

No. 843,867.

PATENTED FEB. 12, 1907.

M. F. CAPRON.

MECHANISM FOR THE MANUFACTURE OF SEAMLESS TUBES.

APPLICATION FILED MAY 26, 1905.

3 SHEETS—SHEET 1.

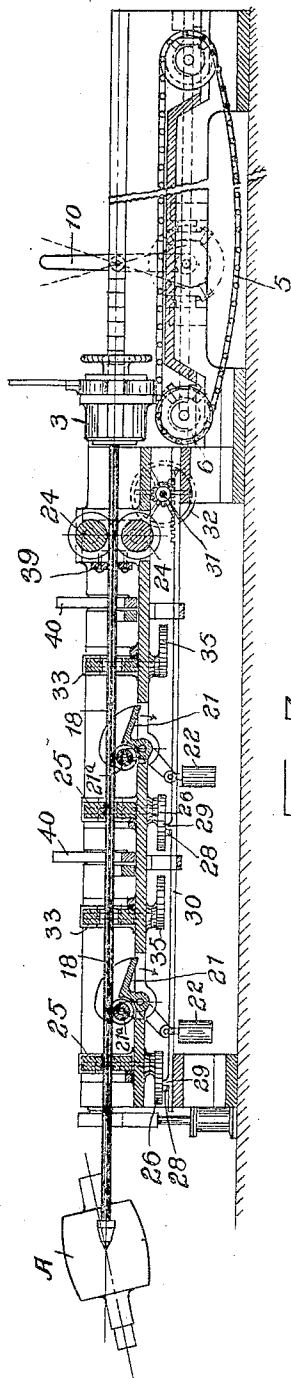


Fig. 3

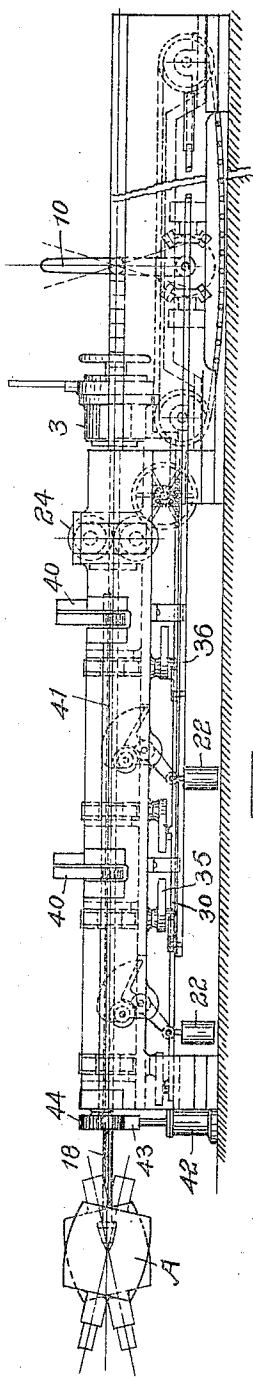


Fig. 2

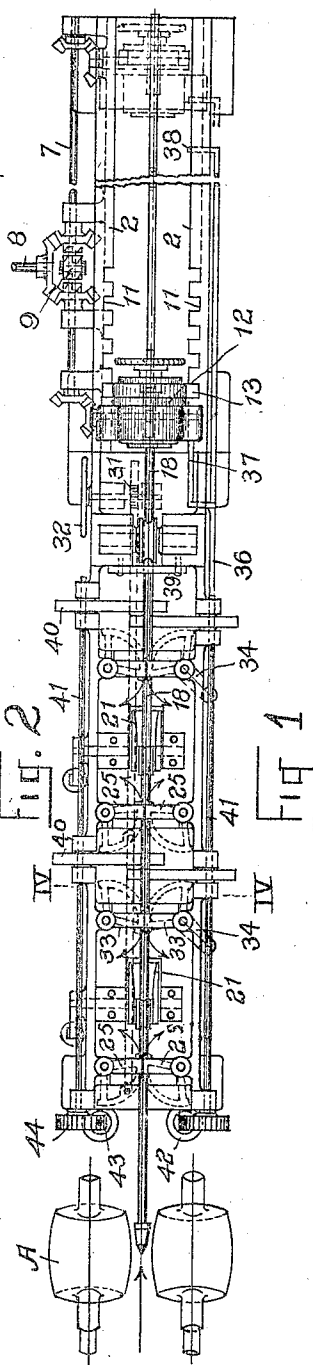


Fig. 1

Witnesses:
Francis Verman
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3 SHEETS—SHEET 2

