No. 685,981. Patented Nov. 5, 1901.

S. M. GUSS.

ROLLING MILL.

(Application filed Aug. 5, 1901.)

(No Model.) 3 Sheets—Sheet 1.

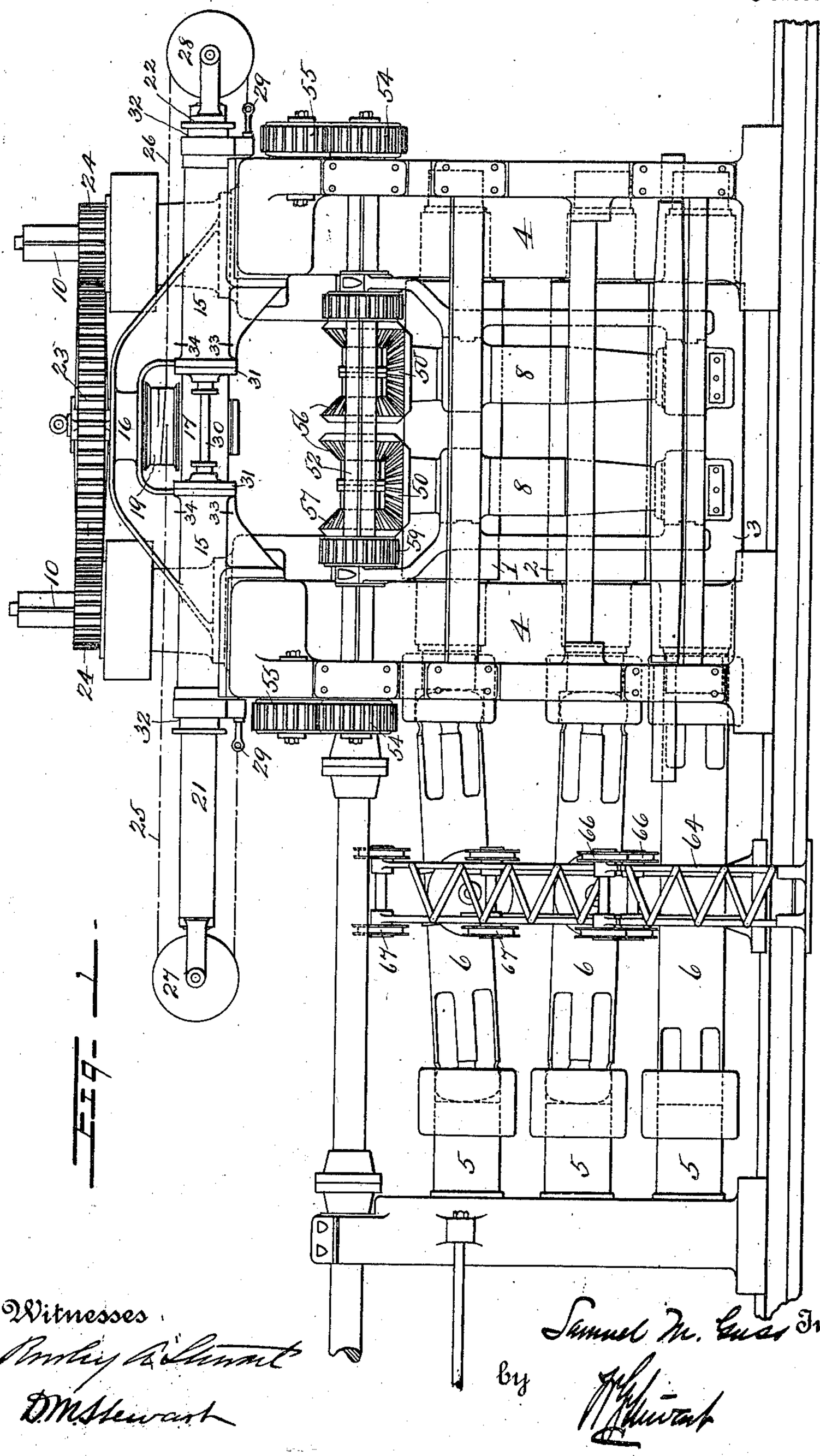

FIG. 1.

