

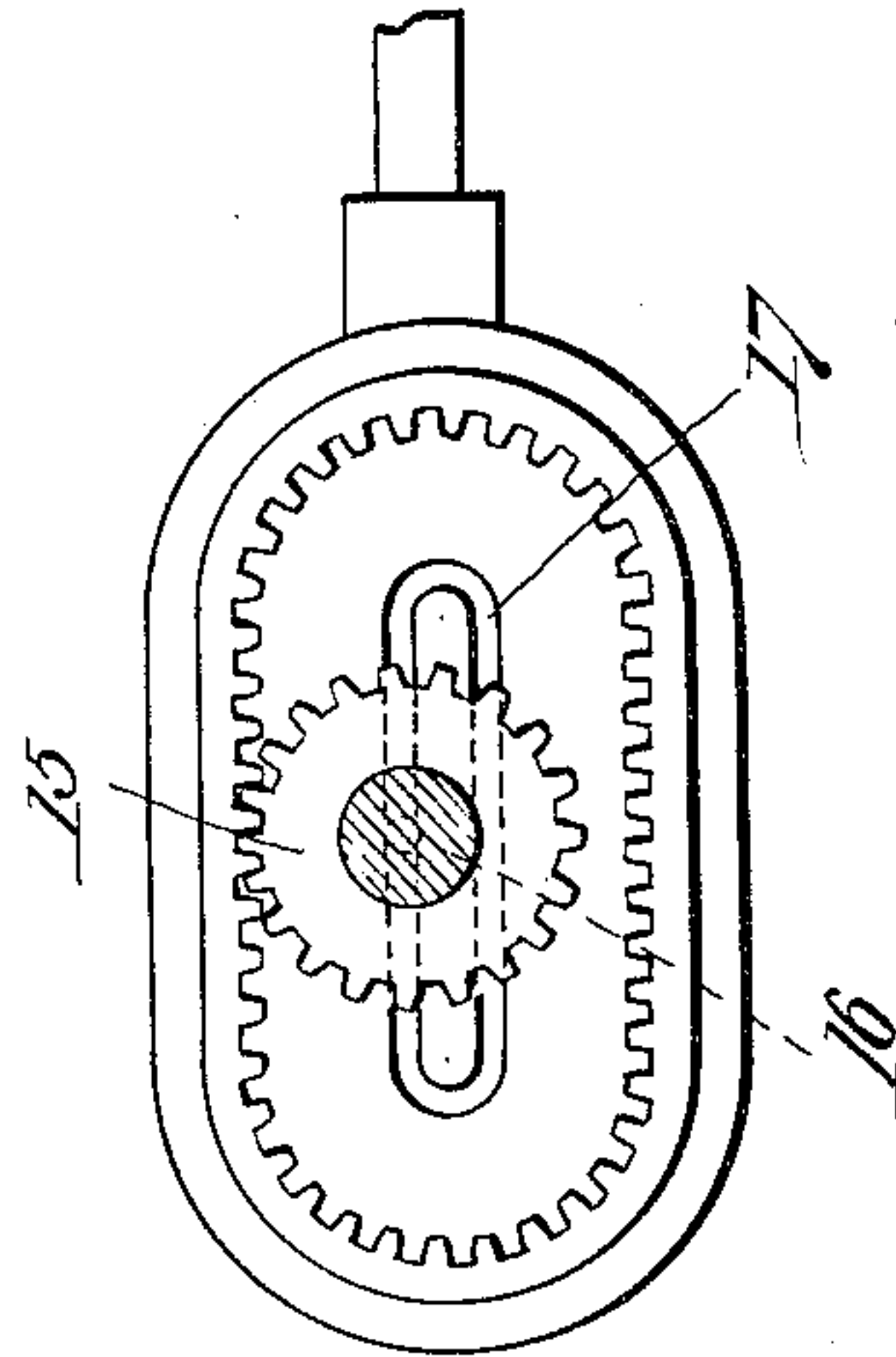