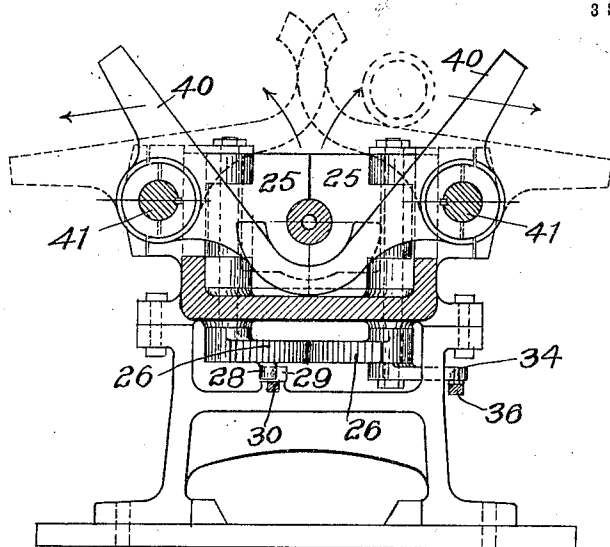


Fig. 4

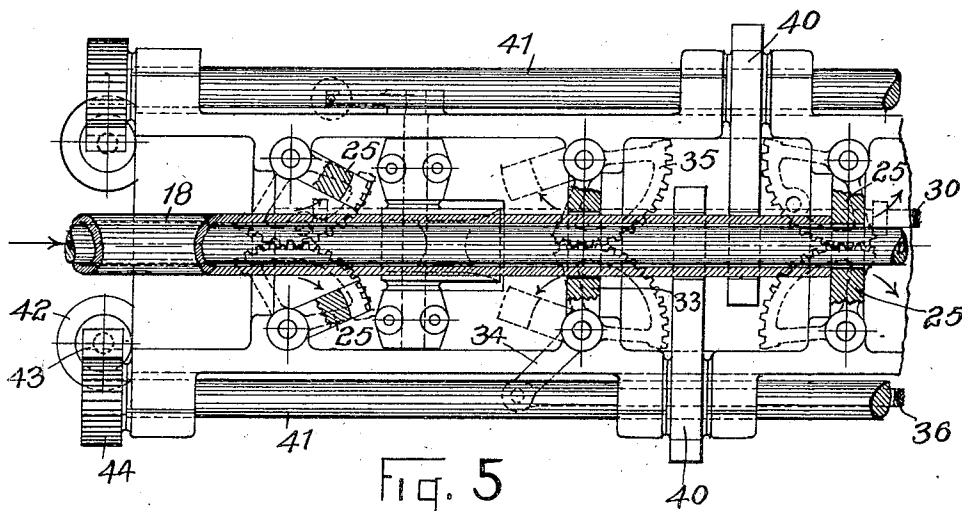


Fig. 5

Witnesses:

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3 SHEETS—SHEET 3.

