No. 666,057. Patented Jan. 15, 1901.

W. L. JONES.

METAL ROLLING MACHINE.

(Application filed Apr. 7, 1900.)

(No Model.) 4 Sheets—Sheet 1.

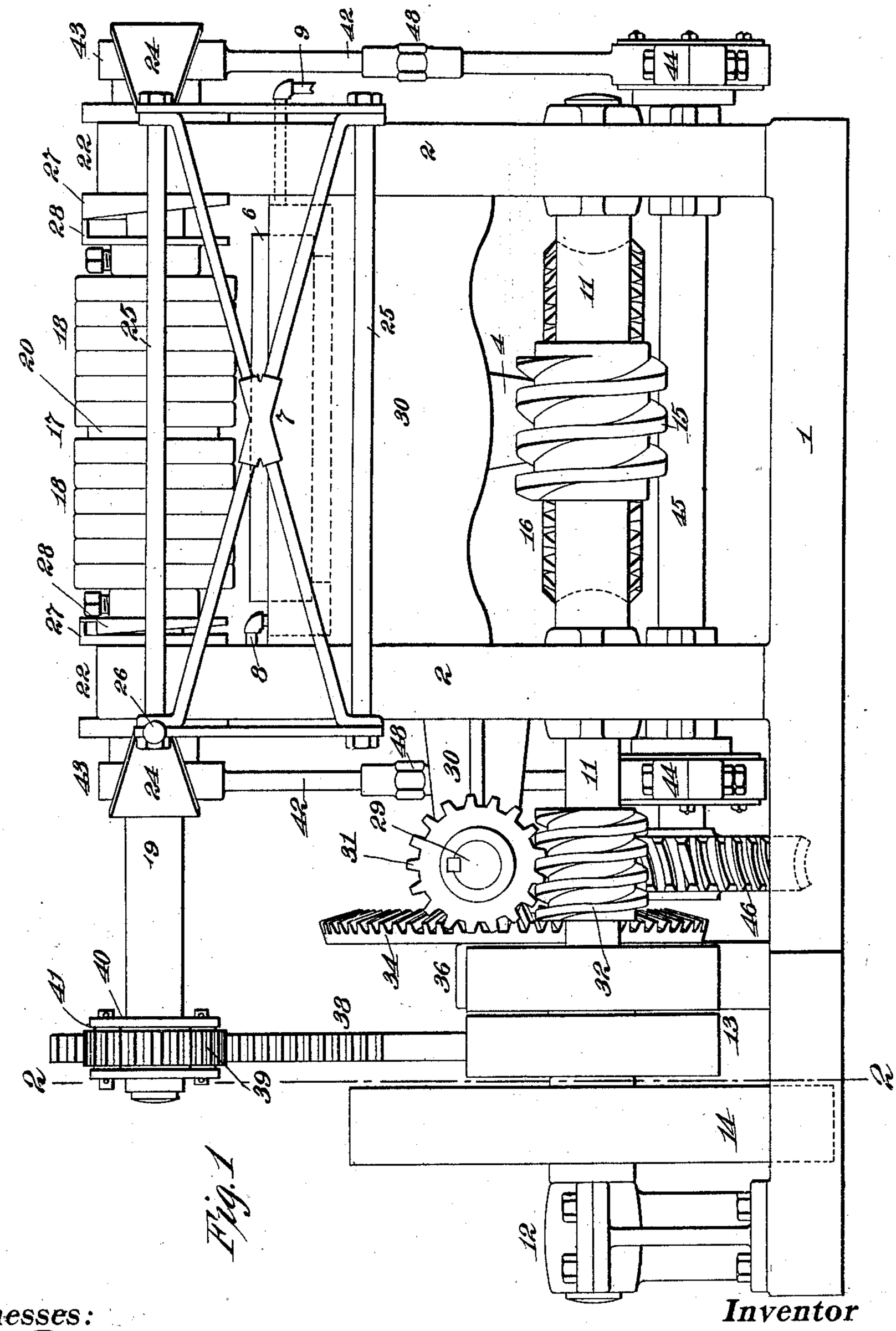

Fig. 1.