Witnesses.
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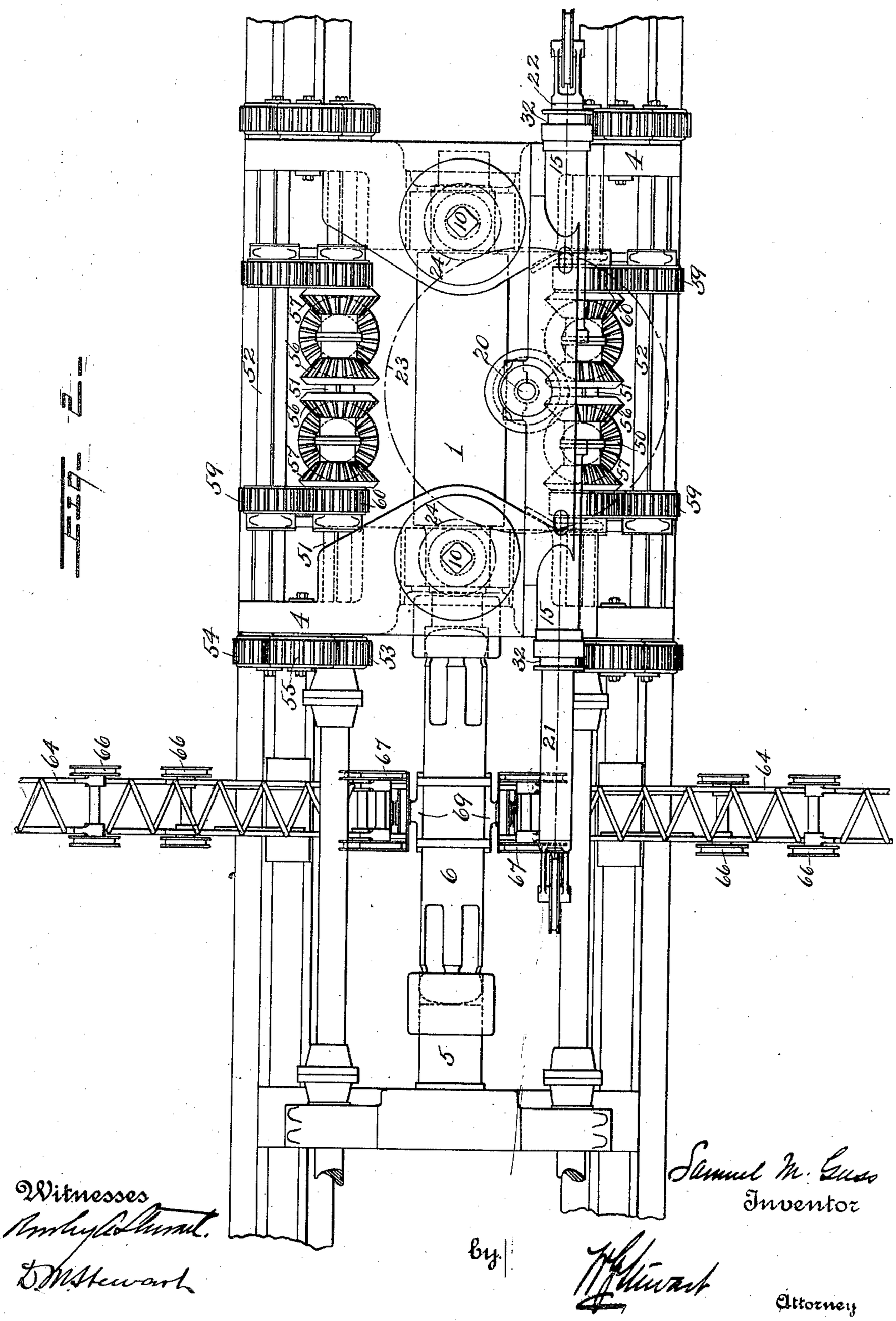
FIG. 2.



Witnesses
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3 Sheets—Sheet 3.

