No. 799,587. PATENTED SEPT. 12, 1905.

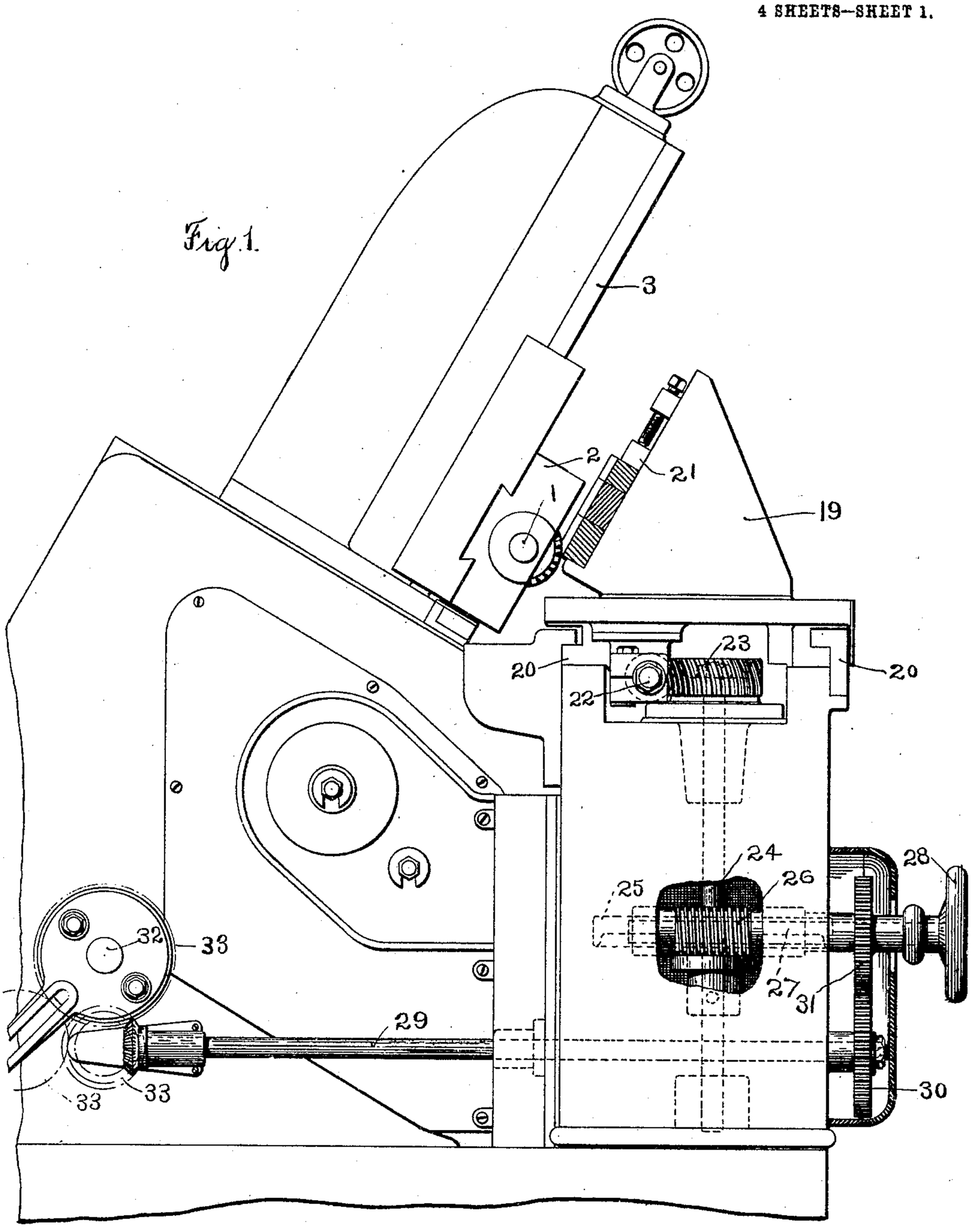
O. J. BEALE.

RACK CUTTING MACHINE.

APPLICATION FILED MAY 8, 1902.

4 SHEETS—SHEET 1.

Fig. 1.



Witnesses.