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Fig. 2

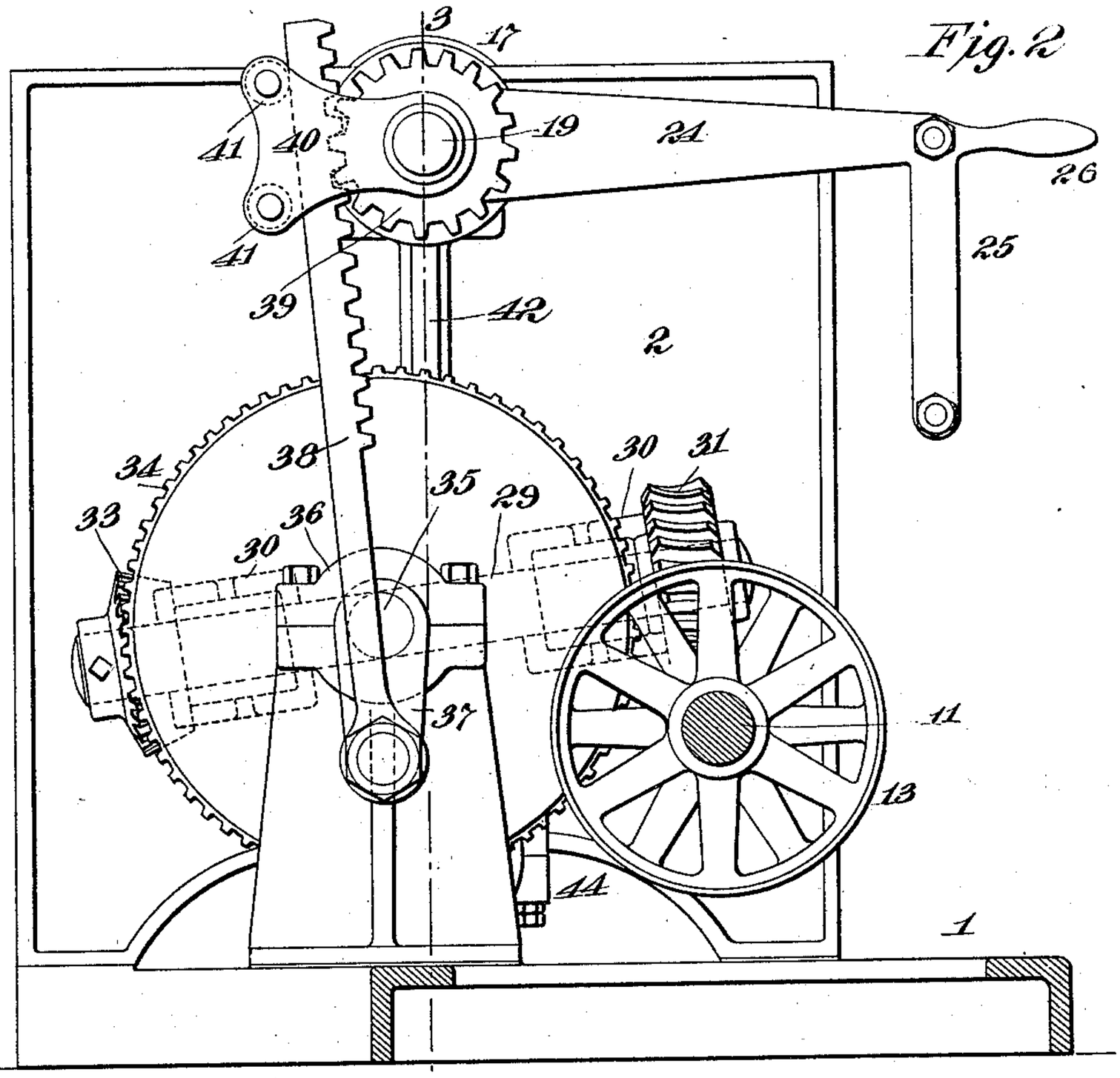


Fig. 4

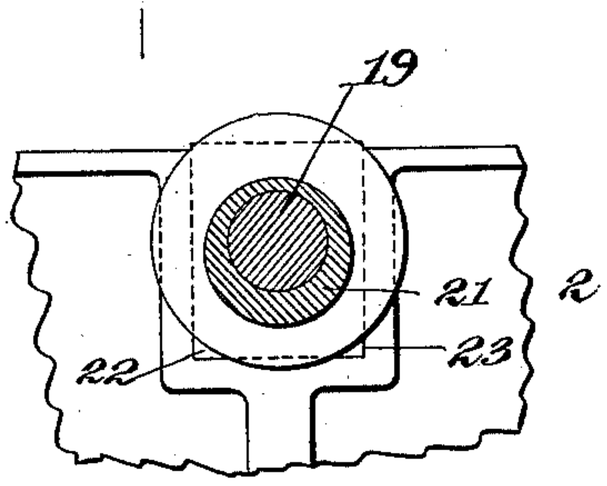


Fig. 6

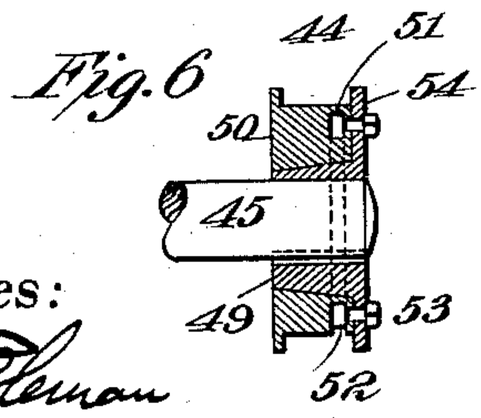
