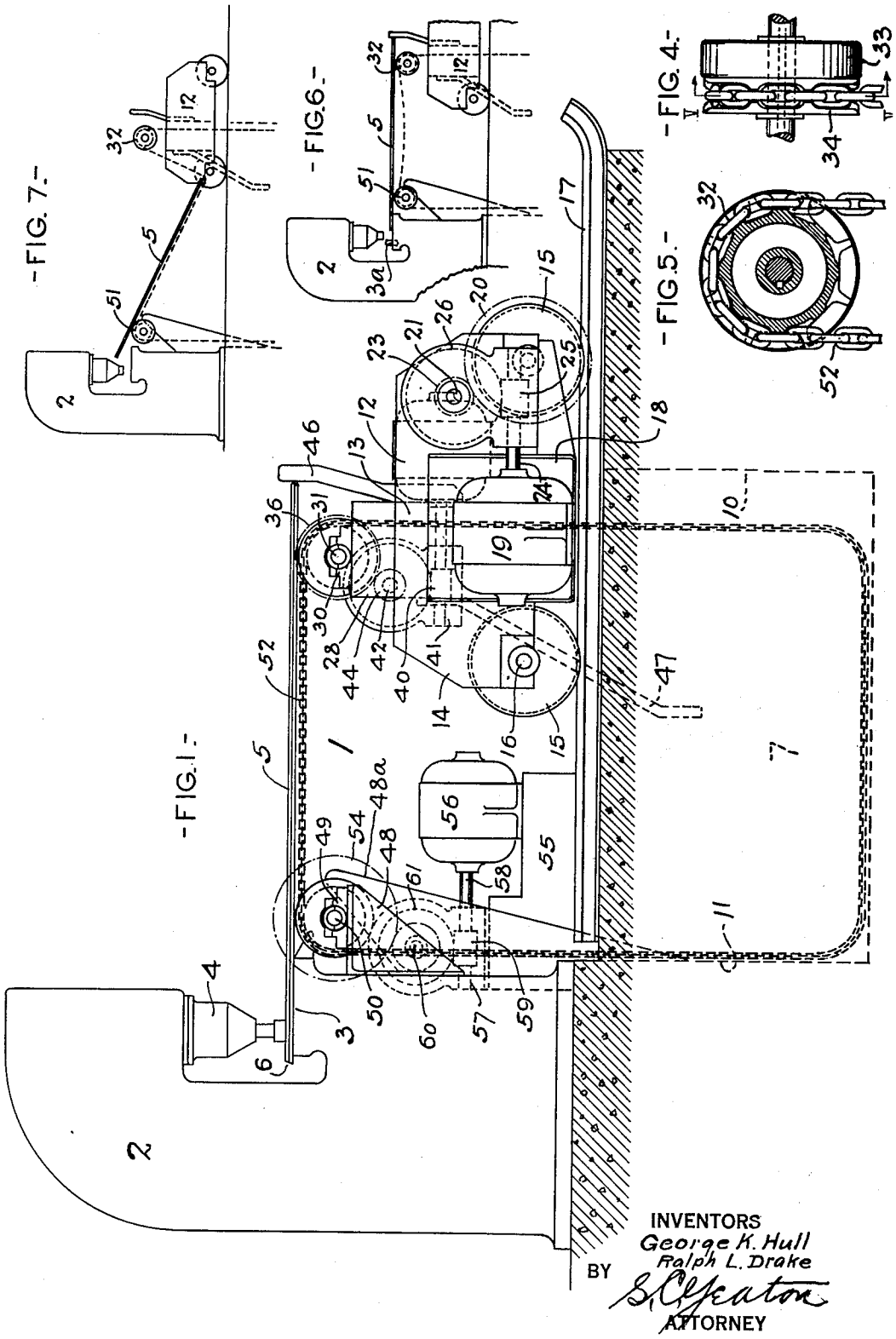
June 12, 1934. G. K. HULL ET AL 1,962,772

DEVICE FOR HANDLING LARGE METAL PLATES

Filed Nov. 22, 1933 3 Sheets-Sheet 1



INVENTORS
George K. Hull
Ralph L. Drake
BY
ATTORNEY

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DEVICE FOR HANDLING LARGE METAL PLATES