J. H. Thurston

C. G. Bradley.

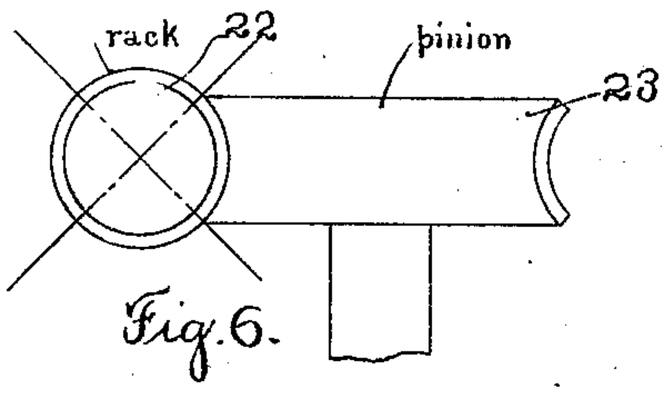


Fig. 6.

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4 SHEETS—SHEET 2.

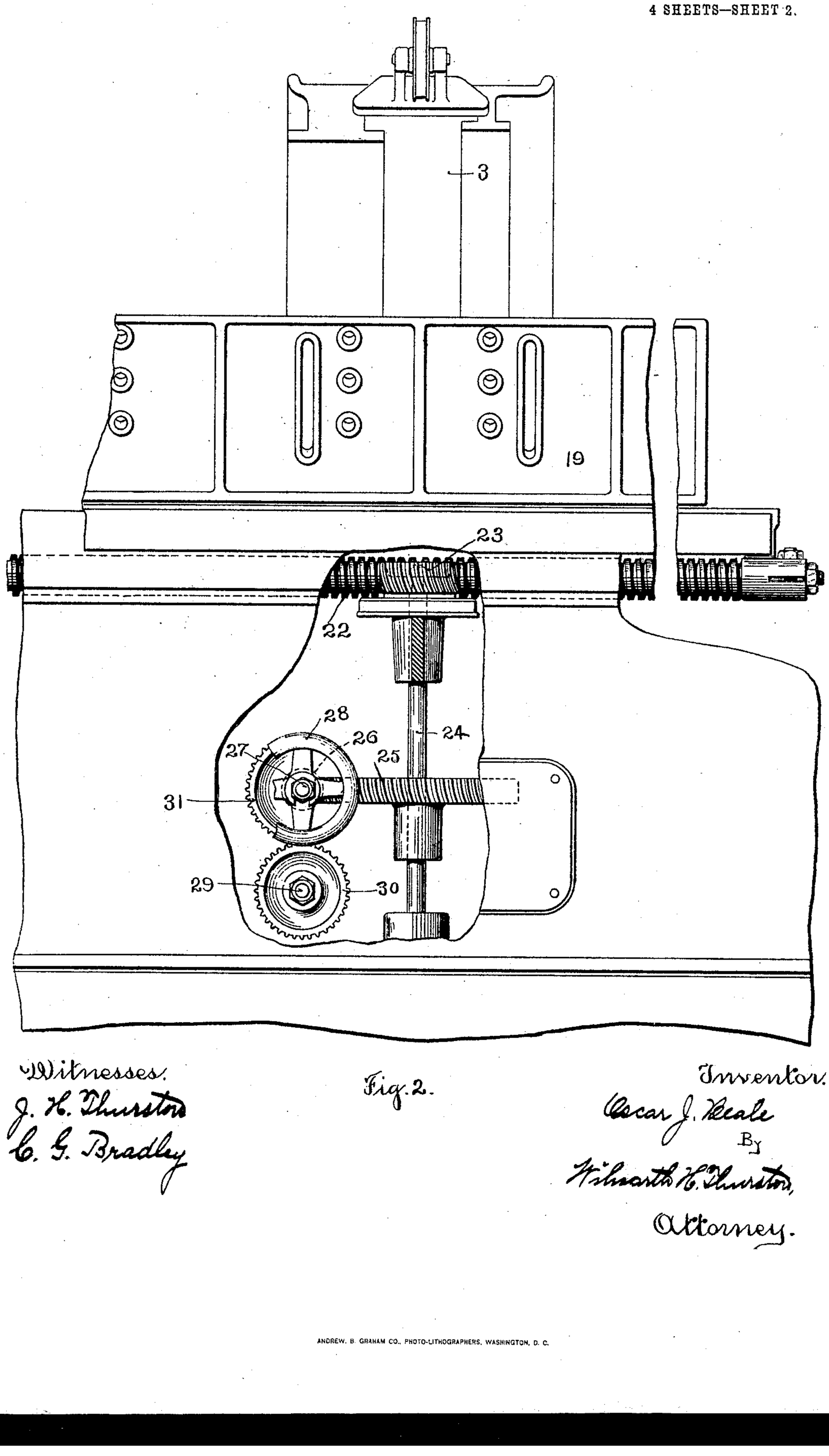

Fig. 2.

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4 SHEETS—SHEET 3.