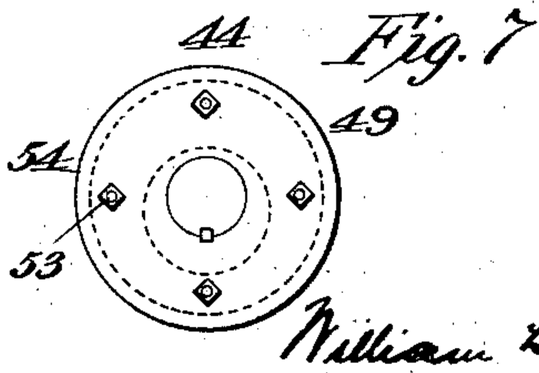


Fig. 7



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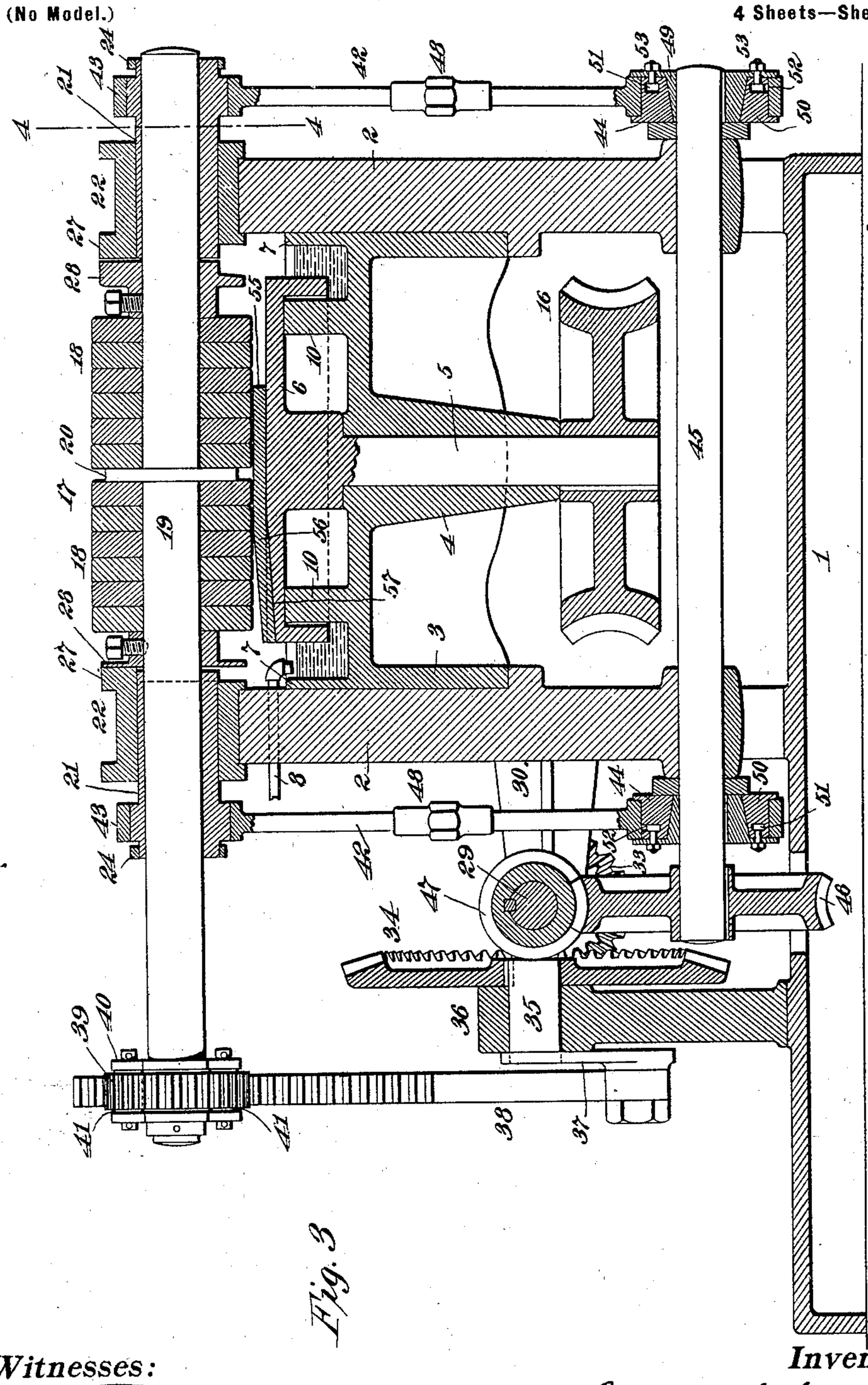

Fig. 3

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(No Model.) 4 Sheets—Sheet 4.