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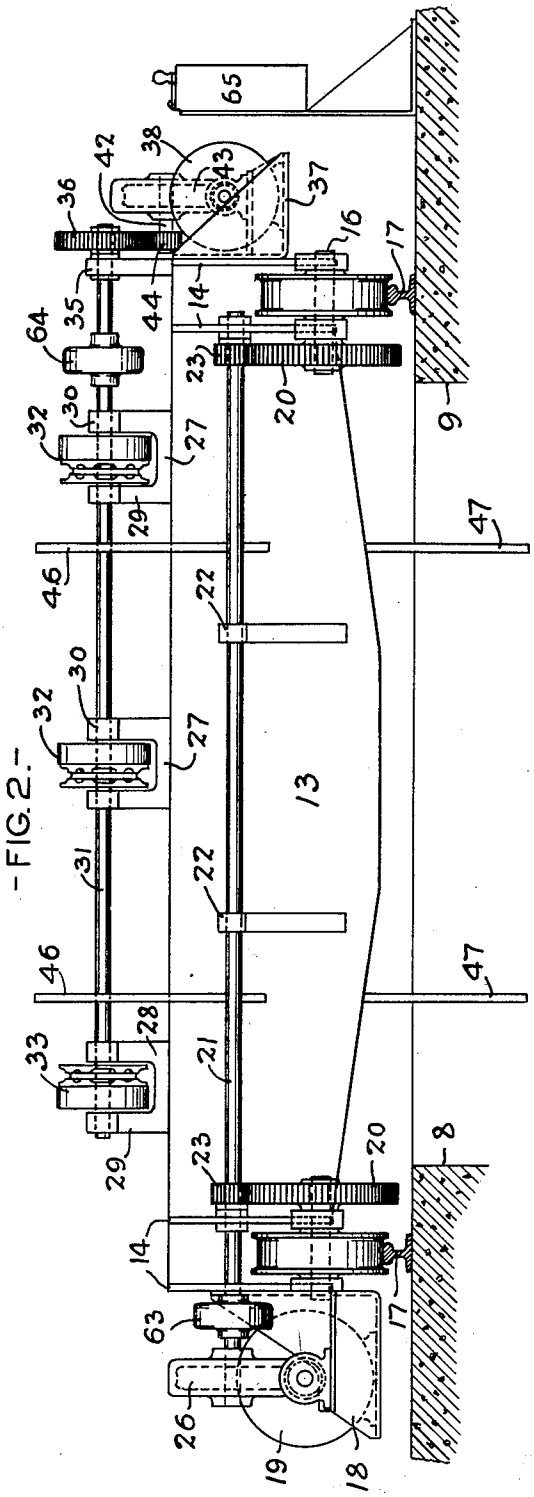
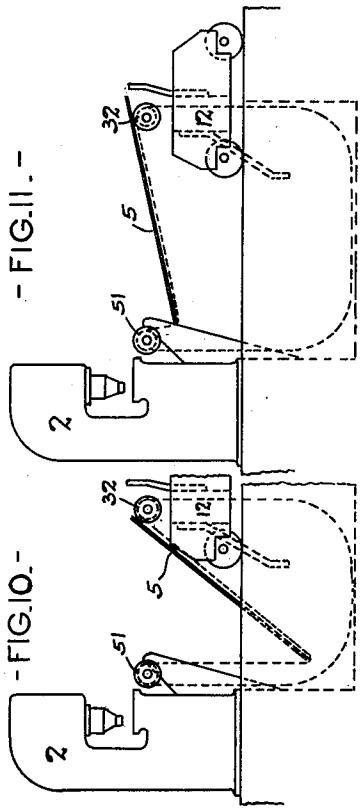
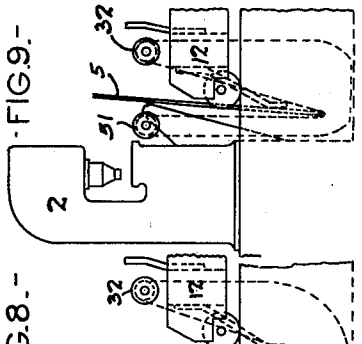