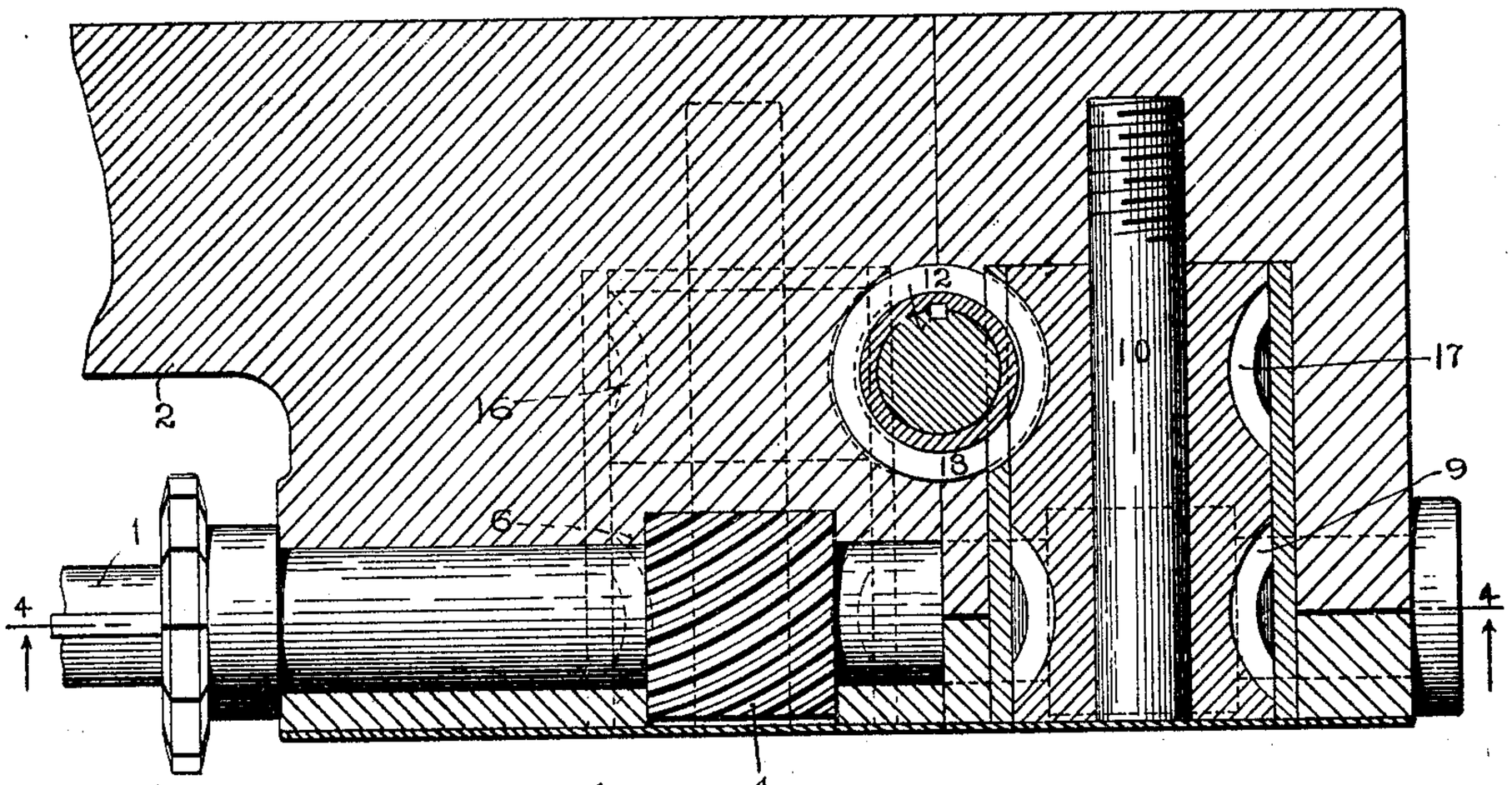

Fig. 3.