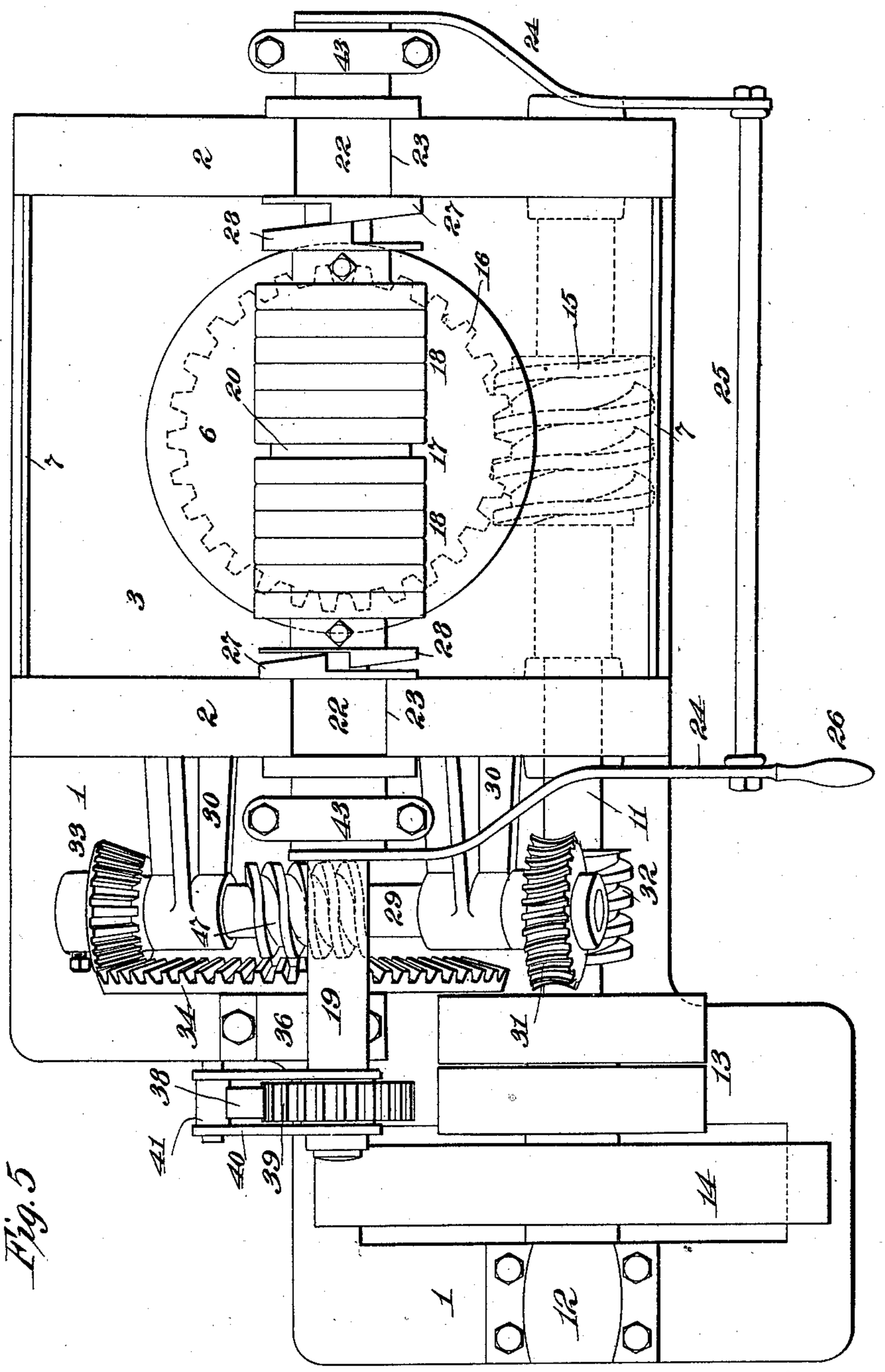

Fig. 5

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UNITED STATES PATENT OFFICE.

WILLIAM L. JONES, OF PARK VIEW, NEW JERSEY.

METAL-ROLLING MACHINE.

