May 23, 1933. J. T. LEECH 1,911,157

MECHANISM FOR DRAWING METAL

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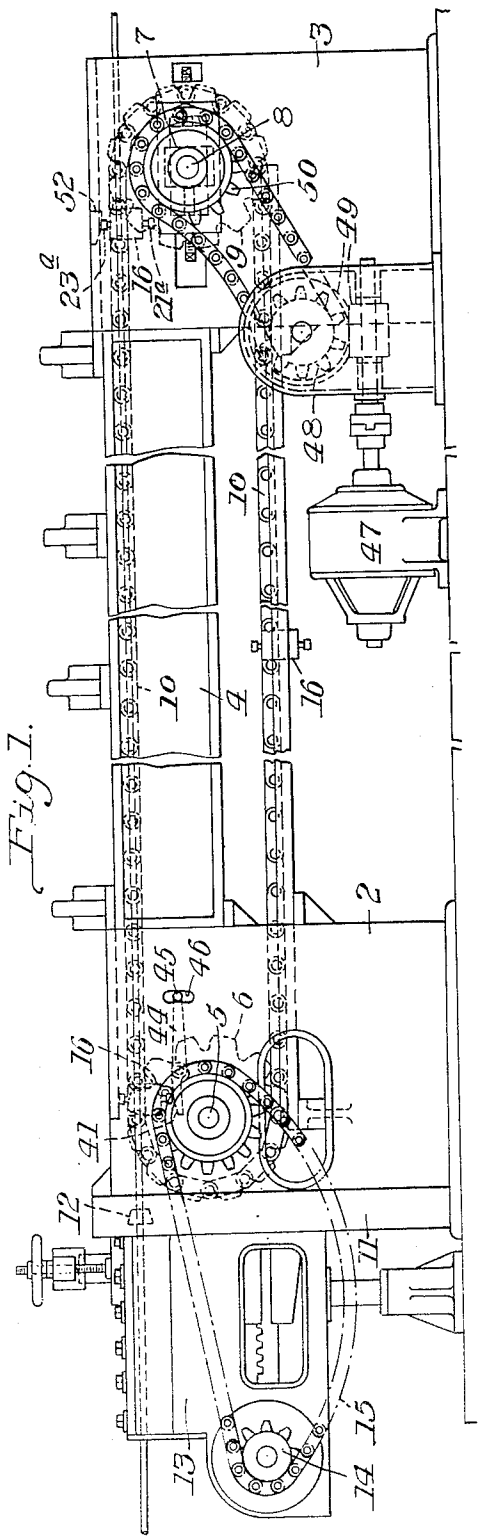


Fig. 1.

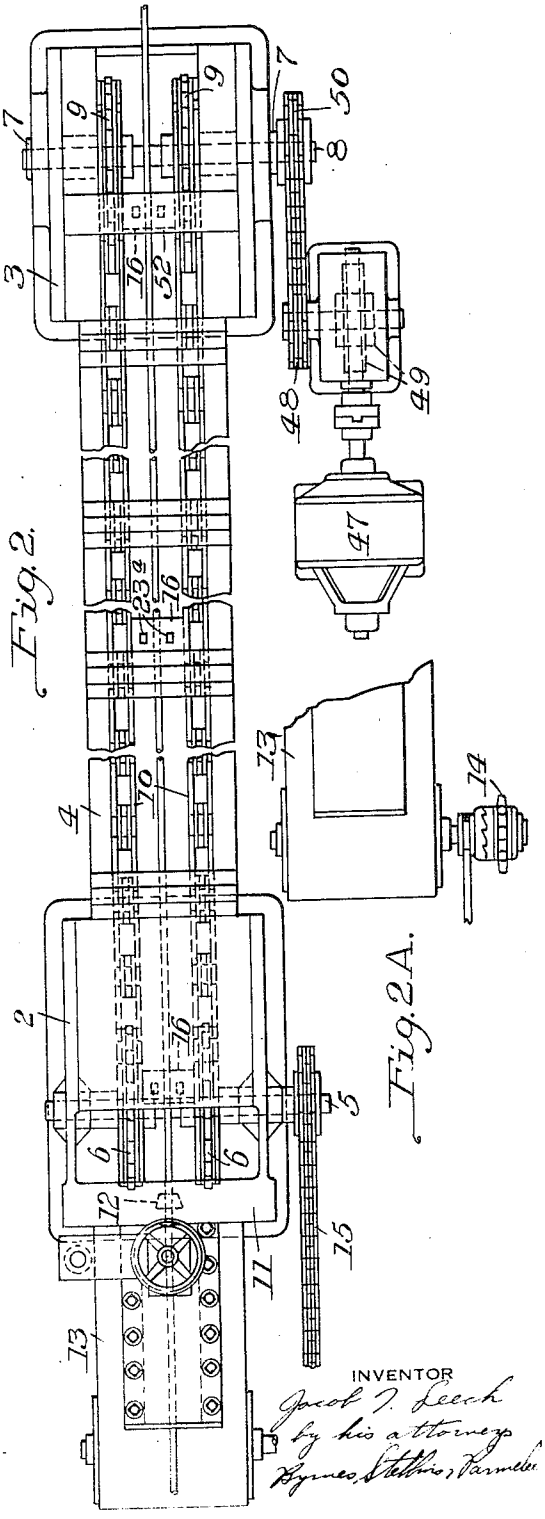


Fig. 2.

Fig. 2A.