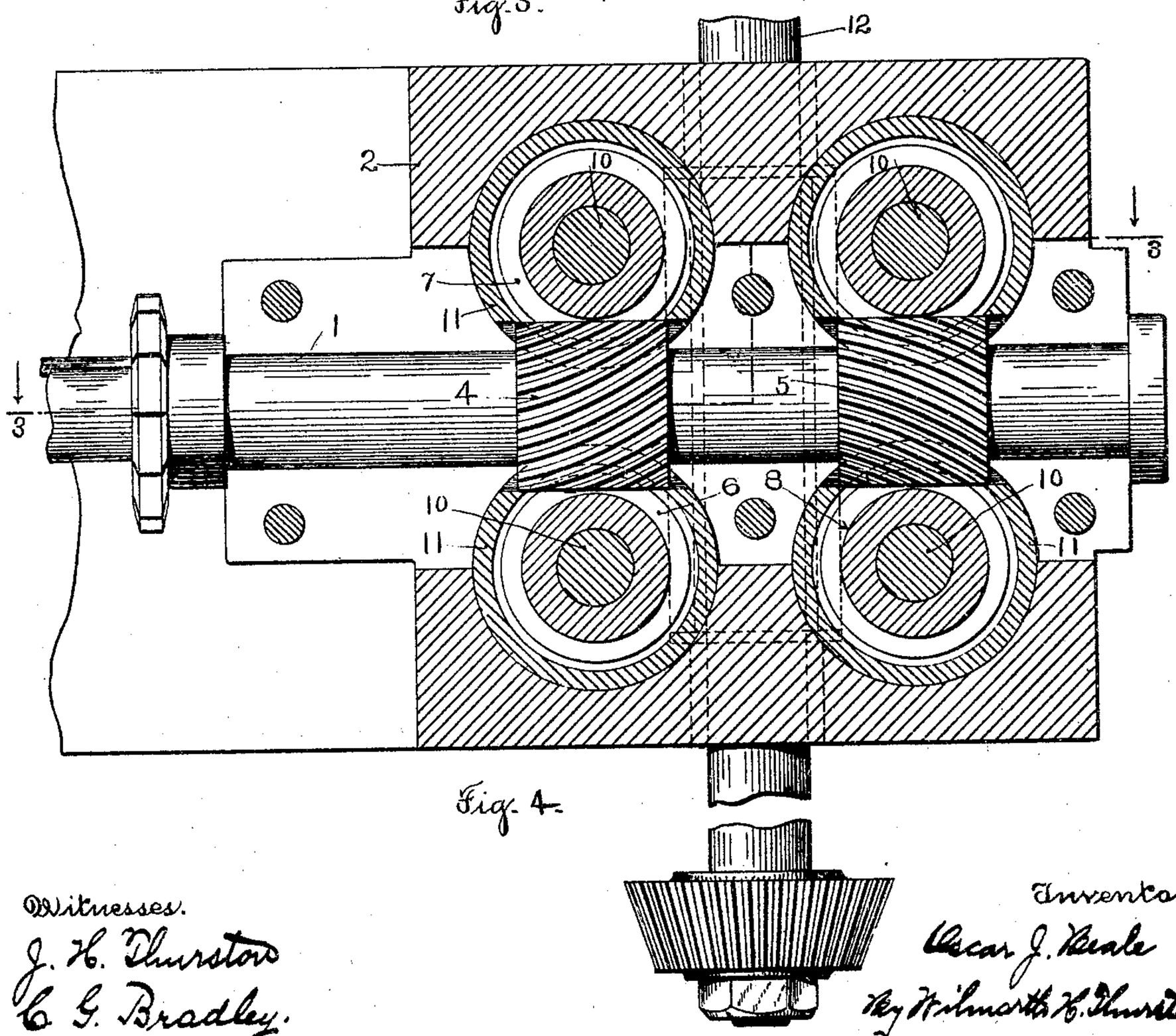

Fig. 4.