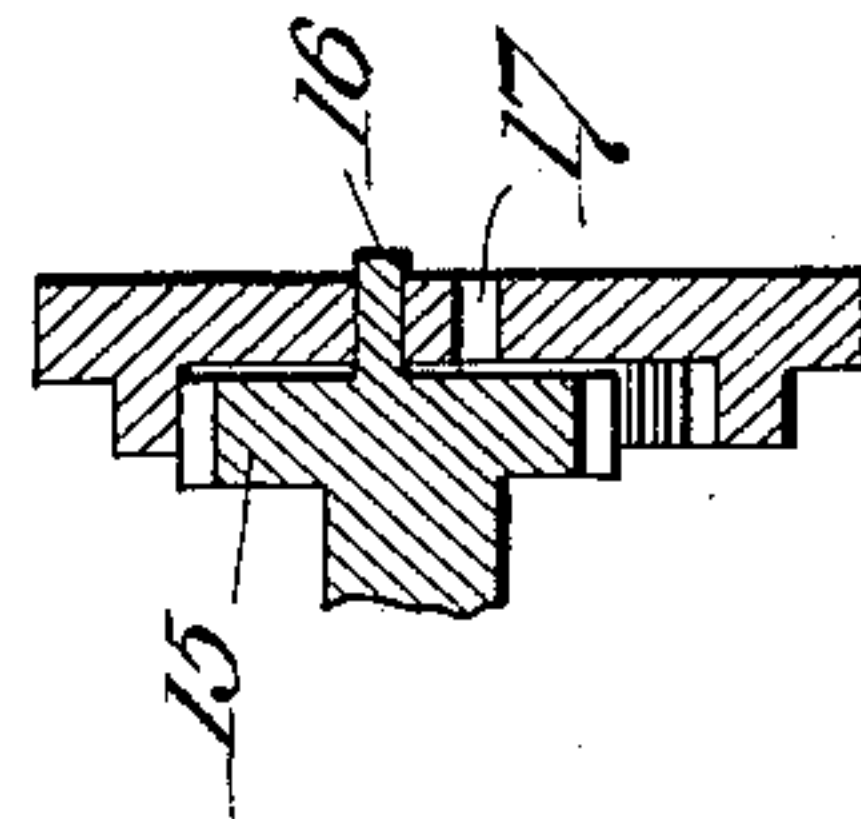
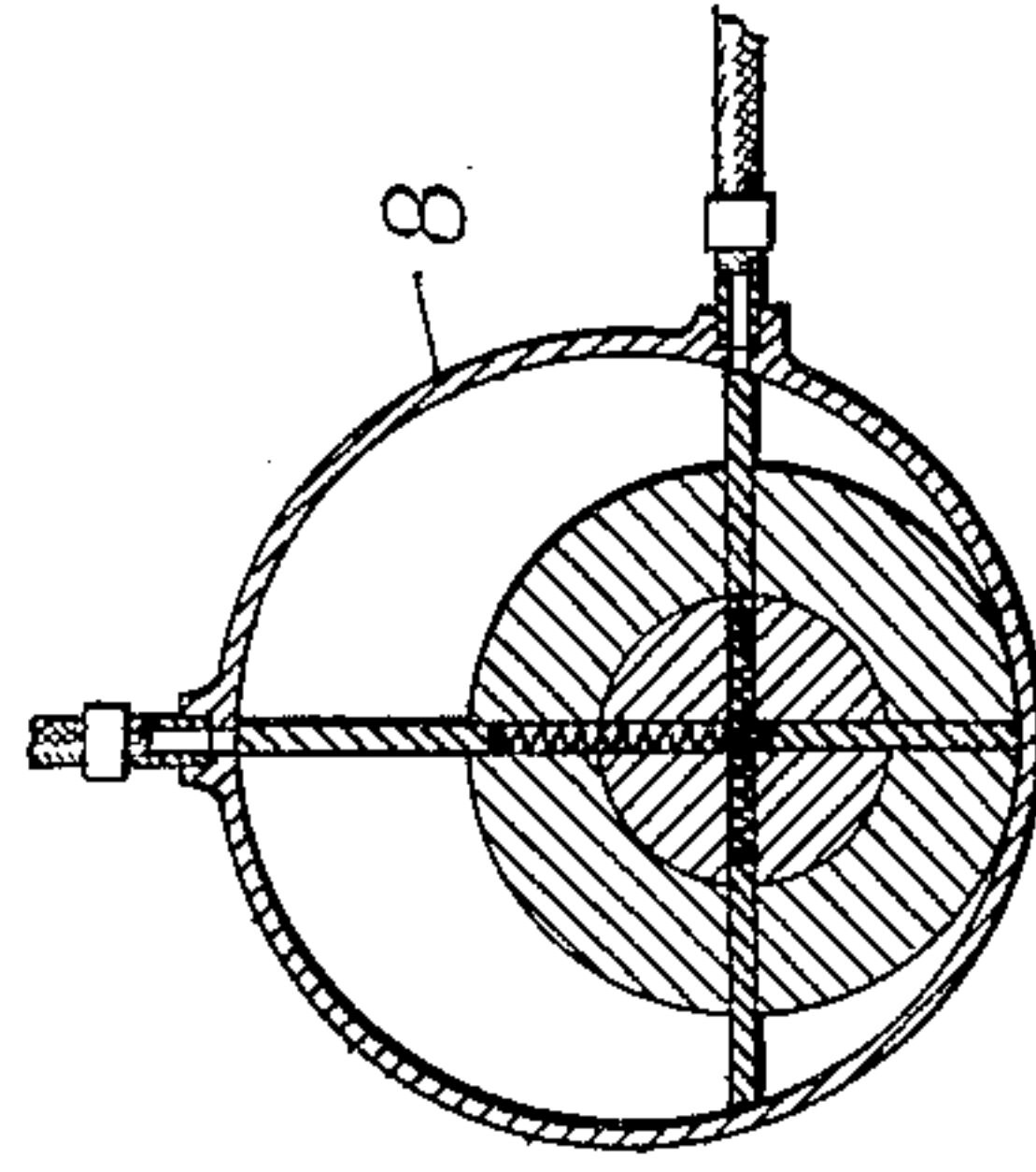