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MECHANISM FOR DRAWING METAL

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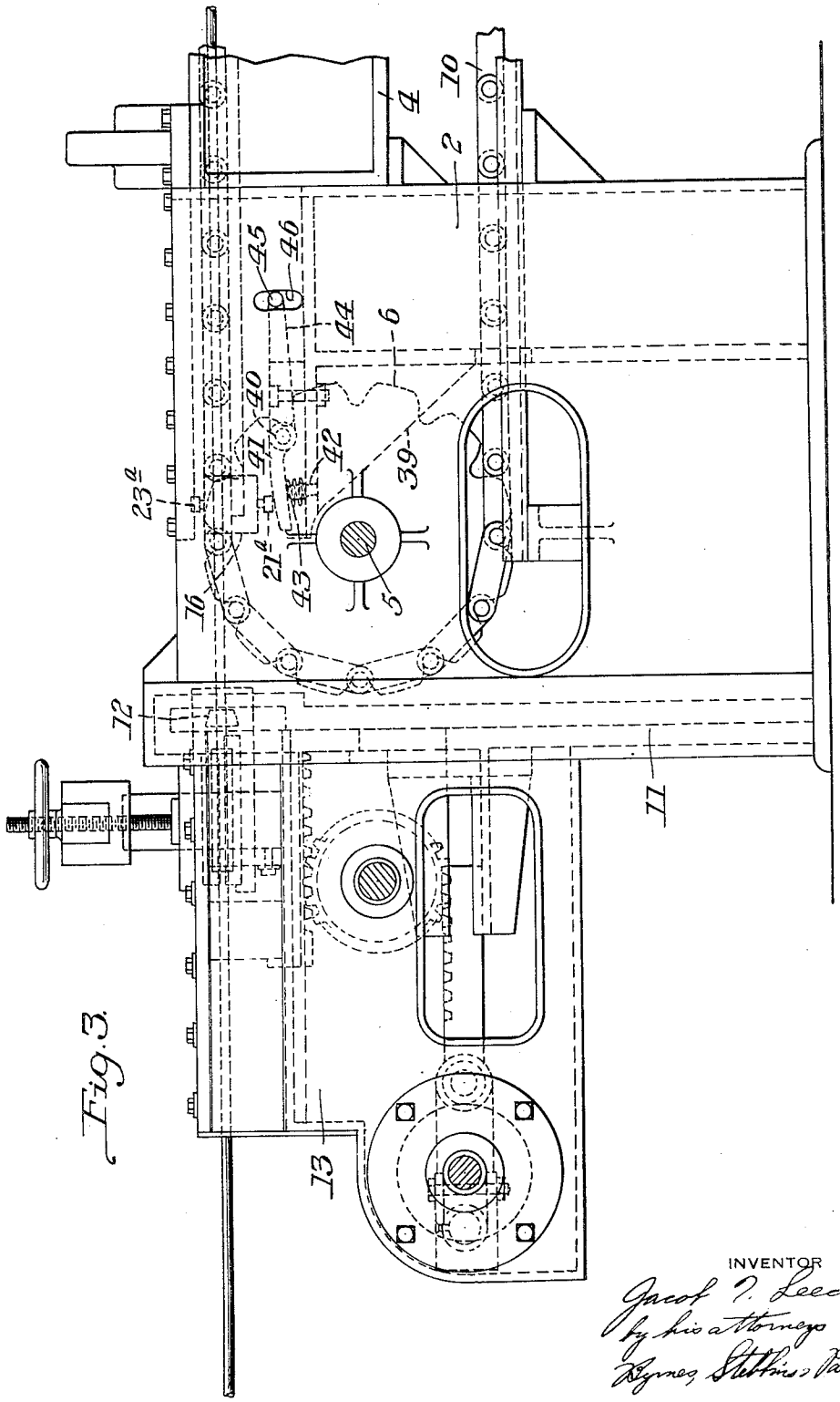


Fig. 3.

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MECHANISM FOR DRAWING METAL

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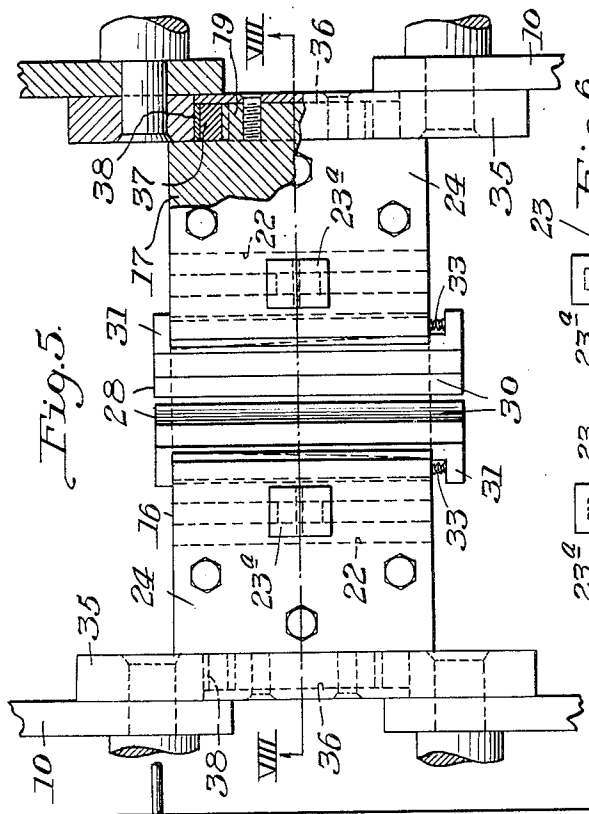


Fig. 5.