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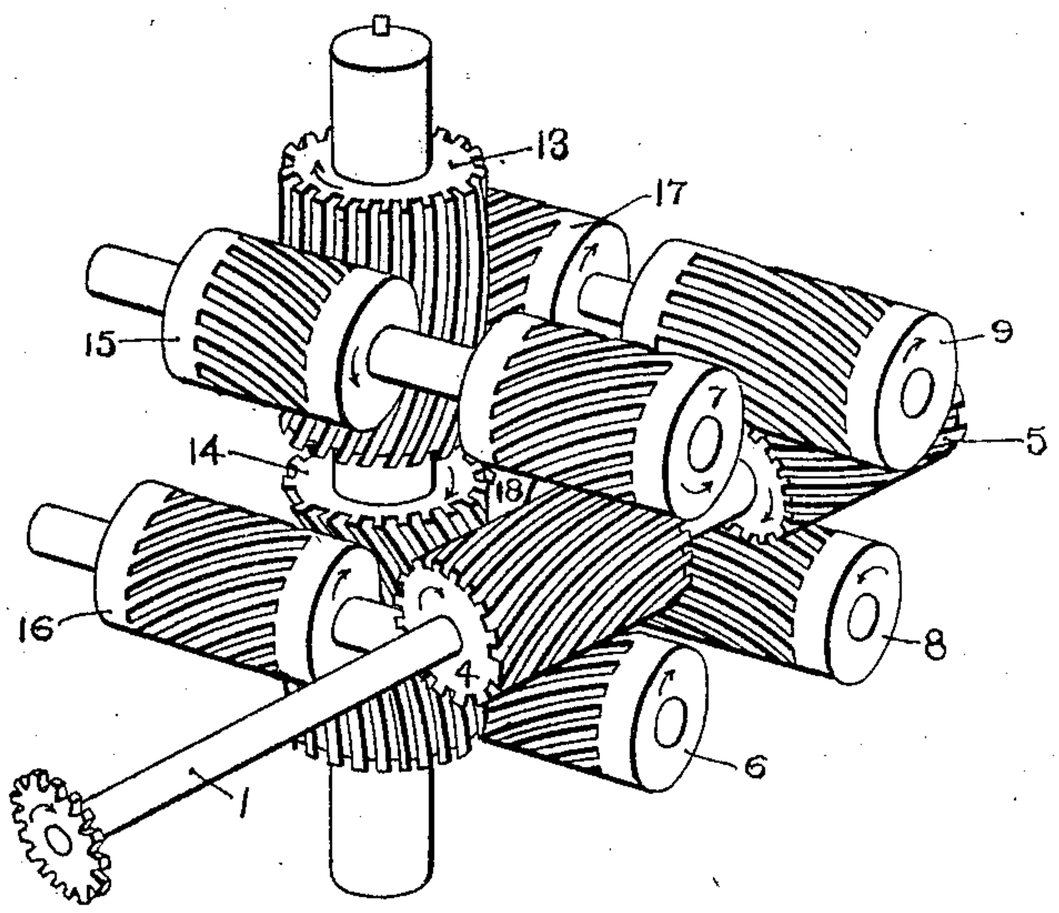