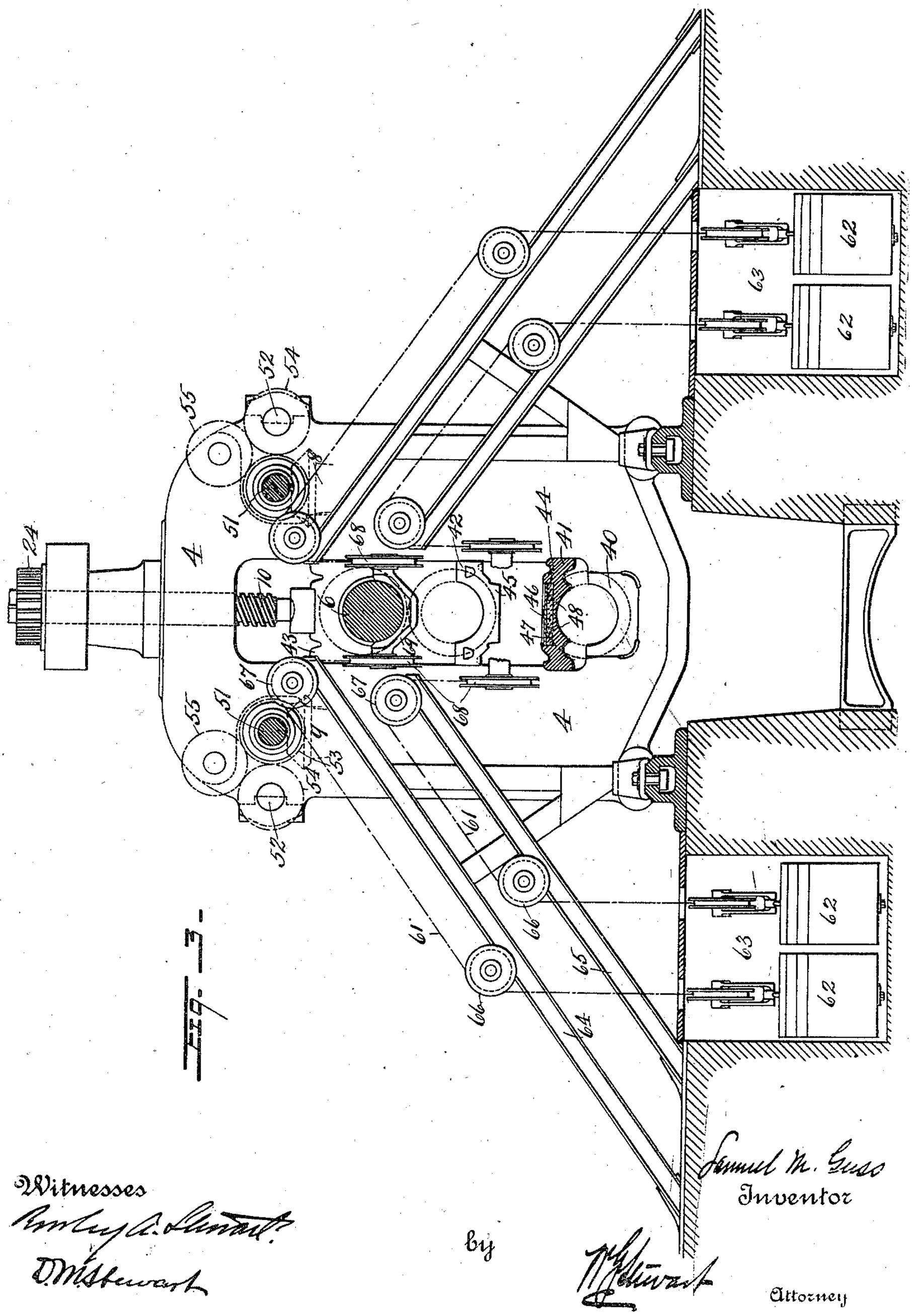

Fig. 3.

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UNITED STATES PATENT OFFICE.

SAMUEL M. GUSS, OF READING, PENNSYLVANIA.

ROLLING-MILL.

SPECIFICATION forming part of Letters Patent No. 685,981, dated November 5, 1901.

Application filed August 5, 1901. Serial No. 70,866. (No model.)

To all whom it may concern:

Be it known that I, SAMUEL M. GUSS, a citizen of the United States of America, and a resident of Reading, in the county of Berks and State of Pennsylvania, have invented certain new and useful Improvements in Rolling-Mills, of which the following is a specification.

My invention relates more particularly to universal rolling-mills; and it consists in certain improvements in the roll operating and adjusting, which are fully described in connection with the accompanying drawings, and specifically pointed out in the claims.

Figure 1 is a front elevation of a universal mill embodying my improvements. Fig. 2 is a partial plan view of the same. Fig. 3 is an end view, partially in section, showing a portion of the spindle-carrier mechanism and also showing the cushion-box arrangement between the middle and bottom horizontal rolls.

In general construction the mill, as shown, comprises the usual features of a three-high universal mill, including the horizontal rolls 1, 2, and 3, mounted, as usual, in housings 4 and driven from driving-shafts 5 through spindle connections 6, and pairs of vertical rolls 8 and 9, respectively in front and to the rear of said horizontal rolls. The bottom horizontal roll is mounted in fixed bearings in the housings, and the upper and middle rolls are mounted in bearings which are vertically adjustable in the housings, the weights of said upper and middle rolls and their movable bearings being separately counterbalanced, as usual, by any suitable mechanism (not shown) and the height of the upper one being regulated by vertical adjusting-screws 10, suitably mounted in the top portion of each housing in a manner common in mill construction.