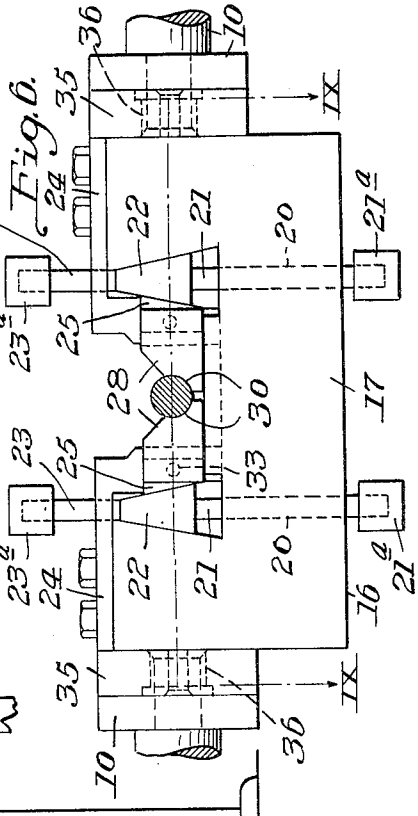


Fig. 6.

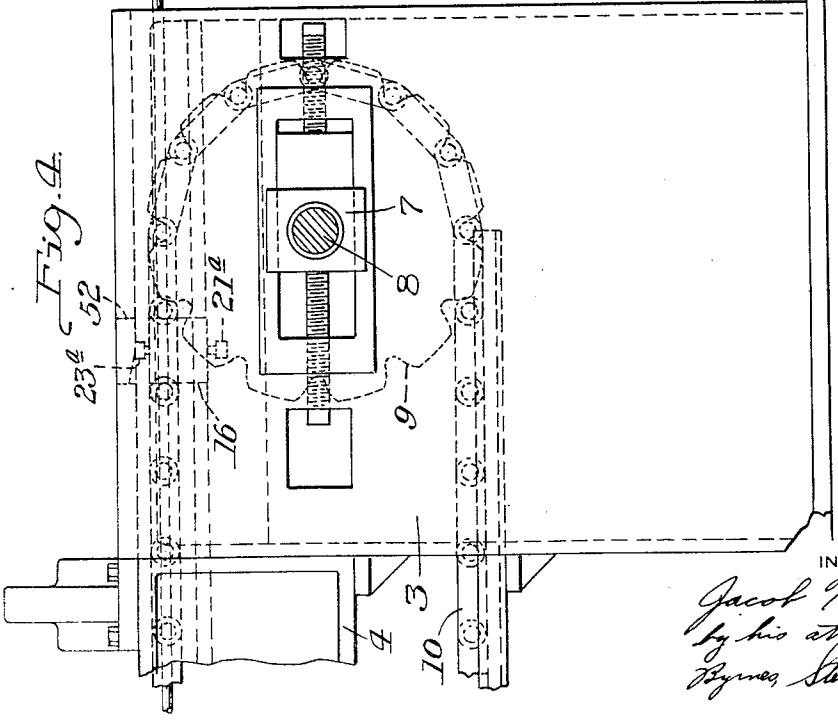


Fig. 4.

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MECHANISM FOR DRAWING METAL

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Fig. 7.

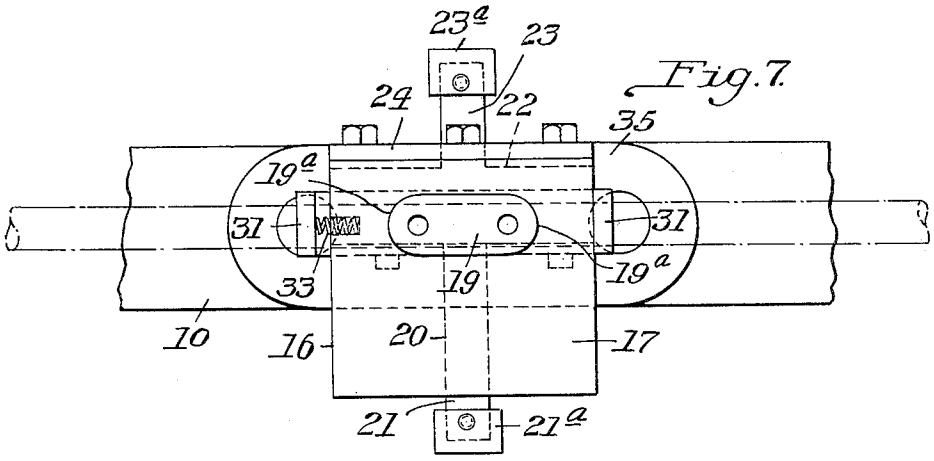


Fig. 8.