- FIG. 2. -

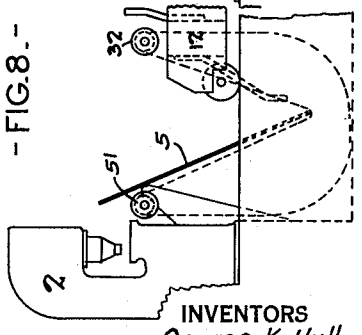


- FIG. 11. -

- FIG. 10. -



- FIG. 9. -



- FIG. 8. -

INVENTORS
George K. Hull
Ralph L. Drake
BY
S. K. Yeaton
ATTORNEY

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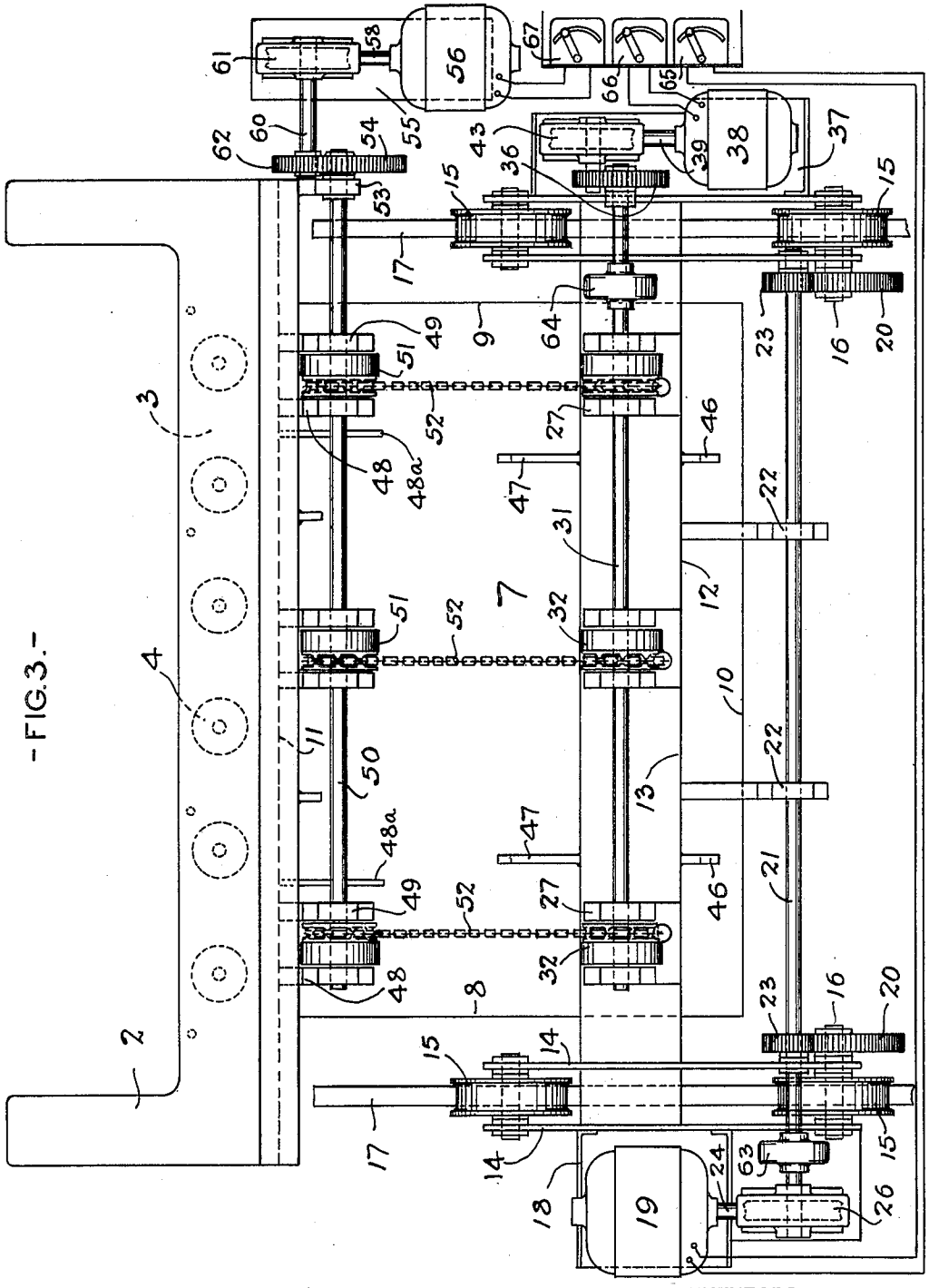
DEVICE FOR HANDLING LARGE METAL PLATES

Filed Nov. 22, 1933 3 Sheets-Sheet 3



- FIG. 3. -

INVENTORS
George K. Hull
Ralph L. Drake

BY S. C. Keaton
ATTORNEY

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UNITED STATES PATENT OFFICE

1,962,772

DEVICE FOR HANDLING LARGE METAL PLATES

George K. Hull, Fredonia, and Ralph L. Drake, Dunkirk, N. Y.