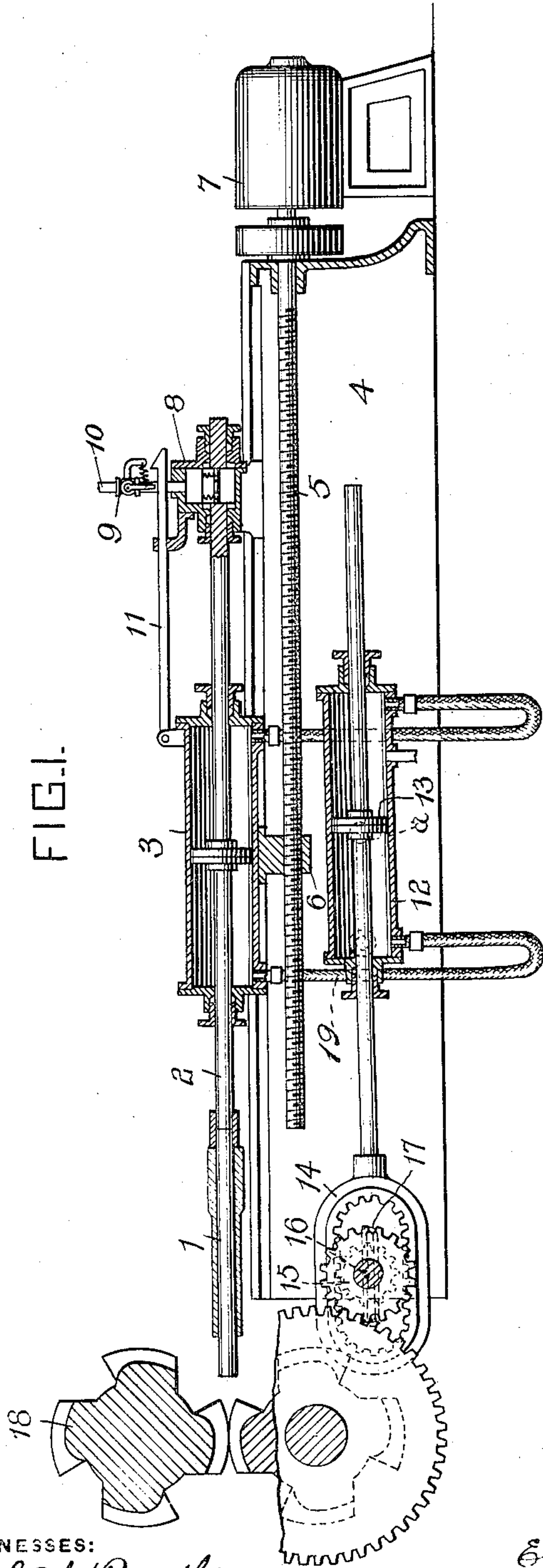
No. 869,282.