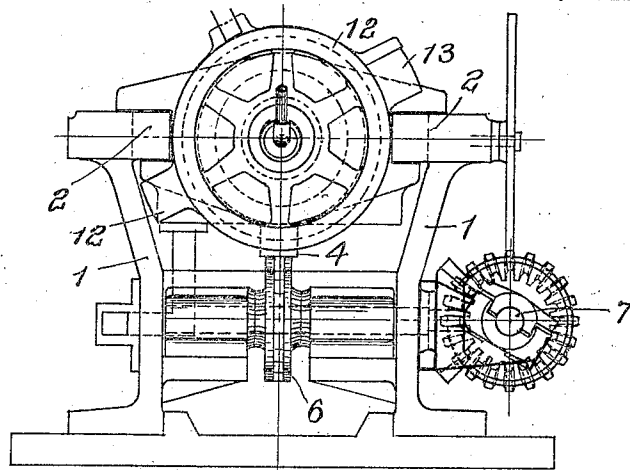


Fig. 6

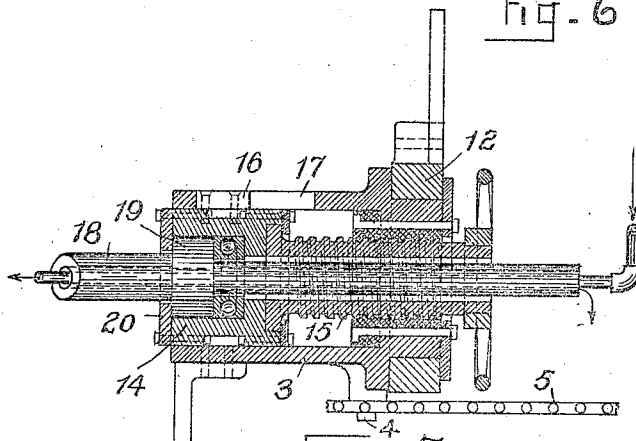


Fig. 7

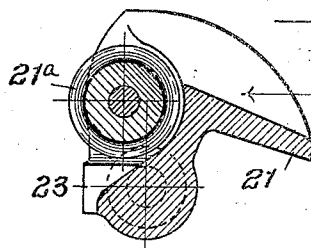


Fig. 8

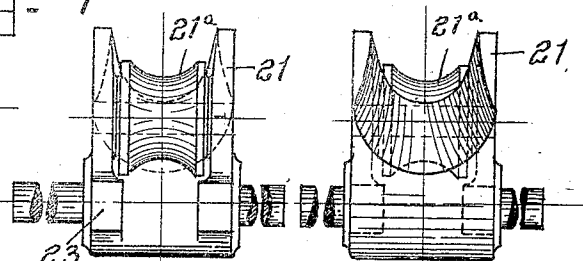


Fig. 9

Fig. 10

Witnesses:
Francis Vernon
Robert Bradley

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UNITED STATES PATENT OFFICE.

MARSHALL F. CAPRON, OF ELYRIA, OHIO.

MECHANISM FOR THE MANUFACTURE OF SEAMLESS TUBES.

No. 843,867.

Specification of Letters Patent.

Patented Feb. 12, 1907.

Application filed May 26, 1905. Serial No. 262,468.

To all whom it may concern:

Be it known that I, MARSHALL F. CAPRON, residing at Elyria, in the county of Lorain and State of Ohio, a citizen of the United States, have invented or discovered certain new and useful Improvements in Mechanism for the Manufacture of Seamless Tubes, of which improvements the following is a specification.

The invention described herein relates to certain improvements in mills for the production of seamless tubes, the improvements being especially adapted to that step of the art by which a tubular blank is formed, such step being commonly known as "piercing."

The invention has for its object the provision of suitable means for supporting the mandrel-bar in proper relation to the rolls, whereby the billet is forced over the mandrel-bar for supporting the billet or blank after being forced onto the mandrel-bar and for shifting the mandrel-bar longitudinally for bringing it into operative relation to the rolls and for withdrawing it from the pierced blank.

The invention is hereinafter more fully described and claimed.

In the accompanying drawings, forming a part of this specification, Figure 1 is a top plan view of my improved mandrel-bar and billet supporting and guiding mechanism. Fig. 2 is a side elevation of the same. Fig. 3 is a view, partly in side elevation and partly in section, of the mechanism. Fig. 4 is a transverse section on a plane indicated by the line IV IV, Fig. 1. Fig. 5 is a top plan view, on an enlarged scale, of a portion of the mechanism, portions being broken away. Fig. 6 is an elevation of the rear end of the mechanism. Fig. 7 is a sectional view of the carriage for shifting the mandrel-bar. Figs. 8, 9, and 10 are detail views of the guide-frames.

In the practice of my invention any suitable rolls can be employed, such as are known in the art as a part of a piercing-mill and adapted to perform what is sometimes called a "spinning" operation on the metal. Such rolls have their faces or operative portions of any desired suitable contour and their axes more or less inclined to each other. The axial line of feed usually bisects the angle of the axes of the rolls.

The main frame of the machine, on which is secured the guides for the mandrel-bar and

billet and on which also moves the mandrel-bar-shifting mechanism, is ordinarily of a length double that of the longest billet to be produced. The rear end of the frame (the right-hand end; shown in Figs. 1, 2, and 3) is provided with guideways 2 for the carriage 3, which, as shown in Fig. 7, is provided with a depending lug 4, adapted to engage a sprocket-chain 5, passing around wheels 6, one or both of which are positively driven by a shaft 7 through suitable gearing. This shaft through suitable clutch mechanism and gearing can be driven in opposite directions by the shaft 8, the clutch mechanism 9 being suitably shifted by its operating-lever 10. By this mechanism or any other mechanism suitable for the purpose the head 3 can be shifted back and forth along its ways as required. In order to lock this carriage as against end thrust of the mandrel-bar incident to the piercing operation, suitable lock mechanism is employed—such, for example, as that shown in the drawings, which consists of notches 11, formed in the ways 2, and the swinging frame 12, mounted on the carriage and provided with lugs 13, adapted when the frame 12 is properly shifted to enter the notches, and thereby lock the carriage as against movement along the ways.