Fig. 5

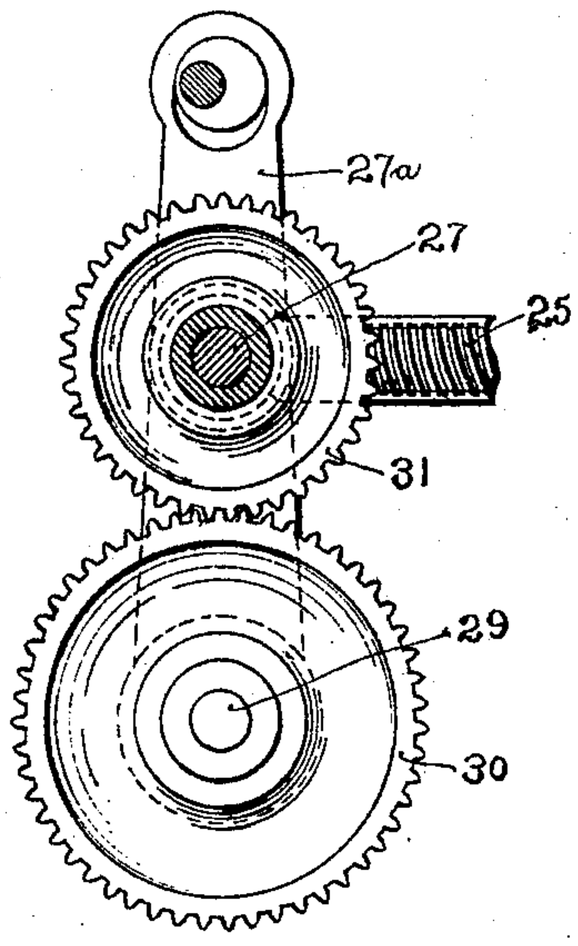

Fig. 7.

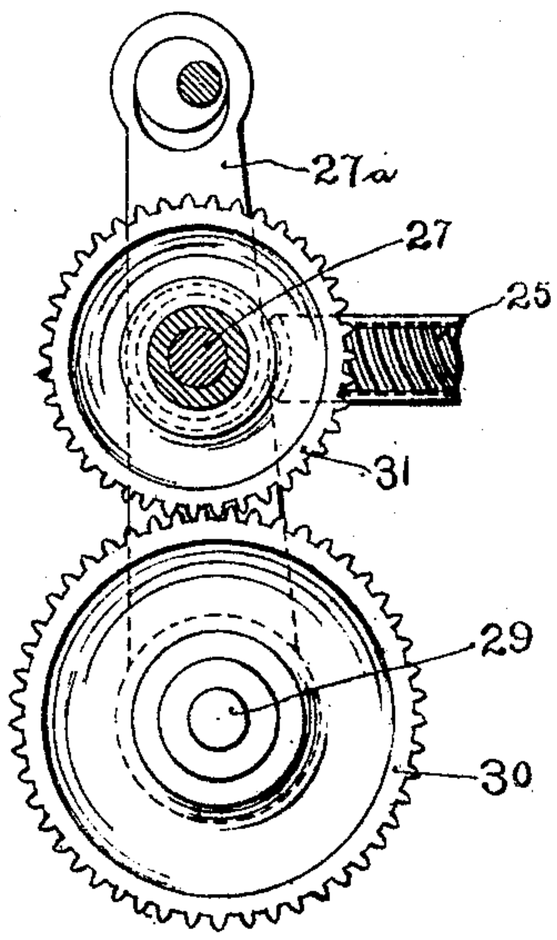

Fig. 8.

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UNITED STATES PATENT OFFICE.

OSCAR J. BEALE, OF PROVIDENCE, RHODE ISLAND, ASSIGNOR TO BROWN AND SHARPE MANUFACTURING COMPANY, OF PROVIDENCE, RHODE ISLAND, A CORPORATION OF RHODE ISLAND.

RACK-CUTTING MACHINE.

No. 799,587. Specification of Letters Patent. Patented Sept. 12, 1905.

Application filed May 8, 1902. Serial No. 106,408.

To all whom it may concern:

Be it known that I, OSCAR J. BEALE, of the city and county of Providence and State of Rhode Island, have invented certain new and useful Improvements in Rack-Cutting Machines; and I do hereby declare the following specification, taken in connection with the accompanying drawings, forming a part of the same, to be a full, clear, and exact description thereof.

The invention relates to that class of rack-cutting machines in which the teeth are cut by a rotary cutter mounted upon a reciprocating carriage and the racks are carried by a bed which is intermittently fed to index the racks and bring them into the proper positions for forming the successive teeth; and the object of the invention is to provide a simple and efficient machine of this character.