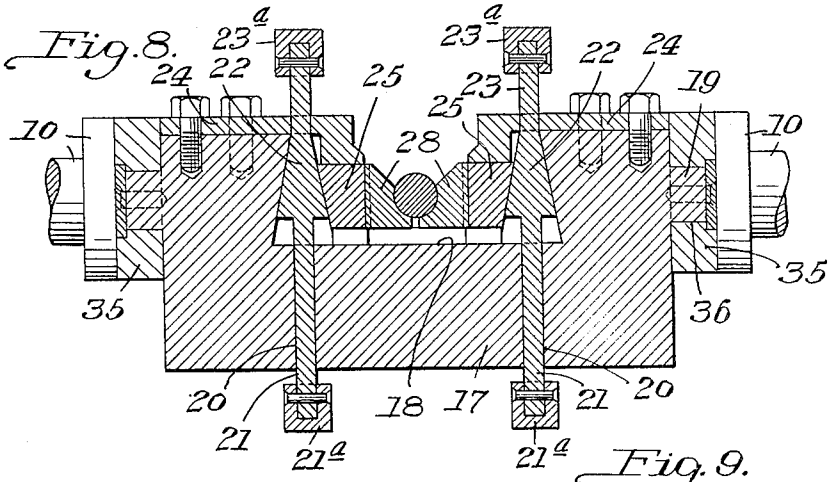
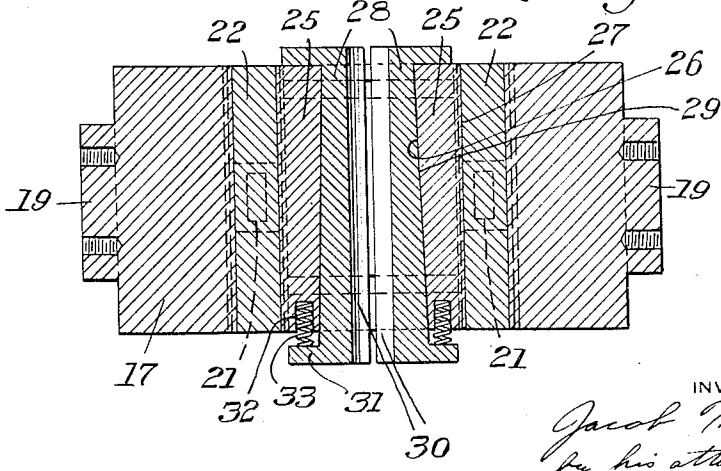


Fig. 9.



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MECHANISM FOR DRAWING METAL

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Fig. 10.

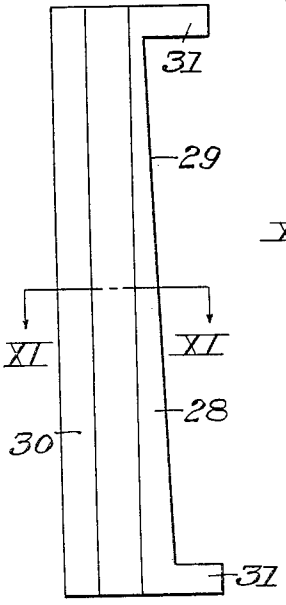


Fig. 12.

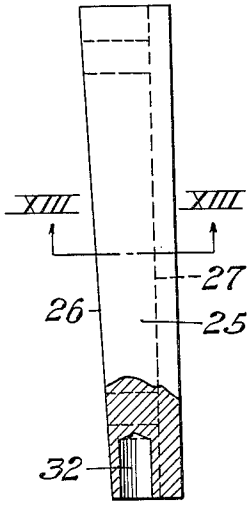


Fig. 14.

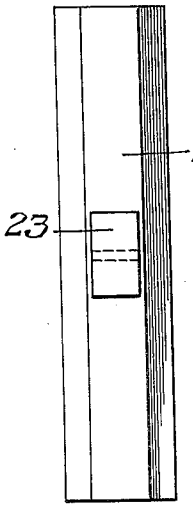


Fig. 15.

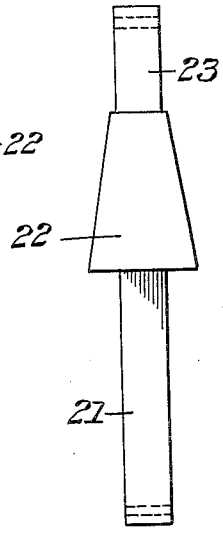


Fig. 11.

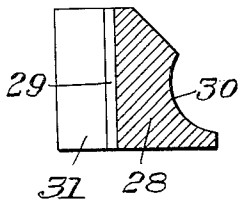


Fig. 13.

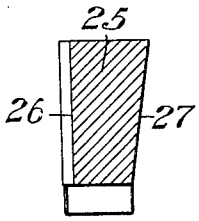


Fig. 16.

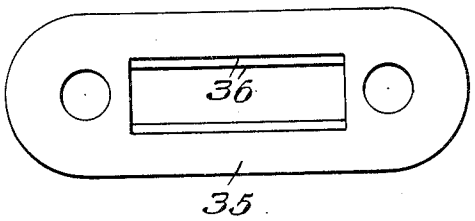
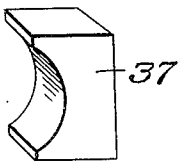


Fig. 17.



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Patented May 23, 1933 1,911,157

UNITED STATES PATENT OFFICE

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MECHANISM FOR DRAWING METAL

Application filed December 28, 1927. Serial No. 243,100.

This invention relates to metal work and more particularly to the drawing of wire or rods through a die.

In the drawing of steel wire or rods, the stock is first pushed through a die having an orifice therein of the shape and dimensions of the finished product. The end of the stock which is pushed through the die is grasped by a suitable clamp. In the drawing of long or continuous lengths of stock, the end of the material which is pushed through the die is engaged by a gripping device on a revolving drum. As the drum revolves, the stock is pulled through the die and reduced by the die to the proper shape and size, and the surface of the material is finished. Due to the strain which the material is under in being pulled through the die and around the drum, the wire is stretched unequally. The surface of the wire lying on the drum is curved on a shorter radius than the portion of the wire at the outside of the drum. The difference in the radius of curvature is, of course, equal to the diameter of the wire. For instance, in the drawing of ½-inch wire there would be a difference of ½ inch in the radius of curvature. This difference in the radius of curvature stretches the metal unequally and makes it difficult to straighten the wire. The only type of straightening machine which has been developed for straightening wire which has been drawn on a drum is one which necessitates the wasting of several feet of wire on each length. Also, when the wire under tension is wound on the drum, one convolution will overlap and slip over another, and the metal is damaged thereby.

Not only is the metal stretched unequally in being pulled on to a drum and damaged by the contact of the metal with adjacent convolutions, but considerable time is lost in removing the coiled material from the drum. During the time that the material is being removed from the drum the drawing machine is inoperative.