PATENTED OCT. 29, 1907.

E. WINTER.

MILL FOR MANUFACTURE OF TUBES.

APPLICATION FILED MAY 9, 1905. RENEWED MAR. 29, 1907.



WITNESSES:  
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INVENTOR

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# UNITED STATES PATENT OFFICE.

EMIL WINTER, OF PITTSBURG, PENNSYLVANIA.

## MILL FOR MANUFACTURE OF TUBES.

No. 869,282.

Specification of Letters Patent.

Patented Oct. 29, 1907.

Application filed May 9, 1905. Serial No. 259,501. Renewed March 29, 1907. Serial No. 365,337.

*To all whom it may concern;*

Be it known that I, EMIL WINTER, residing at Pittsburg, in the county of Allegheny and State of Pennsylvania, a citizen of the United States, have invented 5 or discovered certain new and useful Improvements in Mills for the Manufacture of Tubes, &c., of which improvements the following is a specification.

In one of the known methods of making seamless tubes continuously rotating rolls having die or operative portions and cut away or inoperative portions, 10 are employed. In the practice of this method the feed of the mandrel and billet after each operation of the die portions of the rolls, is determined by a stop, and by the operation of the die portions of the rolls the 15 billet is reduced and extended along the mandrel which is subsequently forced out of the tube or pipe. In another method also in use oscillating dies or swages are employed and the mandrel and billet reciprocate synchronously with the dies or swages. At the begin- 20 ning of the swaging operation the billet is supported by a mandrel which extends only a short distance beyond the end of the billet. By the action of the swages the billet is reduced to the desired dimensions and as fast as brought to the desired size the tube is forced off 25 of the mandrel. In both of these methods the movement of operative portions of the rolls or swages, is during reduction, opposite the direction of feed of the billet.

The object of the invention described herein is to 30 effect the progressive reduction of a billet by means of one or more dies moving continuously in the same direction in combination with means for moving the billet at the time the dies bite on or engage the billet in the direction of movement of the dies and at or 35 approximately at the same speed as the dies. These dies in the manufacture of tubes so operate on the billet as to force the tube as rapidly as finished, off of the mandrel.

The invention is hereinafter more fully described and 40 claimed.

In the accompanying drawing forming a part of this specification Figure 1 is a view partly in section and partly in elevation of a form of my improved swaging 45 apparatus, Fig. 2 is an enlarged transverse section on a plane indicated by the line II—II Fig. 1, and Fig. 3 is a detailed view illustrating a form of mechanism for reciprocating the piston of one of the fluid pressure mechanisms, and Fig. 4 is a transverse section of the construction shown in Fig. 3.