One feature of my invention consists in my improved hydraulic gear for operating these adjusting-screws 10, a main object being to secure a considerable movement of the latter with a relatively small plunger movement and also to retain positive control of the screws, so that they may not be unintentionally shifted by the operating-strain on the rolls. This mechanism comprises two similar hydraulic cylinders 15, mounted horizontally upon the housings in line with each other and preferably formed in a single casting with alined vertical bearings 16 17, located midway between the adjacent inner ends of the cylinders, but out of line with the latter. In the space 18 between these alined bearings is located a drum 19, which is fixed to a shaft 20, mounted in said bearings 16 and 17. This drum and its shaft is arranged to be rotated in one direction or the other or positively held against rotation by its connection to the jointly-movable plungers 21 22, as hereinafter described, and carries with it a large gear-wheel 23, fixed to the upper end of the shaft, which gear-wheel is in mesh with a pinion 24 on each of the two roll-adjusting screws 10, so as to simultaneously and equally move the latter or hold them in adjusted position. The periphery of the drum 19 is preferably set about tangential to a vertical plane passing through the center line of the cylinders and has secured to it the upper ends of two winding cords or chains 25 and 26, which extend therefrom in opposite directions, and after passing over pulleys 27 and 28, respectively, at the opposite projecting ends of the plungers, have their other ends fixed at 29 29 to the housings.

The plungers 21 22 are connected at their inner ends by means of an intermediate connecting-rod 30, which passes through suitable stuffing-boxes in the cylinder-heads 31, and their outer ends pass through other stuffing-boxes 32. Each cylinder has an inlet and an exhaust valve 33 and 34, respectively, near its inner end, with suitable connections (not shown) to a pressure-reservoir and valve-operating mechanism for effecting the joint movement of the plungers in one direction or the other. The exhaust-valve in one cylinder is open when the inlet-valve to the other is open, and vice versa. Thus both are constantly under a positive control, and through the drum 19, large gear 23, and meshing pinions 24 at all times positively control the adjusting-screws 10. Owing to this positive control of the screws they may be provided with screw-threads of greater pitch than usual without danger of backing under strain, and only a small movement of the plunger is required to effect a considerable movement of the screw, thus providing a rapid as well as positive adjustment.

As has been previously referred to, the

lower horizontal roll is mounted in fixed bottom and top bearings 40 and 41, and the middle and top rolls are mounted in vertically-movable bottom and top bearings 42 and 43, slidable in the windows of the housings. The roll counterbalance mechanism is arranged to normally raise both of the movable rolls as far as permitted by the adjusting-screws or to permit of the lowering of the middle one upon the bottom roll, as desired for the upper passes. This movement of the middle roll alternately toward the bottom and the top roll preparatory to a top or bottom pass must be effected as quickly as practicable and commonly results in a more or less jarring contact. In my improved construction I avoid this by providing a yielding or cushioning contact of the box 42 or 43 of the middle roll with the lower box of the upper roll or the upper box 41 of the lower roll, the latter boxes, as indicated in connection with the lower roll, being each formed, as shown, with a pocket or recess, as 44, and the contacting box 42 with a corresponding projection 45, adapted to enter said recess or pocket as the rolls come together and to compress a yielding medium in said pocket which absorbs the momentum of the moving middle roll and stops the same without shock. This medium preferably consists of hair felt 46, loosely packed in said pocket 44 and covered by a movable plate 47 with a restricted liquid inlet or inlets 48 to said pocket, communicating with a source of supply, whereby said packing is normally distended, the middle roll being raised, but upon the approach of the latter is forcibly compressed by the pressing down of the cover-plate 47, the liquid in the pocket 44 being discharged therefrom through the restricted openings so slowly as to practically absorb the momentum of the moving roll and avoid objectionable jar.