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10 Claims. (Cl. 214—1)

This invention relates to a device for handling large metal plates and particularly to a device adapted to support and to position large metal plates and to turn such plates over from one side thereof to the other.

An object of the invention is to provide a device of the character described consisting of a power driven device which will enable a single operator to accomplish the positioning and turning over of large metal plates during manufacturing operations.

A further object of the invention is to provide a device of the character aforedescribed which will eliminate the necessity of using cranes as previously employed, and will constitute relatively safe means for turning over large metal plates.

Other objects of and advantages achieved by the present invention will be apparent from the following description of an approved embodiment thereof.

In some manufacturing operations, such as where fabricated metal pipes are being made from large metal plates, it is necessary at certain stages to turn the plates over. Prior to the present invention this turning presented difficulties of primary importance, particularly where relatively large plates were being worked upon, and the turning had been heretofore accomplished with cranes and required an operator and several helpers. Due to the liability of the plates to slip or fall when being turned over by cranes, such turning involved a certain amount of danger to the workmen. The present invention provides a power driven device for turning the plates over, whereby the use of cranes is eliminated and the aforesaid danger is avoided. Further by the device of the present invention a single operator can accomplish the turning over of plates of the largest size used. It will be understood that frequently plates as large as forty feet long, nine feet wide, and one-half inch thick are worked upon, and that the device of the invention is designed for use in connection with these and even larger plates.

The invention is illustrated in the accompanying drawings wherein Figure 1 is an end view of the device of the present invention applied in connection with a plate planer, a pair of plates being shown supported thereon in position for planing and the pit being indicated by broken lines; Fig. 2 is a front view of the device shown in Fig. 1 with the plates and certain parts omitted, a part of the pit being shown in section; Fig. 3 is a plan view of the device shown in Fig. 1 with the plates omitted; Fig. 4 is an enlarged front view of one of the sprocket rollers of the device with a section of chain engaged therewith; Fig. 5 is a section on the line V—V of Fig. 4, the chain being shown in full; and Figs. 6 to 11 inclusive are reduced diagrammatic end views (some of the views being broken away) of the device shown in Fig. 1, illustrating various steps in the operation of the device of the present invention.

The plate turn-over device, indicated generally by the numeral 1, is illustrated as applied in connection with a plate planer, indicated generally by the numeral 2, certain parts of the turn-over device being supported on the planer, as hereinafter described. It will of course be understood that the turn-over device may be used in connection with any other machine with which its use proves desirable, instead of the plate planer, or it may be used separately. The planer 2 therefore is only briefly described herein and is shown in the drawings only in outline. It includes a supporting table 3 and a plurality of pneumatic holding jacks 4 adapted to be vertically adjusted to suitable closed and open positions for firmly holding a plate or plates on the table 3 or for permitting the insertion and removal of such plate or plates in and from the planer respectively. In Fig. 1 one of the jacks 4 is shown in closed or engaged position holding a pair of plates 5 securely on the table 3 with the inner edges 6 of the plates in a position ready for a bevelling operation. In Figs. 6 to 11 the jacks 4 are shown in open or disengaged position, that is, raised upwardly away from the table so as to permit ready insertion or removal of the plates respectively to and from the positions between the lower ends of the jacks and the table shown in Fig. 1. It will be understood that while only one jack is shown in each of the figures last mentioned, all of the jacks will be operated simultaneously in the same manner.

In connection with the plate turn-over device 1, a pit 7 is provided. The pit is rectangular in plan and includes end walls 8 and 9 and front and rear walls 10 and 11 respectively.