50 In the practice of my invention the billet is supported while being fed and shifted as hereinafter described, by a suitable holder which when reducing hollow billets or ingots to pipes or tubes, consists of a mandrel 1. The billet holder is connected to a suitable 55 mechanism whereby not only a forward feed movement is imparted to the billet, but also a forward and

backward movement; the speed of movement in the direction of rotation of the swage-carrying rolls being equal to the peripheral speed of the rolls when the latter bite on the billet while the billet is in the grip of the dies, and if need be such as to also coöperate with the dies when they are in engagement with the billet to maintain synchronous movement of the dies and billet.

As many forms of constructions of mechanisms for effecting the desired reciprocation and feed of the billet may readily suggest themselves to those skilled in the art, the invention as regards the broad subject-matter of the claims, is not limited to the particular mechanism herein shown and described, in which the mandrel 1 is connected to the piston rod 2 of the cylinder 3 having a length somewhat greater than the desired stroke of the billet. This cylinder is mounted in suitable guide-ways on the bed 4 and is adapted to be shifted to feed the billet between the rolls by any suitable means, as for example by a screw 5 engaging a lug 6 on the cylinder. This screw is rotated preferably continuously, to effect a forward feed of the billet by a suitable means, as an electric motor 7. In order to prevent the formation of fins on the finished article means 80 are provided for rotating the billet holder. As the billet cannot be rotated while in the grip of the dies or swages and as the time between the operation of successive dies is short the rotating mechanism must act promptly, hence it is preferred to construct the motor 85 mechanism so as to apply a pressure or force to the ingot holder during a portion of its reciprocation, *i. e.* while the billet is in the grip of the dies and under such force or pressure effective to turn the billet holder and billet during another portion of its reciprocation, 90 *i. e.* while the billet is free from the grip of the dies or swages. A form of mechanism suitable for this purpose consists of a rotary engine 8 having its shaft secured to the piston rod 2. A valve 9 controlling the admission and exhaust of fluid pressure, is arranged in 95 the supply pipe 10. The valve is adapted to be automatically shifted at the proper times by suitable means operated by some part movable relative to the valve, as for example by the cylinder 3. In the construction shown the valve 9 and motor 8 move synchronously 100 with the billet and an arm 11 extends from the cylinder in such manner as to engage and shift the valve stem at proper intervals.

As heretofore stated the billet holder and billet are shifted in the direction of rotation of die-rolls, preferably a little prior to their engagement with the billet 105 at a speed equal or approximately equal to the peripheral speed of the rolls. The rate of movement of the billet holder and billet in the opposite direction will be dependent upon the distance between successive 110 dies and the peripheral speed of the rolls, but should be such that the billet holder and billet will complete



their return movement and start on their forward movement in the interval between the release of the billet from one pair of dies and its engagement by the next pair. As the billet is moving in the direction of rotation of the rolls and at a rate equal or approximately equal to the peripheral movement of the dies, there will not be any material or injurious shock or jar when the dies or swages engage the billet. While mechanism operating independently of the rolls can be employed, the reciprocating movements of the billet holder are preferably effected or controlled by the rolls and the connection between the rolls and billet holder is preferably such that the billet holder can have some movement *i. e.* sufficient for feed purposes independent of the reciprocating mechanism. In the construction shown the cylinder 3 is connected at or near its ends to a second cylinder 12 at points outside of the range of movement of the piston 13, which is given a complete back and forth movement for each pair of dies carried by the rolls, as for example in the construction shown the rolls have four pairs of dies mounted thereon, hence the piston 13 will be given four complete back and forth movements during each rotation of the rolls. The cylinders 3 and 12 are charged through a suitable supply pipe as 19 with fluid, preferably air under such pressure that piston 3 will respond to any movement of the piston 13 with a degree of promptness equal or approximately equal to that which would exist if provided with an equivalent lever connection. The reciprocation of the piston 13 can be effected or controlled by the rolls in many ways, as for example in the construction shown, a mangle rack 14 is connected to the rod of piston 13 and a pinion 15 engages the teeth of this rack which is moved up or down as the pinion reaches to ends of the rack, so that the pinion may engage the teeth on one side and then on the other. The rack is held in engagement with the pinion by a pin 16 projecting from a suitable support into a groove 17 in the rack. The pinion is driven through a suitable train of gearing by the shaft or journal of one of the rolls. The cylinder 12 is pivotally supported as indicated at *a* to permit of its oscillation by the rack.