As the piercing-plug on the end of the mandrel-bar must be closely adjusted as regards its position relative to the rolls A, a finer adjustment of the carriage and the mandrel-bar should be provided and in the construction shown consists of a head 14, movably mounted on the carriage 3 and adapted to be shifted by means of a threaded stem 15, passing through a nut on the carriage and having a swivel connection to the head 14.

In order to prevent the head 14 from rotating either during its adjustment along the carriage or by the mandrel-bar during the piercing of the billet, a key 16 is secured to the head and projects into a slot 17 in the carriage. The mandrel-bar 18 is held within the head 14 in such manner that it can be shifted back and forth by the head, but is free to rotate therein. In the construction shown the mandrel-bar is provided with a collar 19, held within a seat or socket in the head by a plate 20. As the mandrel rotates during the piercing of the billet excessive friction between the end of the mandrel and the head 14 is avoided by antifriction-rollers interposed

between the end of the mandrel and the end wall of the socket in the head, as shown in Fig. 7.

In order to guide and support the mandrel-bar as it is moved forward or to the left to operative position by the movement of the carriage, a series of tilting frames 21 are pivotally mounted in slots along the median line of the main frame 1. These frames 21 are constructed so that the ends toward the carriage will be inclined and flared outwardly with flaring sides, so that the front end of the mandrel will be properly guided onto friction-rollers 21^a, mounted in the frames; as shown in Figs. 3, 8, 9, and 10. These tilting frames are so pivoted in the slots in the bottom main frame or bed of the machine that normally the mandrel-bar will rest in the bottom of the half-round grooves made in the friction-rollers. The axes of the rollers are a little forward or to the left of the axes of the pivots of the frames sufficiently far so that the weight of the mandrel-bar on the friction-rollers would have no tendency to tilt the frames backward. Weights 22 are connected to arms on the frames so as to give a slight preponderance in the same direction—i. e., to tilting the frames forward. The forward tilting of the frames is preferably limited by a suitable stop, which in the construction shown consists of shoulders 23 on the frames, (see Fig. 8,) adapted to abut against the ends of the slots in which the frames 21 are mounted, thereby limiting the tipping movement of the frames to the left. In this condition the friction-rollers will support the mandrel-bar with its axis in the axial line of feed of the billet to the rolls. It is preferred to employ a pair of idler-rollers 24 as an additional guide for the mandrel-bar, their particular function being to support the forward end of the mandrel-bar after it is withdrawn from the billet and when the carriage is at the end of its rearward movement.

As the mandrel-bar is generally of considerable length, and therefore liable to sag as it is being moved forward to operative position, the bell-mouthed ends of the tilting frames will catch the forward end of the mandrel and guide it into proper alinement with the mandrel-bar guides, to be hereinafter described. These mandrel-bar guides are preferably made in the form of wings or doors 25, mounted on vertical shafts provided at the lower ends with toothed sectors 26, intermeshing with each other, as clearly shown in Fig. 5. These wings are provided in their adjacent edges with half-round grooves which when the wings are in operative position form a circular opening approximately equal to the external diameter of the mandrel-bar and will therefore serve to center and support the mandrel-bar in operative position.

A suitable mechanism may be employed

for swinging the wings to closed position—such, for example, as that shown, which consists of a lug 28, depending from one of the sector-wheels and projecting into the path of movement of a shoulder 29 on a sliding bar 30. This bar extends back to any convenient position—say about the middle of the machine—where provision is made for its operation—as, for example, by a pinion 31, engaging teeth on the bar 30 and operated by a hand-wheel 32. While these wings or doors may be swung open by the operation of the hand-wheel 32 out of the path of the advancing billet as it is being developed along the mandrel-bar, it is preferred that the mechanism employed for operating the doors or wings should be so constructed that the doors or wings can be forced open by the advancing end of the billet.