One feature of invention relates to a mechanism for driving the cutter-spindle which does not interfere with the cutting of long racks and which also drives the cutter with a steady and uniform motion without subjecting the mechanism to undue wear or strain tending to impair its efficiency and necessitating frequent renewal of parts. This mechanism comprises a spiral or worm gear secured to the cutter-spindle and two gears engaging and driving the same. With this arrangement a small gear or pinion may be used upon the cutter-spindle and the driving-gears may be arranged at right angles to the spindle, so that the mechanism does not project in front of the cutter into the cutting plane, where it would prevent the passage of the rack-bars which are being operated upon. With this construction also the drive may be comparatively close to the cutter without interfering with the work, since the gears are all to one side of the path of the work and out of the cutting plane. The employment of two driving-gears relieves the cutter-spindle bearings of any pressure or wear due to the action of the driving-gears and also distributes the pressure between the gears, so that the cutter is driven smoothly with little wear upon the gears. The driving mechanism may be made more effective and the wear on the gears further reduced by securing two spiral or worm gears upon the cutter-spindle and employing four driving-gears, two engaging with each gear upon the spindle, and it is preferred to thus construct the driving mechanism. It is also preferred when two gears are thus secured to the cutter-spindle to form on one gear a right-hand spiral or worm and on the other a left-hand spiral or worm, as with such construction the end thrust on the spindle is balanced and the spindle is driven with a more uniform motion and with less wear upon the bearings.

A further feature of the invention consists in providing an inclined bed for supporting the rack-bars. With this construction the bars are held upon the bed by their own weight while they are being clamped in position and are less likely to work out of position during the cutting than when supported upon a vertical bed, while the oil and chips flow or fall away from the cut as the cutter is fed across the rack-bars instead of accumulating in the cut, as they do with horizontal beds. This arrangement has the advantages of both the vertical and horizontal beds without the disadvantages of either.

The various features of invention will be made clear from a detailed description of the machine in which I have embodied these features.

This machine is illustrated in the drawings, in which—

Figure 1 is an end elevation. Fig. 2 is a front elevation. Fig. 3 is a sectional view longitudinally of the cutter-spindle on the line 3 3, Fig. 4. Fig. 4 is a sectional view on line 4 4, Fig. 3, with the bearing-cap removed. Fig. 5 is a perspective view indicating the arrangement of the cutter-driving gearing. Fig. 6 is a diagrammatic view of the bed-operating rack and pinion. Figs. 7 and 8 are details showing a modified manner of mounting the worm of the indexing mechanism.

In the machine shown the cutter-spindle 1 is mounted in a carriage 2, mounted upon ways 3 and reciprocated by any suitable mechanism, such as is well known in this class of machines. The cutter-spindle is driven through two spiral or worm gears 4 and 5 secured thereto, which are engaged and driven by four spiral or worm gears 6, 7, 8, and 9, the gears 6 and 7 engaging gear 4 and the gears 8 and 9 engaging gear 5. The driving-gears are arranged on opposite sides of the

driven gears and have their axes in planes at right angles to the axis of the spindle. These driving-gears are mounted upon studs 10, secured in the carriage, and are surrounded by sleeves 11, which fit within recesses formed in the carriage, the sleeves being cut away to allow the engagement of the gears with the gears 4 and 5. In order that there may be no endwise thrust on the bearings for the cutter-spindle, one of the gears, as 5, is right-hand, and the other, as 4, is left-hand. Consequently the gears 6 and 7 are left-hand and the gears 8 and 9 right-hand. The gears 6, 7, 8, and 9 are driven from a shaft 12 through right and left hand spiral or worm gears 13 and 14, which are keyed to slide on the shaft and are mounted in a recess in the carriage 2. The gear 13 is engaged by gears 15 and 17, connected, respectively, with gears 7 and 9, while the gear 14 is engaged by gears 16 and 18, connected, respectively, with gears 6 and 8. The connected gears are best connected by being integral with each other, as shown in Fig. 3. As the carriage 2 reciprocates the gears 13 and 14 slide up and down the shaft 12, which is continuously driven and through the gearing described drives the cutter-spindle.