The rolls are provided with one, two or more dies or reducing portions 18 formed on or secured to the peripheries of the rolls, a suitable distance apart, and each made with a suitable tapered groove. The rolls are so constructed that the portions thereof between the dies or reducing portions will not engage the billet, so that the latter may be moved back between successive reductions of the billet. The rolls are rotated continuously and in a direction to cause the metal of the billet to flow forward and in the manufacture of pipes or tubes off of the mandrel. The reducing portions are provided with tapering grooves.

While it is preferred to rotate the rolls in the direction of feed of the billet, they may rotate in the opposite direction, in which case feed would occur during the forward movement of the billet. And unless otherwise expressed I include such combinations within the claims hereunto annexed. When the rolls rotate in the direction of the feed of the billet, the portions of the operative faces of the rolls having the smallest diameter will bite first on the billet and on a finished portion, which at the time the operative faces bite will be

moving in the same direction and at the same speed as the operative faces hence there will not be any shock or jar at the time of the engagement of the operative faces with the billet nor subsequently thereto, as the action of the operative faces on the billet is a true rolling operation.

It will be readily seen that the mechanism employed for reciprocating the billet acts as a sort of governor in respect of the proper presentation of the billet to the roll dies. That is, this mechanism regulates the proper presentation of the billet to the dies, and its movement with respect to the rotation of the rolls, said mechanism bearing the weight of movement of reciprocation of the billet in accordance with variations of rate of rotation of the roll dies, so that the billet and dies may move in the same direction and at substantially the same speed at the time of bite of the dies on the billet. Hence the mechanism for reciprocating the billet as distinguished from the mechanism for the progressive feed movement of the billet can be conveniently termed the billet governor.

I claim herein as my invention:

1. In a rolling mill, the combination of rolls having any desired number of swaging portions and a corresponding number of portions of less diameter than the swaging portions, means for continuously rotating said rolls, and billet moving mechanism operative in the direction of roll rotation and operative to move the billet at a speed approximately that of the rolls at the time of bite of rolls on the billet.

2. In a rolling mill, the combination of rolls having any desired number of swaging portions, and means for continuously rotating said rolls, and a billet reciprocating mechanism operative to reciprocate the billet and arranged on the movement in the direction of roll rotation, to impart to the billet a speed approximately equal to that of the rolls at the time the swaging portions of the rolls engage the billet.

3. In a rolling mill, the combination of rolls having any desired number of swaging portions and a corresponding number of portions of less diameter than the swaging portions, means for continuously rotating said rolls, a billet reciprocating mechanism operative to reciprocate the billet and arranged on the movement in the direction of roll rotation to impart to the billet a speed approximately equal to that of the rolls at the time swaging portions of the rolls engage the billet, and means for progressively feeding the billet.

4. In a rolling mill, the combination of rolls having any desired number of swaging portions and a corresponding number of portions of less diameter than the swaging portions, means for continuously rotating said rolls, and means for moving the billet into the bite of the swaging portions of the rolls at a speed approximately that of the swaging portions, and means for moving the billet in a reverse direction after swaging or reducing action.

5. In a rolling mill, the combination of rolls having any desired number of swaging portions and a corresponding number of portions of less diameter than the swaging portions, means for continuously rotating said rolls, means for moving the billet into the bite of the swaging portions of the rolls at a speed approximately that of the swaging portions, means for moving the billet in the reverse direction after swaging or reducing action, and means for progressively feeding the billet between said rolls.