In order to provide supports for the billet and mandrel-bar as the former is developed along the mandrel, a series of doors or wings 33 are mounted on vertical shafts and preferably alternate with the mandrel-bar wings or doors 25. These wings or doors 33 are provided with grooves in their meeting edges, which when the wings are in operative position form openings of approximately the external diameter of the billet being developed along the mandrel-bar, so as to afford efficient support and guide therefor. These doors are preferably operated by the carriage 3 as it reaches the ends of its movement along the ways 2, and to this end arms 34 extend from the vertical shaft of one of each pair of doors or wings (which are caused to move in unison by two sectors 35, intermeshing with each other) and are connected by pins or other suitable means to a sliding bar 36. This bar 36 is provided with tappets 37 and 38, projecting into the path of movement of the carriage 3, so that when the carriage reaches the forward limit of its movement the doors 33 will be closed or brought into operative position, and when the carriage reaches or approaches the rearward limit of its movement, at which time the mandrel-bar will be withdrawn, the doors 33 will be swung open to permit the billet to be removed by suitable swinging arms, as hereinafter described.

In order to strip the billet from the mandrel, an abutment 39 is provided and preferably secured to the bearings for the idler-rolls 24.

During the formation or development of a billet along the mandrel-bar the forward end of the billet will first strike against a pair of mandrel-bar-supporting wings 25 and force them open without affecting any of the other wings or doors 25 of the series. As the development of the billet continues it will next strike the friction-roller 21^a on one of the tilting guides 21 and so tip such frame that the friction-roller carried thereby will be shifted to the opposite side of the vertical

plane passing through the pivot of the frame 21 and take a somewhat lower position, dependent upon the thickness of the wall of the billet developed along the mandrel, and thereby serve to guide the advancing end of the billet into the opening of the wings or doors of the billet-guides 33. After the billet has been entirely pierced and lies wholly on the mandrel-bar the carriage 3 is unlocked and drawn backward and with it the billet until the rear end of the latter strikes against the stripping-plate 39. In this backward movement of the carriage, the mandrel-bar, and billet any of the guides 25 which have not been opened during the development of the billet will be forced open, and as the carriage reaches the rear limit of its movement all the billet-guides 33 will be opened, so that the billet will thereafter be supported by the friction-rollers of the tilting frames 21.

In order to remove the billet from these rollers, I provide a series of tilting arms along one or both sides of the path of movement of the billet along the mandrel. These arms 40 are secured to shafts 41, mounted in suitable bearings on the main frame and adapted to be rotated to raise and lower the arms by any suitable means—as, for example, by fluid-pressure cylinders 42, operating rack-bars 43, which intermesh with pinions 44 on the shafts 41. As shown in Fig. 4, these arms have hook-shaped inner ends which normally project under and across the path of movement of the billet along the mandrel-bar. When the mandrel-bar has been withdrawn, as stated, one or the other of the shafts 41, dependent upon which side of the machine the pierced billet is to be discharged, is operated, thereby lifting the inner ends of the arm and with them the billet resting on the rollers of the tilting frames 21. These arms are so swung that the complete billet will roll off along the arms to one side of the machine.

After the billet has been removed the carriage 3 is shifted to the left, locked, and if necessary the mandrel adjusted by the screw 15. The carriage in its movement to the left closes the billet-supporting wings or doors 33. After the mandrel has been shifted to operative position the wings or doors for the mandrel-bar are closed by operating the hand-wheel 32.

If desired, provision may be made for causing the circulation of a cooling medium through the mandrel-bar.

I claim herein as my invention—

1. The combination of rolls of a billet-piercing mill, a mandrel-bar, and wings or doors mounted to move horizontally to and from operative position and arranged in pairs and of any desired number of pairs for engaging and holding the mandrel-stem in the axial line of roll delivery.

2. The combination of rolls of a billet-piercing mill, a mandrel-bar, doors or wings

mounted to move horizontally to and from operative position and in pairs and of any desired number for engaging and holding the mandrel-stem in the axial line of roll delivery and movable to open position by the billet as it is formed along the mandrel-bar.

3. The combination of rolls of a billet-piercing mill, a mandrel-bar, wings or doors mounted to move horizontally to and from operative position and in pairs of any desired number for engaging and holding the mandrel-stem in the axial line of roll delivery and mechanism for shifting the doors or wings from an open to a closed position.

4. The combination of rolls of a billet-piercing mill, a mandrel-bar, wings or doors mounted to move horizontally to and from operative position and in pairs of any desired number, and provided in their meeting faces with grooves properly proportioned for receiving and guiding the billet as formed and arranged with the groove-centers in the axial line of roll delivery.

5. The combination of rolls of a billet-piercing mill, a mandrel-bar, swinging wings or doors mounted to move horizontally to and from operative position and in pairs and of any desired number of pairs for engaging and guiding the billet as formed along the mandrel, and mechanism for opening and closing such guides.