In the drawing of short lengths of bars the stock is pushed through a die and engaged in a gripping device which travels longitudinally along the drawing machine a distance equal to the length of the bar being drawn. When the gripping device has travelled the full length of the bar, the gripping jaws must be opened, the bar discharged, and the gripping device returned to the forward end of the machine to grip the next piece of material to be drawn. Considerable time is lost in returning the gripping device to operative position after it has travelled the full length of the bar in one direction. Considerable difficulty is also encountered in releasing the jaws of the gripping device after the bar has been pulled. The time required for releasing the gripping jaws of the gripping device and the time required for returning the gripping device to operative position for releasing the jaw constitutes a considerable portion of the operating time of the drawing machine.

The present invention provides a drawing mechanism applicable to the drawing of either continuous strips of wire or to the drawing of bar lengths wherein a drum about which the wire is coiled is not required, and wherein there is no time loss due to the releasing of the gripping jaws and the returning of the drawhead to starting position.

According to my invention there is provided a draw frame having a continuous chain therein with a plurality of cross heads thereon. Each cross head is provided with wire gripping means of unique construction and so arranged that when one draw head is at the extreme limit of its operating travel another draw head will be in operating position. The draw heads automatically release the wire or bars at the end of the operating travel and can be arranged to automatically engage the wire at the starting point of their operating travel.

My invention may be readily understood by reference to the accompanying drawings, which illustrate a preferred embodiment of my invention, and in which—

Figure 1 is a side elevation of a drawing machine constructed in accordance with my invention;

Figure 2 is a top plan view partly broken away of the machine shown in Figure 1;

Figure 2-A is a top plan view of the left

hand end portion of Figure 2, showing the driving connection for the pusher mechanism;

Figure 3 is a side elevation on a larger scale of the front end of the machine with the pusher mechanism removed therefrom;

Figure 4 is a side elevation on a larger scale of the rear end of the machine;

Figure 5 is a plan view of one of the gripping heads;

Figure 6 is a side elevation of the gripping head shown in Figure 5;

Figure 7 is an end view of the gripping head shown in Figure 5;

Figure 8 is a cross section in the plane of line VIII—VIII of Figure 5;

Figure 9 is a cross section in the plane of line IX—IX of Figure 6;

Figure 10 is a plan view of one of the gripper jaws;

Figure 11 is a cross section along the line XI—XI of Figure 10;

Figure 12 is a detail view of one of the longitudinal wedges;

Figure 13 is a cross section along the line XIII—XIII of Figure 12;

Figures 14 and 15 are detail views showing one of the vertically movable wedges for cooperation with the wedge shown in Figure 12;

Figure 16 is a detail view of one of the links connecting the gripper head to the draw chain; and

Figure 17 is a perspective view of one of the bearing blocks for the link of Figure 16.

The drawing mechanism as shown in Figure 1 comprises a front end housing 2, a rear end housing 3 and a bed frame 4 supported on the housings 2 and 3.

Supported in bearings in the front end housing 2 is a transverse shaft 5 having spaced apart sprocket wheels 6 thereon. Supported in longitudinally adjustable bearings 7 in the rear end housing 3 is a transversely extending shaft 8 having sprocket wheels 9 thereon. Passing around the sprockets 6 and 9 are continuous parallel roller chains 10.

In the front part 11 of the front frame 2 is a drawing die 12. Mounted in a guide way on the front of the part 11 of the front frame 2 for vertical movement thereon is a pusher mechanism 13. The pusher mechanism 13 may be of any suitable preferred construction. The particular mechanism which is shown is fully described in my co-pending application Serial No. 250,505, filed January 30, 1928. The pusher mechanism is driven from the shaft 5 through a sprocket wheel 14 and a chain 15, the chain 15 being sufficiently slack to allow for a limited vertical movement of the entire pusher unit.

The die 12 has its vertical center disposed substantially in line with the center line of the upper reach of the chains 10.

Secured on the chains 10 at regular intervals are gripping heads 16. As many of these gripping heads may be used as are desirable. Ordinarily, three of the gripping heads are sufficient and but three of them are shown in the accompany drawings.

Each of the gripping heads comprises a main cross head 17 having a cut away central portion 18. At each end of the member 17 is an elongated boss or projection 19 having rounded ends 19^a. In the cross member 17 at each side of the cut away portion 18 is an opening 20. Received in each of the openings 20 is a post 21 on which is a wedge 22, the wedge having an upwardly extending projection 23. The upwardly extending projections 23 are passed through keeper plates 24 secured to the top of the member 17 at each side of the central cut away portion 18.

Received in the cut away portion 18 at each side thereof is a wedge block 25 having a vertical face 26 and an inclined face 27, the inclined face 27 being adapted to cooperate with one of the tapered faces of the wedge block 22. The vertical face 26 of the block 25 is tapered longitudinally, the wedge being wider at one end than at the other.

Located in the central opening 18 at each side thereof is a gripping jaw 28 having a longitudinally tapered face 29 for cooperation with the tapered face 26 of the member 25. Each of the jaw members 28 has a wire gripping portion 30, the portions 30 of the two members 28 being opposed. At each end of each member 28 is a transverse lug 31. The lugs 31 extend in front of the wedge members 25 at each end thereof. Received in a pocket 32 in one end of each wedge 25 is a compression spring 33. The compression springs 33 engage against the lugs 31 of the respective members 28 for urging the members 28 longitudinally with respect to the members 25.