SPECIFICATION forming part of Letters Patent No. 666,057, dated January 15, 1901.

Application filed April 7, 1900. Serial No. 12,008. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM L. JONES, a citizen of the United States, and a resident of Park View, in the county of Essex and State of New Jersey, have invented a certain new and useful Improvement in Rolling-Machines, of which the following is a specification.

My invention relates to improvements in machines for rolling metal; and the object of the invention is to provide a machine by which a metal slab or billet may be subjected to a rolling effect of such a character as to cause the metal to be reduced in thickness and to be extended in area to substantially corresponding longitudinal and lateral extents. In ordinary metal-rolling machines, wherein a slab or billet is passed between two powerful compression-rolls, the metal in being reduced in thickness is principally expanded longitudinally and the lateral expansion is comparatively slight. There are many arts wherein it is desirable to effect a rolling action of such a character as to secure as great a lateral expansion of the metal as its longitudinal expansion, or substantially so, in order that there may be a minimum waste of metal. Thus, for example, in the manufacture of ladles the slabs or billets are generally spade-shaped, with a handle of substantially the required thickness and with a flat generally disk-like head of the thickness of the handle and which it is desired to reduce in its vertical dimension and to expand both laterally and longitudinally. In the working of billets of this kind it is the practice at the present time to effect the reduction in thickness of the heads by means of power-hammers, since no rolling-machine has heretofore been suggested by which this work can be effected by a rolling operation.

I have designed my machine with the special object in view of properly rolling the slabs or billets from which ladles are made; but the machine may, with or without modifications obvious to skilled persons, be employed for the rolling of other slabs or billets and for analogous purposes.

Broadly stated, my invention comprises a table on which the work is placed, said table being preferably arranged in a horizontal plane, a series of compression-disks forming a sectional roll coöperating with the table for applying pressure to a slab or billet placed thereon, means for effecting a relative rotatable movement of the table with respect to the sectional roll, and means for effecting a lateral movement of the table with respect to the sectional roll whereby the sectional roll will be caused to engage with all portions of the slab or billet, including that portion coincident with the center of rotation. The relative rotatable movement of the table with respect to the roll is preferably effected by rotating the table; but said movement may be effected by employing a stationary table and by revolving the sectional roll or series of disks rotatably with respect to the same. The former construction, however, enables me to employ simpler driving mechanism than the latter.

Preferably the invention also comprises, in combination with a table and a sectional roll, (the table and roll being movable with respect to each other both rotatably and laterally,) suitable mechanism or means for moving the table and roll toward and away from each other to the proper extent to thereby secure the desired rolling effect upon the slab or billet. Thus when a horizontal turning table is employed in combination with a sectional roll movable laterally with respect to the table the driving mechanism for turning the table may also operate suitable devices for moving the roll toward and away from the operative face of the table to the extent desired. The lateral movement of the table and sectional roll with respect to each other may be effected by any suitable devices, and I shall describe convenient mechanism for this purpose as a specific instance of my invention. The mechanism by which the table and roll are caused to approach each other to secure the desired compression effect upon the slab or billet is preferably of such a character as to permit of an adjustment of this movement whereby the machine may be employed for working upon slabs or billets of different thicknesses and for reducing them to different thicknesses, and I shall describe herein as a specific instance convenient mechanism for securing this object.

It is desirable in a machine of the type to which my invention relates that provision should be made to permit the separation of

the table and roll manually when desired in order to remove the slab or billet for any purpose—as, for instance, in the case of a breakdown in the driving mechanism, which might otherwise not result in a sufficient separation of the table and roll to allow the withdrawal of the slab or billet. My machine provides for the securing of this object also.

I propose to effect the rolling of slabs or billets when the latter are made workable by heat, and it is therefore desirable that the machine should be provided with means for keeping the table properly cool. My improved rolling-machine in its preferred form contemplates the submersion of the table in a water-bath at all times in order that the temperature of the table may be kept sufficiently low.

My invention contemplates various improvements in details of construction in addition to those which have been briefly referred to and which will be more fully described and claimed herein.

In order that my invention may be better understood, attention is directed to the accompanying drawings, forming a part of this specification, and in which—

Figure 1 is a side elevation of my improved rolling-machine; Fig. 2, a section on the line 2 2 of Fig. 1; Fig. 3, a longitudinal sectional view through the machine on the line 3 3 of Fig. 2; Fig. 4, a section on the line 4 4 of Fig. 3; Fig. 5, a plan view; Fig. 6, a cross-section showing the preferred construction of the adjustable eccentric for use in effecting the approach and recession of the sectional roll, and Fig. 7 a face view of Fig. 6.

In all of the above views corresponding parts are represented by the same numerals of reference.