6. The combination of rolls of a billet-piercing mill, a mandrel-bar, wings or doors in pairs and of any desired number of pairs for engaging and guiding the billet as it is formed along the mandrel, a movable carriage for shifting the mandrel and means interposed between the carriage and doors whereby the latter may be shifted to open and closed position on the movement of the carriage.

7. The combination of rolls of a billet-piercing mill, a mandrel-bar, wings or doors horizontally movable to and from operative position and arranged in pairs and of any desired number of pairs for engaging and guiding the billet as it is formed along the mandrel, mechanism for opening the wings or doors and mechanism for lifting the completed billet from between the open wings or doors.

8. The combination of rolls of a billet-piercing mill, a mandrel-bar, wings or doors horizontally movable to and from operative position and arranged for engaging and supporting the billet as it is formed along the mandrel-bar, mechanism for opening the wings or doors, means for withdrawing the mandrel from the billet and means for lifting the completed billet from between the open wings or doors.

9. The combination of rolls of a billet-piercing mill, a mandrel-bar, horizontally-swinging wings or doors for guiding the billet as it is formed along the mandrel, a

movable carriage connected to the mandrel-bar, an abutment for engaging the end of the completed billet during the longitudinal movement of the mandrel-bar and mechanism operative during the longitudinal movement of the mandrel-bar for opening the wings or doors.

10. The combination of rolls of a billet-piercing mill, a mandrel-bar, guiding wings or doors horizontally movable to and from operative position and arranged in pairs of any desired number, means for operating the wings or doors, a pivotally-mounted frame arranged along and below the mandrel-bar, and means for lifting the completed billet from the wings or frames.

11. The combination of rolls of a billet-piercing mill, a mandrel-bar, a traveling carriage connected to the mandrel-bar, means for shifting the carriage and a lock for holding the carriage as against movement along its guides, and means for adjusting the mandrel-bar relative to the carriage.

12. A combination of rolls of a billet-piercing mill, a hollow mandrel-bar, a traveling carriage; a head movable on the carriage and having a loose connection to the mandrel-bar, a hollow screw engaging a nut carried by the carriage and having a swivel connection to the head, tubes extending through the screw and head and connected to the mandrel-bar and a lock for holding the carriage as against longitudinal movement.

13. The combination of rolls of a billet-piercing mill, a mandrel-bar, a traveling carriage, a frame arranged in the path of the forward end of the mandrel-bar and pivoted to swing in the direction of movement of the mandrel-bar and provided with a bell-mouthed opening in the direction of the forward movement of the mandrel-bar to operative position.

14. The combination of rolls of a billet-piercing mill, a mandrel-bar, a traveling carriage, a guide-frame provided with a friction-roller and pivoted to swing in the direction of the movement of the mandrel-bar, the portion of the frame in the rear of the friction-roller being constructed to guide and direct

the mandrel-bar onto the friction-roller, and means tending to hold the frame in operative position.

15. The combination of rolls of a billet-piercing mill, a mandrel-bar, a traveling carriage connected with the mandrel-bar, a guide-frame arranged in the path of the forward end of the mandrel-bar as it is shifted to operative position, and pivoted to swing in the direction of movement of the mandrel-bar, a friction-roller mounted on the frame forward of the vertical plane passing through the pivot of the frame, and means tending to hold the frame in operative position and a stop for limiting the movement of the frame.

16. The combination of rolls of a billet-piercing mill, a mandrel-bar, a traveling carriage connected to the mandrel-bar, a frame arranged in the path of the forward end of the mandrel-bar as it is shifted to operative position, and pivoted to swing in the direction of movement of the mandrel-bar, a friction-roller mounted on the frame forward of the vertical plane passing through the pivot of the frame, the frame being so pivotally mounted as to permit of its being tilted backward by the billet as it is formed along the mandrel-bar, means tending to hold the frame in operative position and a stop for limiting the movement of the frame.

17. The combination of rolls of a billet-piercing mill, a mandrel-bar, a series of horizontally-swinging wings or doors for engaging and guiding the mandrel-bar, a second series of horizontally-swinging wings or doors for engaging and guiding the billet as it is formed along the mandrel-bar, the mandrel-bar-supporting doors being movable to open position in the direction of the development of the billet along the mandrel-bar and the billet-supporting wings or doors being movable to open position in the opposite direction.

In testimony whereof I have hereunto set my hand.

MARSHALL F. CAPRON.

Witnesses:

ESTELLE CULLINS,
ARTHUR E. ADAMS.