The gripping heads 16 are connected to the cross chains 10 by means of special links 35 shown in detail in Figures 5 and 16, having longitudinally extending slot 36 therein. The link 35 is adapted to fit against one end of the cross head 16 with the boss 19 projecting into the slot 36. At each end of the boss 19 is a bearing block 37 having a curved bearing surface for engaging with the rounded portion *a* of the boss. By reason of the slot 36 being longer than the boss 19 and by reason of the bearing blocks 37, the cross heads have a floating connection with the chain. Inasmuch as the chains will wear unevenly, and inasmuch as it is desired that the cross heads shall always be at right angles to the chains, this connection between the chains and cross heads permits of relative adjustment of the cross heads with either of the chains so as to compensate for uneven wear. For instance, after the machine has been in use for a time one chain may be slightly looser than the other. In this case, a shim or filler plate can be inserted between the forward

bearing block 37 and the end of the slot 36 at one side of the machine. A shim of similar thickness can be inserted between the rear block and the end of the slot at the opposite side of the cross head. Such shims so disposed are shown at 38 in Figure 5.

On the lower ends of the vertically movable bars 21 are cam engaging caps 21^a. On the tops of the extensions 23 are similar caps 23^a.

In the front frame 2 between the sprocket wheels 6 is a bracket 39. Supported on a shaft 40 above the bracket 39 is a hinged plate 41 having a slightly curved top face. On the under side of the plate 41 is a projection 42 around which is a compression spring 43, the purpose of the compression spring being to urge the plate 41 upwardly to a very limited extent. Means may be provided for rocking the plate from the outside of the machine. Such means may comprise a lever 44 on the shaft 40 having a laterally turned extension 45 projecting through a slot 46 in the side of the housing.

In the operation of the machine, the chain is driven from a suitable source of power. A driving means is diagrammatically indicated in Figure 1, where 47 indicates a driving motor which drives a sprocket 48 through a reducing gear 49. The sprocket 48 drives a sprocket 50 on the shaft 8. In first starting the machine the end of the wire or rod is drawn through the die 12 by means of the pusher mechanism 13. The end of the wire or rod projects through the die sufficiently to extend between the jaws 30 of the gripping device 16, which is then located at the starting end of the machine, as shown in Figure 1. When the end of the rod or wire has been projected through the die and is positioned between the jaws 30, the operator pushes down on the rod 45 of the lever 44 rocking the plate 41 upwardly. At this time the caps 21^a of the rods 21 are resting on the plate 41, so that the upward movement of the plate 41 serves to lift the rods 21 vertically raising the wedges 22. The wedges 22 force the wedge blocks 25 toward each other, moving the jaws 28 inwardly so that the gripping portions 30 of the jaws are in frictional contact with the end of the wire or rod. Then the chain is started. Due to the friction with which the jaws engage the rod, the jaws are moved longitudinally. The longitudinal movement of the jaws causes the tapered face 29 of the jaw blocks 28 to ride along the tapered faces 26 of the wedge blocks 25, thereby forcing the jaws into tight gripping engagement with the end of the rod or wire. As the chain continues to move along the rod or wire is pulled through the die.

When the gripping head 16 has moved along the entire upper reach of the conveyor to a point adjacent the sprocket wheels 9, the caps 23^a on the upper ends of the extension 23 will engage a curved cam plate 52. This cam plate 52 will force the extensions 23 down, moving the wedge blocks 22 down. As soon as the wedges 22 move down the wedge blocks 25 then spread apart and allow the jaws 28 to release the rod. As soon as the jaws 28 are released from the wire or rod, the compression springs 25 act to move the jaws 28 longitudinally to their normal inoperative position.

If a continuous length of wire is being drawn, the next cross head 16 will have been moved to operative position just before the first cross head releases the bar. The caps 21^a riding up on the curved surface of the plate 41 will be lifted to automatically force the wedges 22 in to set the jaws 28 against the rod. By the time that the strain has been released from the first cross head, the second cross head will be tightly gripped to the wire and continue to pull the same. The operation is repeated as long as the continuous length is being drawn through the mill. It is only necessary to lift the plate 41 by operation of the handle 46 at the start of the operation because at the start of the operation the wire does no project sufficiently far through the die to enable the jaws to grip it to start the pulling. The wire is thus drawn through the die continuously without being drawn over a drum and the line of pull is always a straight line. Uneven strains in the material are thus avoided and the material is not damaged as it is where it is wound on a drum under heavy tension.

In the drawing of short lengths of rods the operation of the jaws is the same. However, in the drawing of short lengths of rods it is necessary to rock the plate 41 manually to set the jaws of the cross head for each length being drawn. However, due to the fact that by the time one length of rod has been drawn another cross head is in operating position, no time is lost in waiting for a cross head to be returned to the starting point. There is always a cross head in position to take the end of the bar as it is pushed through the die, so that the machine can be operated substantially continuously.

The construction of the jaws and wedges is such that just as soon as the wedges 22 are dropped down the entire gripping device can release itself from the wire or rod. Gripping devices as heretofore constructed require that the tension be relieved from the wire or rod before the gripping device could be released. The present invention eliminates the time and labor necessary for relieving the tension on the rod because it is capable of releasing whether the rod is under tension or not.

Upon inspection of Figures 7 and 8, it will be seen that the boss or projections 19 at each side of the cross head lie in the plane of the upper flight of the chain and that a hori-

zontal line drawn centrally through the boss passes through the center of the gripping jaws 30. The center of the gripping jaws is in the center of the axis of the drawing die. Therefore, as the draw head moves along the bed of the machine, it is drawing the metal directly along the axis of the die. Due to the manner in which the draw head can be adjusted with respect to the two chains by shimming the blocks 37, any looseness which develops in the chains tending to throw the draw head out of a true transverse position can be easily compensated for.