6. In a rolling mill, the combination of rolls having any desired number of swaging portions and a corresponding number of portions of less diameter than the swaging portions, means for continuously rotating said rolls, a billet moving mechanism operative in the direction of roll rotation and operative to move the billet at a speed approximately that of the rolls and means for progressively feeding the billet in the direction of the roll rotation.

7. In a rolling mill, the combination of rolls having any



desired number of swaging portions and a corresponding number of portions of less diameter than the swaging portions, means for continuously rotating said rolls, a means for moving the billet in the direction of roll rotation into the bite of the swaging portion of the rolls at a speed approximately that of the swaging portions, and means for moving the billet in the reverse direction after swaging or reducing action.

8. In a rolling mill, the combination of rolls having any desired number of swaging portions and corresponding portions of less diameter than the swaging portions, means for continuously rotating said rolls, and a billet moving mechanism controlled by the rolls and operative in the direction of roll rotation, to move the billet at a speed approximately that of the rolls at the time when the rolls engage the billet.

9. In a rolling mill, the combination of rolls having any desired number of swaging portions and a corresponding number of portions of less diameter than the swaging portions, means for continuously rotating said rolls, and a billet reciprocating mechanism controlled by the rolls and operative to reciprocate the billet and arranged on the movement in the direction of roll rotation to impart to the billet a speed approximately equal to that of the rolls at the time the swaging portions of the rolls engage the billet.

10. In a rolling mill, the combination of intermittingly acting rolls, means for operating said rolls, a billet holder, a fluid pressure cylinder, a piston, one of said parts being connected to the billet holder, a second fluid pressure mechanism consisting of a cylinder and piston, said cylinders being connected at points outside of the traverse of the pistons, and means controlled by the rolls for reciprocating one of the members of the second fluid pressure mechanism.

11. In a rolling mill, the combination of intermittingly acting rolls, means for operating said rolls, a fluid pressure cylinder, a piston, one of said parts being connected to the billet holder, a second fluid pressure mechanism consisting of a cylinder, and piston, said cylinders being connected at points outside of the traverse of the pistons, means controlled by the rolls for reciprocating one of the members of the second fluid pressure mechanism, and means for feeding the billet.

12. In a rolling mill, the combination of intermittingly

acting rolls, means for operating said rolls, a billet holder, a fluid pressure cylinder, a piston, one of said parts being connected to the billet holder, means for imparting a feed movement to the other part, a second fluid pressure mechanism consisting of a cylinder and piston, said cylinder being connected at points outside of the traverse of the pistons, and means controlled by the rolls for reciprocating one of the members of the second fluid pressure mechanism.

13. In a rolling mill, the combination of intermittingly acting rolls, means for operating said rolls, a billet holder a fluid pressure cylinder, a piston, one of said parts being connected to the billet holder, a second fluid pressure mechanism consisting of a cylinder and piston, said cylinders being connected at points outside of the traverse of the pistons, a means operated by the rolls for reciprocating one of the members of the second fluid pressure mechanism.

14. In a rolling mill, the combination of rolls having any desired number of reducing or swaging portions and a corresponding number of portions of less diameter, means for continuously rotating said rolls, a billet holder, means for progressively feeding the billet holder towards said rolls, means for moving the billet holder in direction of the rotation of the rolls at a speed approximately equal to that of the rolls at the time when the rolls engage the billet, means for moving the holder in the opposite direction, and means operative on the release of the billet from the rolls for rotating the holder.

15. In a rolling mill, the combination of rolls having any desired number of reducing or swaging portions, and a corresponding number of portions of less diameter, means for continuously rotating said rolls, a billet holder, means for feeding the holder towards the rolls, means for moving the holder in the direction of rotation of the rolls at a speed approximately equal to that of the rolls at the time when the rolls engage the billet, means for moving the holder in the opposite direction, a fluid pressure means for rotating the holder operative when the billet is released from the grip of the rolls.

In testimony whereof, I have hereunto set my hand.

EMIL WINTER.

Witnesses:

CHARLES BARNETT,  
HERBERT BRADLEY.