1 represents a suitable base, to which are secured the two side frames 2 2. Connecting these side frames is a heavy rigid bed 3, formed with a vertical bearing 4 therein, as shown. Mounted in this bearing is a shaft 5, which carries a table 6 of the desired dimensions and shape, having, preferably, an essentially flat upper or operative face. Preferably the bed is provided with a rim 7, forming a water-bath, to which water may be admitted by a pipe 8 (see Fig. 3) and taken off through an overflow 9. When a water-bath is used, the bearing 4 is provided with a flange 10, (see Fig. 3,) which prevents leakage of water down through the bearing.

The main shaft 11 of the machine is mounted in bearings in the frames 2 2 and in an end bearing 12. This shaft carries the fast and loose pulleys 13, as is common, and it may also carry a fly-wheel 14. Motion between the shaft 11 and table-carrying shaft 5 may be communicated in any suitable way; but since the table 6 turns relatively slowly an effective connection is to employ a worm 15 on the shaft 11, which engages with a worm-gear 16 on the shaft 5.

Mounted above the table is a sectional roll 17, formed of a series of disks 18, loosely mounted on a shaft 19. The disks may be arranged in two series, as shown, placed on opposite sides of a disk 20 of smaller diameter, which is keyed to the shaft 19, or the disks may be arranged in a continuous series extending entirely across the face of the table or to any other extent equal at least to the radius of the table. The construction shown is that which I prefer to adopt. The shaft 19 is preferably carried in sleeves 21 and is located eccentrically within said sleeves, as shown particularly in Figs. 3 and 4. The sleeves 21 are mounted in journal-boxes 22, which are preferably square in cross-section and work in guides 23 (see Fig. 4) in the side frames 2. Each of the sleeves 21 is connected to a lever 24, and these levers are connected together by a frame 25, so that they will work in unison. One of the levers may be continued to form a handle 26, by which both may be operated to simultaneously partially rotate both of the sleeves 21. To secure rigidity in this operation, the frame 25 may be suitably braced and strengthened, as shown.

In operating upon a flat disk-like slab or billet placed on the table 6 and turned with respect to the roll it will be obvious that if there were no lateral movement of the roll with respect to the table the portion of the slab or billet coincident with the center of rotation would not be acted on by the roll, and in this case a projection would be left on the slab or billet coincident with the fixed disk 20. Moreover, unless the disks of the sectional roll were very closely fitted together the turning of such roll along the same path on the slab or billet would result in the forming of a series of corrugations or ridges thereon, which would be objectionable. In order that these objections may be overcome, I move the rotatable table and roll laterally with respect to each other, and when a horizontal turning table is employed, as is preferable, the sectional roll itself is moved slowly back and forth across the operative face of the table, whereby the roll will operate on all portions of the slab or billet, including the portion thereof which is coincident with the fixed disk 20, and this movement also will tend to prevent the formation of ridges on the slab or billet, as will be obvious. In order to effect this movement, I form the inner faces of the journal-boxes 22 with oppositely-disposed cams 27 of a pitch necessary to give the desired throw, and I coöperate with said cams two other and oppositely-disposed cams 28, secured rigidly to the shaft 19. It will be obvious that by giving to the shaft 19 a half-rotation, first in one direction and then the other, the two sets of cams 27 and 28 will cooperate together to give a limited lateral or back-and-forth movement to the shaft 19, carrying the sectional roll with it across the operative face of the table 6. This movement of the shaft 19 first in one direction and then in the other may be effected by suitable me-

chanical devices. In the drawings for this purpose I show a shaft 29, mounted in bearings 30 30, carried by one of the side frames 2 and having a worm-gear 31, which is engaged and driven by a worm 32 on the main shaft 11. The shaft 29 carries a bevel-pinion 33, which drives a bevel-gear 34, keyed to a short shaft 35, mounted in a single bearing 36 on the base 1. The shaft 35 carries a crank 37, to which is connected a rod 38, having a rack formed near its upper end, which rack engages a gear 39 on the shaft 19. A stirrup 40, swinging from the shaft 19 and having rollers 41, is used to keep the rack on the rod 38 in engagement with the gear 39. The length of the crank 37 and the diameter of the gear 39 are so proportioned that on the upthrow of the crank the shaft 19 will be given substantially a half-turn in one direction, while on the downthrow of the crank the shaft will be returned to its former position.