The invention results in the saving of considerable time in the drawing of wire in long lengths or in the drawing of short bar lengths of material. In the former case, it eliminates the time required in removing the wire from the drawing drums. In the latter case it eliminates the idle return travel of the draw head to operative position as well as the operation of backing up the draw head to release the jaws. In the drawing of wire it results in an improved product because, when a wire is wound under the drawing tension over a drum, unequal strains are developed in the portion of the metal nearest the surface of the drum and the peripheral portion. To straighten wire in which such strains have developed requires an additional operation and one which results in the loss of a considerable amount of material due to the fact that any straightening machines which will satisfactorily straighten the wire require that a certain portion of the wire be mutilated. Also, when the wire is wound over a drum under drawing tension, one convolution slipping on or over another multilates the wire. The straight line continuous pull developed by the present invention eliminates any unequal tension in the metal as it is drawn and avoids mutilation by eliminating the winding of the wire under tension on a drum. In a drawing unit of the type herein disclosed, the wire may be wound on a drum after it has been drawn, but the drum itself would not draw the wire through the die, and the wire would not be wound under such heavy tension as to set up unequal strains. Where the wire is to be cut into rod lengths, it can be fed directly from the drawing unit to a shearing unit, such as a flying shear, which will automatically cut the wire into straight lengths, thereby eliminating entirely the expense of straightening operations now required.

While I have shown and described a preferred embodiment of my invention, it will be understood that this is merely illustrative of the invention and that various changes and modifications may be made therein within the contemplation of my invention and under the scope of the following claims. It will also be understood that the novel cross head construction herein disclosed is particularly applicable to use on a continuous chain. It can be advantageously used in present types of draw heads and eliminate the necessity at the end of each draw of slightly backing up the draw head to release the jaws before the wire can be released from the jaws and the draw head returned to its operating position.

I claim:

1. In an apparatus for making drawn steel, a drawing die, a frame, an endless carrier comprising continuously parallel chains on the frame operating in the same plane, said carrier having a horizontal reach substantially in the plane of the axis of the die and substantially parallel with the axis of the die, a plurality of cross heads on the carrier at spaced intervals therealong extending between the chains, said cross heads being adjustably connected with the chains at each side thereof through connectors which are variable relatively to the cross heads, and wire gripping jaws on the cross heads, and means carried by said frame adjacent the die end of the chain and operatively associated with said gripping jaws for moving the latter into gripping relation to a wire.

2. In an apparatus for making drawn steel, a drawing die, an endless carrier comprising continuously parallel chains disposed side by side, said carrier having a horizontal reach substantially in the plane of the axis of the die and substantially parallel with the axis of the die, a plurality of cross heads on the carrier extending between the chains and arranged at regularly spaced intervals therealong, said cross heads being adjustably connected with the chains at each side thereof, and wire gripping jaws on the cross heads, the center of the jaws being substantially coincident with the axis of the drawing die throughout the travel of the cross heads along the said horizontal reach of the carrier and means carried by the cross heads for moving said jaws into operative position upon movement of said chains.

3. A draw head for drawing machines comprising a cross frame, work engaging jaws in the cross frame movable longitudinally, longitudinally movable wedge elements carried by the cross frame and engageable with the jaws for forcing the jaws toward each other upon longitudinal movement of the cross frame in one direction, and vertically movable wedges arranged for cooperation with longitudinally movable wedges for also moving the jaws toward and away from each other.

4. A wire gripping unit for metal drawing mechanism comprising a cross frame, a pair of longitudinally movable jaws on the cross frame, longitudinally tapered wedges for cooperation with the jaws, said wedges being movable toward and away from each other, and movable means back of the wedges mov-

able transversely of the wedges for positively moving the wedges toward each other.

5. A wire gripping unit for metal drawing mechanism comprising a cross frame, longitudinally movable jaws on the frame, a transversely movable longitudinally tapered wedge back of each jaw for cooperation therewith, and movable means back of the wedges movable transversely of the wedges for effecting transverse movement of said wedge.

6. A wire gripping unit for metal drawing mechanism comprising a cross frame, longitudinally movable work engaging jaws on the cross frame, a transversely movable longitudinally tapered wedge back of each jaw for cooperation therewith, means for effecting transverse movement of said wedges toward each other, and a spring operatively engaging each jaw for opposing longitudinal movement thereof in one direction.

7. A wire gripping unit for metal drawing mechanism comprising a cross frame, a pair of longitudinally movable jaws in the cross frame, a transversely movable longitudinally tapered wedge back of each jaw for cooperating therewith, and a second wedge back of the first and movable transversely thereof and at right angles thereto, said second wedges being adapted to effect transverse movement of said first wedges.

8. A wire gripping unit for metal drawing mechanism comprising a cross frame, a pair of longitudinally movable jaws in the cross frame, a transversely movable longitudinally tapered wedge back of each jaw for cooperating therewith, and a second wedge back of the first and movable transversely thereof and at right angles thereto, said second wedges being adapted to effect transverse movement of said first wedges, each of said second wedges having an operating extension thereon.

9. A wire gripping unit for metal drawing mechanism comprising a cross frame, horizontally disposed longitudinally reciprocable jaws in said cross frame, horizontally disposed transversely movable longitudinally tapered wedges back of the jaws for cooperation therewith, and a vertically movable vertically tapered wedge back of each of said horizontally disposed wedges for effecting transverse movement thereof.

10. A draw head for drawing units comprising a cross frame, horizontally disposed longitudinally reciprocable jaws in said cross frame, horizontally disposed transversely movable longitudinally tapered wedges back of the jaws for cooperation therewith, and a vertically movable vertically tapered wedge back of each of said horizontally disposed wedges for effecting transverse movement thereof, each of said vertical wedges having an operating extension at the top and the bottom thereof.