Another feature of my invention relates to the operating mechanism for the vertical rolls. These are commonly driven by means of a bevel gear-wheel 50, fixed to one end thereof and arranged in mesh with similar bevel-gears fixed to a horizontal driving-shaft 51. The main object of my improvement is to provide for the use of a bevel-gear 50 of comparatively small diameter, so as to permit of close adjustment of the rolls and at the same time secure ample strength in the gear-teeth and a balanced rotating action thereon. To accomplish this, I employ in connection with the driving-shaft 51 a counter-shaft 52, which is driven from the shaft 51 by means of a spur-wheel 53 thereon, arranged in gear with a spur-wheel 54 on the counter-shaft through an intermediate idler 55. The driving-shaft 51 for each pair of vertical rolls carries a bevel-gear 56 for each of said rolls, which meshes directly with the roll-gear 50 to rotate said roll, and it also carries loosely thereon a second bevel-gear 57, which likewise meshes with said roll-gear 50 on its opposite side from the gear 56. This loose bevel-gear 57 is driven from the counter-shaft 52 by a spur-gear 59, fixed to the latter and in mesh with a spur-gear 60, fixed to or formed integral with the bevel-gear 57. By means of this improved mechanism each vertical roll-gear 50 is driven from the shaft 51 by two meshing gears 56 and 57, operating at opposite sides thereof to rotate it in the same direction, thus dividing the strain upon the teeth, so as to safely allow the use of a smaller size gear 50 and at the same time preventing the lateral strains upon the vertical rolls which arise from exerting the rotating action on one side of the roll only.

Another cause of unequal strain and wear upon the roll mechanism is due to the carrying of one end of the horizontal roll-driving spindles or connections 6 by the roll-boxes of the connected roll end and the hammering action due to the wabbling movement of these spindles in different positions of the rolls. To overcome this, I have provided an improved carrier mechanism for the two spindles connecting with the movable rolls. This mechanism comprises cradles 69, such as have heretofore been employed, located under each spindle, ordinarily about midway of its length and each carried by a chain 61, passing over guide-pulleys mounted on supporting-frames rising from the bed and carrying at their lower ends counterbalance-weights 62, adapted to freely rise and fall in suitable pits 63. In the preferred construction shown the supporting-frames form two parallel inclines 64 and 65, arranged in a plane at right angles to the spindles and suitably braced and secured at the base. On each of these inclines are mounted two pairs of guide-pulleys 66 66 and 67 67, over which the respective chains 61 pass, with the depending bend of each chain carrying one end of a cradle 69, said end being trunnioned, as shown, in a pulley 68, around which the bend of the chain passes, while the free lower ends of each chain carry the counterbalance-weights 62, the respective pits 63 for the latter being located on opposite sides of the plane of the rolls. Each spindle is thus adjustably carried independently of the roll-bearings with which the engaging end of the spindle rises or falls without jarring or wearing the same.

While I have particularly described my improvements in the preferred forms shown, I do not desire to limit myself to such preferred construction, which may be readily modified without departing from the spirit of my invention.

What I claim is—

1. In a three-high rolling-mill the combination with the movable roll and the relatively-fixed roll or rolls, of bearing-boxes for said rolls having their respective meeting faces provided respectively with recesses or pockets and corresponding projections to enter said pockets, and a cushioning medium in said pockets adapted to prevent jarring contact of the movable and fixed rolls substantially as set forth.

2. In a rolling-mill the combination with the roll-adjusting screws of tandem cylinders mounted on the housings and provided with vertical shaft-bearings between said cylinders and out of line therewith, a drum-shaft in said bearings having a drum fixed thereto above the center line of the cylinders and a gear-wheel above said drum arranged in gear with said adjusting-screws, connected plungers in said cylinders having their ends projecting therethrough, pulleys carried by said projecting plunger ends and separate flexible connections to said drum passing over said pulleys, substantially as set forth.

3. In a rolling-mill the combination with vertical rolls having bevel-gears fixed thereto, of a driving-shaft carrying meshing bevel-gears arranged to directly rotate said rolls and loose bevel-gears also in mesh with said roll-gears on opposite sides of the roll center, and a counter-shaft driven by said driving-shaft and in turn driving said loose bevel-gears in reverse direction to coöperate in rotating the rolls, substantially as and for the purpose set forth.

4. In a rolling-mill apparatus, a carrier mechanism for the roll-driving spindle of the movable roll or rolls comprising fixed carrier-frames located between the ends of said spindles, guide-pulleys mounted on said frames, a carrier-cradle for the spindle, and carrier-chains connected to opposite sides of said cradle, passing over said guide-pulleys, and carrying at their lower ends counterbalance-weights, substantially as set forth.

Signed at Reading, Pennsylvania, this 23d day of July, 1901.

SAMUEL M. GUSS.

Witnesses:
D. M. STEWART,
W. G. STEWART.