocking roll.

3. In a ring-rolling machine, a frame, a roll mounted on a rocking support carried by the frame, said roll having one end extending beyond said frame, bearings in said support for each end of the roll and an intermediate bearing in proximity to the working end of said roll.

4. In a ring-rolling machine, a frame, a roll mounted on a rocking support carried by the frame, said roll having one end extending beyond said frame, bearings in said support for each end of the roll and an intermediate bearing in proximity to the working end of the roll, guide surfaces on the intermediate and inboard bearings, and corresponding guide surfaces in the frame.

5. In a ring-rolling machine, a frame, a roll mounted on a rocking support, a shaft on which said support is mounted, and means for removing said shaft laterally from said frame comprising caps 21, arms 22′, and means for clamping said arms to the frame.

6. In a ring rolling machine, a frame, a movable support carried by said frame, journals on said support, a roll journaled at each end in said journals and guide rolls mounted on one of said journals on each side of said roll.

7. In a ring-rolling machine, a frame, a rocking support carried by said frame, a roll journaled at each end in said support, a shaft on which said support is carried, a pinion on said shaft, and a gear on said roll in mesh with said pinion.

8. In a ring rolling machine, a frame, a rocking support carried by said frame, journals in said support, a roll journaled at each end in said journals, a shaft on which said support is carried, gears on said shaft and pinions on said roll in proximity to said journals.

9. In a rolling-mill, a frame, a pair of respectively fixed and movable rolls mounted in said frame and having working ends extending beyond said frame, said rolls having pinions formed in their bodies, and driving gears engaging said pinions.

10. In a rolling mill, a frame having standards at each end, a fixed roll journaled in said standards, a movable roll journaled in a support carried by said frame, means for moving the movable roll toward the fixed roll, and coöperating means on said standards, said rolls and said support preventing lateral shifting of the rolls.

11. In a ring-rolling mill, a frame, a fixed roll journaled in said frame and having one end extending therefrom, an extension of said frame having a fixed and a movable standard, a journal in said movable standard for the end of said roll, and means carried by the fixed standard for moving the movable standard toward and from the frame.

12. In a ring-rolling mill, a frame, a fixed roll journaled in said frame and having one end extending therefrom, an extension of said frame having a fixed and a movable standard, a journal in said movable frame for the end of said roll, guide rods secured to the fixed standard and frame and passing through the movable standard, and means carried by the fixed standard for

moving the movable standard toward and from the frame.

13. In a ring-rolling mill, a frame, a fixed roll journaled in said frame and having one end extending therefrom, an extension of said frame having a fixed and a movable standard, a journal in said movable frame for the end of said roll, guide rods secured to the fixed standard and frame and passing through the movable standard, guide rolls on said guide rods in proximity to the frame, and means carried by the fixed standard for moving the movable standard toward and from the frame.

14. In a ring-rolling mill, the combination of an upright frame, a roll turning in fixed bearings thereon and having a portion projecting at one side of the frame, a standard spaced from the frame and normally supporting the free end of the roll, means for moving said standard into and out of supporting position, and a movable roll on the frame substantially co-extensive with and above the fixed roll and having a portion projecting at one side of the frame.

15. In a ring-rolling mill, the combination of an upright frame, a roll turning in fixed bearings thereon and having a portion projecting at one side of the frame, a standard spaced from the frame and normally supporting the free end of the roll, means for moving said standard into and out of supporting position, a movable roll on the frame substantially co-extensive with and above the fixed roll and having a portion projecting at one side of the frame, and means for shifting the movable roll with respect to the fixed roll.

16. In a ring-rolling mill, the combination of a frame, two rolls mounted on the frame and having portions projecting at one side of the frame, and a structural element spaced from the frame and adapted to form with the outer face of the frame guide surfaces for the ring.

17. In a ring-rolling mill, the combination of a frame, two rolls mounted on the frame and having portions projecting at one side of the frame, a structural element spaced from the frame, and having an extended surface facing the frame, said element and frame forming a chamber acting as a guide for the ring.

18. In a ring-rolling mill, the combination of a frame, two rolls mounted on the frame and having portions projecting at one side of the frame, a structural element spaced from the frame, and normally supporting the free end of one of the rolls, said element and frame being adapted to form a guide chamber for the ring, and means for moving the element into and out of supporting position.

19. In a ring-rolling mill, the combination of a frame, two rolls mounted on the frame and having portions projecting at one side of the frame, a structural element spaced from the frame and having an extended surface facing the frame, said element and frame forming a guide chamber for the ring, and rollers placed between the element and the frame for determining the shape of the ring.

20. In a ring-rolling mill, the combination of a frame, a roll turning in fixed bearings thereon and having a portion projecting at one side of the frame, a support and means for affording a shifting of the support toward and away from the roll, a roll mounted on the support and having a portion projecting at one side of the frame in proximity to the projecting end of the first roll, and rollers mounted on the support for determining the shape of the ring.

21. In a ring-rolling mill, the combination of a frame, a roll turning in fixed bearings thereon and having a portion projecting at one side of the frame, a support and means for affording a shifting of the support toward and away from the roll, a roll mounted on the support and having a portion projecting at one side of the frame in proximity to the projecting end of the first roll, rollers mounted on the support for determining the shape of the ring, a structural element spaced from the frame and normally supporting the free end of the first roll, said element and frame being adapted to form a guide for the ring, and rollers placed between the element and the frame for coöperation with the first mentioned rollers in the determination of the shape of the ring.

22. In a ring-rolling mill, a frame, upper and lower driven rolls between which the ring is formed, a movable support carried by the frame in which said upper roll is journaled, a pair of guide rolls carried by said support on each side of said upper roll, and a multiplicity of guide rolls carried on the frame, the peripheries of all said rolls being tangent to a circle having the diameter of the ring to be rolled.

23. In a ring-rolling mill, the combination of a frame, two rolls mounted on the frame and having portions projecting at one side of the frame, a structural element spaced from the frame, and normally supporting the free end of one of the rolls, said element and frame being adapted to form a guide chamber for the ring, wear plates on the walls of said chamber, and means for moving the element into and out of supporting position.

24. In a ring-rolling mill, a frame comprising spaced uprights, a lower roll turning in fixed bearings on said uprights and having one end projecting beyond said

frame, a support and means for shifting the support from above toward and away from the fixed roll, an upper roll mounted in said movable support and having an end projecting beyond the frame to coöperate with the fixed roll, an outboard bearing carried by said support for said movable roll, and a movable standard having a bearing for the outboard end of the fixed roll, means for applying pressure to the movable roll, means for reciprocating the standard, and means for driving both rolls.

In testimony whereof I affix my signature.

WILLIAM SCRIMGEOUR.