11. A draw head for drawing units comprising a frame, longitudinally movable jaws in the frame, springs for yieldably resisting the longitudinal movement of the jaws, a longitudinally tapered wedge back of each jaw for cooperation therewith, and means back of each wedge for effecting transverse movement thereof.

12. An apparatus for the manufacture of drawn steel, a die, an endless carrier having a horizontal reach extending in the direction of the axis of the die, a frame structure along which the carrier moves, a draw head on the carrier having a pair of longitudinally movable jaws therein, longitudinally tapered wedges back of the jaws for causing the jaws to move into gripping position upon longitudinal movement of the jaws with respect thereto, other means for effecting transverse movement of the jaws into and out of gripping position, said means having an operating extension thereon, and means on the frame for engaging said operating extension to actuate the cross head.

13. An apparatus for the manufacture of drawn steel, a die, an endless carrier having a horizontal reach extending in the direction of the axis of the die, a frame structure along which the carrier moves, a draw head on the carrier having a pair of longitudinally movable jaws therein, longitudinally tapered wedges back of the jaws for causing the jaws to move into gripping position upon longitudinal movement of the jaws with respect thereto, other means for effecting transverse movement of the jaws into and out of gripping position, said means having an operating extension thereon, means on the frame adjacent the die for cooperating with said extension to effect a closing movement of the jaws at the beginning of the travel of the jaws along said horizontal reach of the conveyor, and other means adjacent the opposite end of said horizontal reach for cooperation with said operating extension to effect movement thereof in a reverse direction to permit spreading of the jaws.

14. In a drawing machine, a drawing die, an endless carrier having a horizontal reach extending in the direction of the axis of the die and in substantially the plane thereof, a draw head on the carrier, a frame for the carrier, jaws on the draw head movable longitudinally thereof, longitudinally tapered wedges for cooperating with the jaws for forcing the jaws toward each other upon longitudinal movement of the jaws in one direction, a vertically extending wedge back of each of the jaws for also moving the jaws toward and away from each other, means at one end of the frame adjacent the die for raising said vertical wedges to close the jaws, and means at the opposite end of said carrier frame for lowering said vertical wedges to permit opening of the jaws.

15. In a mechanism for drawing metal, a die, a draw head, an endless carrier on which the draw head is mounted, a frame on which the endless carrier is supported, jaws in the draw head movable relatively thereto transversely and longitudinally with respect to their longitudinal axes into and out of gripping position, means for effective transverse movement of the jaws comprising a vertically movable operating wedge, an operating extension for said last named means, means at one end of said frame for cooperation with said operating extension adapted to set the jaws, and means at the other end of the frame for cooperating with said operating extension to release the jaws, both of said last named means being disposed in the path of travel of said cross head.

16. An apparatus for the manufacture of drawn steel comprising a die, an endless chain located entirely at one side of the die having a reach which travels in a direction coaxially of the die and in the same horizontal plane as the axis of the die, a series of cross heads carried on the endless chain at regularly spaced intervals therealong, each of the cross heads of said series having a pair of oppositely movable cooperating gripping jaws thereon which are in the same plane as the chain, means for setting the jaws into gripping position at the beginning of their travel along said reach, means operable upon further movement of the cross head for holding the jaws set during such travel, and means for releasing the jaws near the end of the travel of the cross head along said reach.

17. In a drawing machine, a die, an endless carrier, means for driving the carrier continuously in one direction, a plurality of transverse cross heads having a pair of movable opposed gripping jaws slidably mounted thereon, means carried by said carrier and engageable with said gripping jaws adapted to move said jaws into operative position upon movement of said carrier, and means for releasing both of said jaws of the cross heads when the cross heads have moved to a point remote from the die, the center of the carrier and gripping jaws being in the same horizontal plane as the center of the die.

18. An apparatus for the manufacture of drawn steel comprising a die, an endless chain operatively disposed entirely on one side of the die and having a reach which travels in a direction co-axially of the die, means for driving the chain continuously in one direction, a series of draw heads carried on the endless chain, gripping jaws carried by said draw heads, means including wedge members adapted to move said gripping jaws into operative position upon movement of said endless chain, said draw heads being spaced at substantial intervals along the chain.

19. An apparatus for the manufacture of drawn steel including a die, a carrier including horizontally disposed endless chains parallel throughout the extent of their travel and positioned entirely at one side of the die, one reach of the carrier extending substantially parallel to axis of the drawing die and in the horizontal plane thereof, means for driving the carrier continuously in one direction, a plurality of draw heads on the carrier between the chains and arranged at widely separated intervals therealong, gripping jaws on said draw heads, and means carried by said carrier operable upon movement of said chains for moving said gripping jaws into operative position.

20. In a wire drawing unit, a die, a frame, an endless carrier including spaced chains so arranged on the frame as to be parallel throughout the extent of their travel, said carrier having a horizontal reach extending substantially parallel with the axis of the die and in the horizontal plane of the die, a draw head carried between the chains and having gripping jaws thereon, means carried by said frame adjacent the die end of the chains and operatively associated said gripping jaws for moving the latter into gripping relation to a wire upon movement of the endless chain, the center of the gripping jaws of the draw heads being coincident with the axis of the die when the draw head is in one horizontal reach of said carrier, means for driving the carrier in one direction and fixed means remote from the die end of the frame and operatively associated with the gripping jaws for releasing the gripping pressure of the latter on the wire.

In testimony whereof I have hereunto set my hand.

JACOB T. LEECH.