The rack-bars to be operated upon are supported upon a bed 19, mounted in suitable ways 20. The supporting-surface 21 of the bed is inclined, as indicated in Fig. 1, so that the weight of the rack-bars tends to keep them against the bed and so that the chips will fall away from the cutter as fast as formed.

The bed 19 is moved for adjustment or to index the rack-bars through a rack 22, secured to the under side of the bed and engaged by a pinion 23, which is secured to the upper end of a shaft 24. The rack is cylindrical, and the teeth of the rack extend spirally about the cylinder. By turning the rack about its axis an unworn part of the periphery of the rack may be engaged with the pinion 23 after the part in use has become worn. The spiral arrangement of the teeth enables the teeth to be conveniently and accurately cut.

The shaft 24 is operated to move the bed 19 through a worm-wheel 25, secured thereto, which is engaged by a worm 26, secured to shaft 27.

The shaft 27 may be mounted in fixed bearings, as indicated in Fig. 1, but is preferably mounted in an arm 27ª, pivoted on a shaft 29, as shown in Figs. 7 and 8, so that the worm 26 may be disengaged from the worm-wheel 25 in case the bed is to be quickly returned or moved manually through mechanism not shown. The shaft 27 may be operated manually through a hand-wheel 28 when setting up or adjusting the work. When the machine is operating automatically and the bed is being automatically indexed, the shaft 27 is rotated intermittently through the shaft 29, to which is secured a gear 30, which engages a gear 31, secured to shaft 27. The shaft 29 is driven from the shaft 32 through a system of change-gearing 33 such as is usually employed in gear and rack cutters to vary the movement of the work for differences in the pitch of the gears or racks being cut. The shaft 32 is revolved at the proper time through any of the well-known mechanisms for effecting intermittent rotation used in indexing mechanisms.

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

1. A rack-cutter having in combination, a cutter-spindle, a rack-supporting bed mounted to move parallel to the axis of the cutter-spindle in indexing the work, a spiral or worm gear secured to the cutter-spindle, two gears engaging and driving said spiral or worm gear, spiral or worm gears connected with said driving-gears, and a driving-shaft carrying spiral or worm gears engaging said latter gears, substantially as described.

2. A rack-cutter having in combination a cutter-carriage, a cutter-spindle carried thereby, a rack-supporting bed mounted to move parallel to the axis of the cutter-spindle in indexing the work, a spiral or worm gear secured to said spindle, two gears engaging and driving said spiral or worm gear, spiral or worm gears connected with said driving-gears, a driving-shaft, and spiral gears having sliding connections with said shaft and engaging said latter gears, substantially as described.

3. In a rack-cutter the combination of a work-supporting table having an inclined supporting-surface, a cutter-carriage mounted on inclined ways extending parallel to said supporting-surface, and a cutter-spindle mounted in the carriage, substantially as described.

4. A rack-cutter having in combination a cutter-spindle, a rack-supporting bed mounted to move parallel to the axis of the cutter-spindle in indexing the work, two spiral or worm gears secured to the cutter-spindle and out of the cutting plane, one of said gears being left and the other right handed, and two gears out of the cutting plane engaging and driving each of said spiral or worm gears, substantially as described.

5. A rack-cutter having in combination a cutter-spindle, a rack-supporting bed mounted to move parallel to the axis of the cutter-spindle in indexing the work, a spiral or worm gear secured to the cutter-spindle and out of the cutting plane, two gears out of the cutting plane engaging and driving said spiral or worm gear, spiral or worm gears connected with said driving-gears, and a driving-shaft carrying spiral or worm gears engaging said latter gears, substantially as described.

6. A rack-cutter having in combination a cutter-carriage, a cutter-spindle carried thereby, a rack-supporting bed mounted to move

parallel to the axis of the cutter-spindle in indexing the work, a spiral or worm gear secured to said spindle and out of the cutting plane, two gears out of the cutting plane engaging and driving said spiral or worm gear, spiral or worm gears connected with said driving-gears and driving-shaft, and spiral gears having sliding connection with said shaft and engaging said latter gears, substantially as described.

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