It is desirable in machines of the type under consideration to effect automatically a movement of the sectional roll toward the table in order that the slab or billet thereon may be reduced to the required thickness and to then withdraw the sectional roll from the table to its former position to permit the rolled slab or billet to be removed and a new one to be replaced on the table. I prefer to effect these movements of the sectional roll by means of connecting-rods 42, which are provided at their upper ends with straps 43 encircling the outer ends of the sleeves 21 and operated at their lower ends from eccentrics 44, mounted on a shaft 45. I illustrate the latter shaft as being operated from a worm-gear 46, driven from a worm 47 on the shaft 29. The connecting-rods 42 may be provided with turnbuckles 48, by which their lengths may be adjusted. Preferably I also provide means for permitting variations in the throw of the sectional roll toward and away from the rotatable table, whereby the machine may be employed for work on slabs or billets of different thicknesses and for the reduction of slabs or billets to varying extents. To this end each of the eccentrics 44, as shown in Figs. 6 and 7, is made, preferably, in two parts 49 and 50, the former being keyed to the shaft 45, eccentrically mounted therein, and the latter being carried by the tapered body of the part 49, eccentrically thereto. When the parts of the adjustable eccentric occupy the position shown in Fig. 7, it will be obvious that the center of the shaft 45 will be concentric with the outer surface of the part 50, with which engage the straps of the connecting-rods 42 Rotation of the shaft 45 will therefore not operate these connecting-rods. By turning the part 50 of each adjustable eccentric on the part 49 thereof it will be obvious that the eccentricity of the outer surface of the part 50 will be gradually increased, whereby it becomes possible to effect any desired throw of the connecting-rods, and hence of the sectional roll, as will be understood. The two parts of the adjustable eccentric may be locked together in any suitable way—as, for instance, by forming the part 50 with a groove 51, extending around its face and having an enlargement 52 at its bottom, in which may work the heads of bolts 53, which pass through openings in the rim 54 of the part 49.

Assuming the improved rolling-machine to be used for the rolling of a slab or billet from which a ladle is to be made, its operation will be as follows: A slab or billet 55 is first secured, having a handle 56, which is of the desired thickness and which is rested within a groove 57, formed radially in the table 6, so that the disk-like body of the slab or billet will rest upon the table at approximately its center. The handle 26 is now moved downward, moving the levers 24 and rotating the sleeves 21, so that the shaft 19 will occupy its lowermost position with respect to the journal-boxes 22. Power is applied to the shaft 11, and through the worm 15 and gear 16 the table 6 will be slowly turned. Through the worm 32 and gear 31 the shaft 29 will be rotated to turn the gear 34 through the pinion 33, thereby operating the crank 37. The movements of this crank cause the rod 38 to be slowly elevated up and down, giving to the shaft 19 a half-turn first in one direction and then in the other. By reason of the coöperative engagement of the two cams 27 and 28 at each side the shaft 19 will be moved slowly back and forth with respect to the operative face of the table 6 and of the slab or billet carried thereon. The comparatively slow rotation of the shaft 29 will, through the worm 47 and gear 46, rotate the shaft 45 very much more slowly, and the turning of the latter shaft will operate the eccentrics 44 to depress the journal-boxes 22, thereby bodily lowering the sectional roll and causing it to engage with the slab or billet and to reduce it to the desired vertical thickness. As soon as the sectional roll engages the slab or billet the disks forming the roll will be turned by friction and a rolling action will be imposed upon the slab or billet. If the sectional roll did not move laterally with respect to the table, it will be obvious that a projection would be formed on the slab or billet coincident with the stationary disk 20 and also that a series of corrugations or ridges would be formed on the slab or billet by the spaces between the disks of the sectional roll, unless these disks were very closely fitted together. Since, however, the sectional roll moves slowly laterally with respect to the slab or billet, the roll will engage with all portions of the slab or billet and the formation of any ridges or corrugations therein will be prevented, even when the disks forming the sectional roll are not closely fitted together. It is obvious that by making a sectional roll of a series of disks it can be thus caused to engage with a rotating slab or billet, the surface of which along any radius travels at correspondingly higher speeds, since the sections of the sectional roll

are free to turn independently of each other. When the eccentrics 44 of the shaft 45 have lowered the roll to its full extent, the further movement of said eccentrics returns the roll to its former position, whereupon the machine is stopped, the completed slab or billet is removed, and a new one replaced, after which the machine is again started.

If for any cause the machine stops during the time that a slab or billet is engaged by the sectional roll, the latter may be elevated for the release of the slab or billet by elevating the handle 26, thereby simultaneously moving the two levers 24 and turning the sleeves 21 21 in the journal-boxes 22 to elevate the shaft 19 within such boxes.

When the work to be acted on is heated, as is preferable, the table 6 may be kept sufficiently cool by allowing water to constantly circulate within the water-bath formed within the rim 7 of the bed 3, as will be understood.

Having now described my invention, what I claim as new, and desire to secure by Letters Patent, is as follows:

1. In a metal-rolling machine, the combination with a table upon which the work to be rolled is carried, of a compression-roll coöperating with the table, means for effecting a relative rotation of the table with respect to the roll, and means for effecting a lateral movement of the roll with respect to the table, substantially as set forth.

2. In a metal-rolling machine, the combination with a table upon which the work to be rolled is carried, of a compression-roll coöperating with the table, means for effecting a relative rotation of the table with respect to the roll, means for effecting a lateral movement of the roll with respect to the table, and means for effecting a movement of the roll toward and away from the operative face of the table, substantially as set forth.

3. In a metal-rolling machine, the combination with a table upon which the work to be rolled is carried, of a sectional roll coöperating with the table, means for effecting a relative rotation of the table with respect to the roll, and means for effecting a relative lateral movement of the roll with respect to the table, substantially as set forth.

4. In a metal-rolling machine, the combination with a table upon which the work to be rolled is carried, of a sectional roll coöperating with the table, means for effecting a relative rotation of the table with respect to the roll, means for effecting a relative lateral movement of the roll with respect to the table, and means for moving the roll toward and away from the table, substantially as set forth.

5. In a metal-rolling machine, the combination with a rotatable table, of a compression-roll mounted parallel to the operative face of the table, means for rotating the table, and means for laterally moving the compression-roll, substantially as set forth.

6. In a metal-rolling machine, the combination with a rotatable table, of a compression-roll mounted parallel to the operative face of the table, means for rotating the table, means for laterally moving the compression-roll, and means for moving the compression-roll toward and away from the table, substantially as set forth.

7. In a metal-rolling machine, the combination with a rotatable table, of a sectional compression-roll mounted parallel to the operative face of the table, means for rotating the table, and means for moving the roll laterally with respect to the table, substantially as set forth.

8. In a metal-rolling machine, the combination with a rotatable table, of a sectional compression-roll mounted parallel to the operative face of the table, means for rotating the table, means for moving the roll laterally with respect to the table, and means for moving the roll toward and away from the table, substantially as set forth.

9. In a metal-rolling machine, the combination with a rotatable table, of a sectional compression-roll mounted above the table and parallel therewith, said compression-roll extending on both sides of the center of rotation of said table, a non-rotatable section of said roll located substantially coincident with the center of rotation of the table, means for rotating the table, and means for moving the roll laterally with respect to the table, substantially as set forth.

10. In a metal-rolling machine, the combination with a rotatable table, of a sectional compression-roll mounted above the table and parallel therewith, said compression-roll extending on both sides of the center of rotation of said table, a non-rotatable section of said roll located substantially coincident with the center of rotation of the table, means for rotating the table, means for moving the roll laterally with respect to the table, and means for moving the roll bodily toward and away from the table, substantially as set forth.

11. In a rolling-machine, the combination with a rotatable table, of means for rotating the same, a sectional compression-roll mounted adjacent to the operative face of the table, a shaft carrying said compression-roll, cams on said shaft, stationary cams with which the shaft-cams engage, and means for partially rotating said shaft first in one direction and then in the other, substantially as set forth.

12. In a rolling-machine, the combination with a table, of means for rotating the same, journal-boxes, a shaft mounted in said journal-boxes, a sectional roll on the shaft extending parallel with the operative face of the table, cams carried by said journal-boxes, cams carried by the shaft coöperating with the first-mentioned cams, and means for partially rotating the shaft in reverse direction, substantially as set forth.

13. In a rolling-machine, the combination with a table, of means for rotating the same,

journal-boxes, a shaft mounted in said journal-boxes, a sectional roll on the shaft extending parallel with the operative face of the table, cams carried by said journal-boxes, cams carried by the shaft coöperating with the first-mentioned cams, means for partially rotating the shaft in reverse direction, and means for moving the journal-boxes to advance and retract the sectional roll toward and away from the table, substantially as set forth.

14. In a rolling-machine, the combination with a rotatable table, of a sectional roll extending parallel to the operative face of the table, a shaft carrying said roll, journal-boxes in which said shaft is mounted, an eccentric-shaft, eccentrics on said shaft, and connections between said eccentrics and the journal-boxes, substantially as set forth.

15. In a rolling-machine, the combination with a rotatable table, a sectional roll extending parallel to the operative face of the table, a shaft carrying said roll, journal-boxes in which said shaft is mounted, an eccentric-shaft, eccentrics on said shaft, connections between said eccentrics and the journal-boxes, and means for adjusting said eccentrics, substantially as set forth.

This specification signed and witnessed this 4th day of April, 1900.

WILLIAM L. JONES.

Witnesses:
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