A travelling bridge, indicated generally by the numeral 12, extends longitudinally across the pit 7. The bridge inclues a longitudinally extending frame comprising a substantially box-shaped girder 13 having a pair of transversely extending spaced supporting plates 14 suitably secured thereto by welding (not shown) at each of its opposite ends. A double flanged supporting wheel 15 is provided at each side of the girder 13 between the respective plates of the pairs of

plates 14 at each end thereof. An axle 16 for each wheel is supported in bearings carried by the plates 14.

On each of the end walls 8 and 9 a rail 17 is secured. The rails extend in a direction transversely of the bridge and are parallel to each other, and the flanged wheels 15 ride upon the rails, one pair of wheels on each respective rail. The bridge 12 is thus readily movable over the pit 7.

At one end of the girder 13 (left end as viewed in Fig. 2) a supporting bracket 18 is secured, by welding, to the outer supporting plate 14, which plate forms an end wall for the bridge 12, and a reversible electric motor 19 is supported on this bracket. Each of the supporting wheels 15 at the front of the bridge is secured to its respective axle 16 to turn therewith, and each of these axles is extended inwardly, and a gear wheel 20 is secured on the extended portion. A longitudinally extending shaft 21 is rotatably mounted on the bridge in suitable bearings provided therefor, indicated at 22, the bearings being mounted on the girder 13 and inner transverse supporting plates 14.

A pair of gear wheels 23 is carried by the shaft 21, one being keyed to the shaft adjacent each of the gear wheels 20. The respective adjacent pairs of gear wheels 20 and 23 are in mesh with each other so that when the shaft 21 is rotated the front wheels 15 will be positively driven to move the bridge. One end of the shaft 21 (the left end as viewed in Fig. 2) is extended beyond the bridge through the outer plate 14 at this end. The motor 19 is provided with a drive shaft 24 to which a worm 25 is keyed, and a worm wheel 26 is keyed to the extended end of the shaft 21 in mesh with the worm 25, thereby operably connecting the motor for moving the bridge.

A plurality of spaced bearing blocks 27 (three being shown) is provided on the top of the bridge. Each block comprises a base member 28 which is suitably secured to the girder 13 by bolts (not shown) and a pair of spaced upstanding arms 29. In each of the arms 29 a shaft bearing 30 is provided. The openings of all of the bearings 30 are aligned with each other, and a longitudinal shaft 31 is mounted in the bearings.

A plurality of sprocket rollers 32 (three being shown) is keyed to the shaft 21, one roller being disposed between the upstanding arms of each of the bearing blocks. Each of the rollers 32 (see Figs. 4 and 5) comprises a roller portion 33 and a flanged sprocket portion 34 adjacent to the roller portion and integrally formed therewith.

The right end (as viewed in Figs. 2 and 3) of the shaft 31 is extended beyond the end of the bridge, a suitable additional bearing 35 being mounted on the girder 13 at this end for the adjacent end of the shaft 31, and a gear wheel 36 is keyed to the extended end of the shaft 31 at the outer side of the bearing 35. A bracket 37 is suitably secured by welding to the outer supporting plate 14 at this end of the girder 13 (which plate forms an end wall for the bridge 12). A reversible motor 38 is supported on the bracket 37. The motor 38 is provided with a drive shaft 39 extending rearwardly and having a worm 40 keyed to its rear end. A bearing block 41 for the shaft 39 is also supported on the bracket 37, and a shaft 42 is also mounted in the bearing block 41, extending at one end therebeyond in the direction of the girder 13. A worm wheel 43 is keyed to the shaft 42 and is in mesh with the worm 40. A pinion 44 is keyed to the extended end of the shaft 42 and is in mesh with the gear wheel 36. It will thus be apparent that the reversible motor 38 is adapted to drive the shaft 31 and the rollers 32 in either direction as desired.

A pair of longitudinally spaced upstanding guide arms 46 is secured to the girder 13 at the front thereof and a pair of longitudinally spaced downwardly extending guide arms 47 is secured to the girder 13 at the rear side thereof. The guide arms 46 and 47 are suitably secured by welding (not shown) and serve purposes hereinafter to be explained.

A plurality of longitudinally spaced bearing brackets 48 is suitably secured to the front wall of the planer 2 by bolts (not shown), one bracket 48 being disposed opposite each of the bearing blocks 27. A pair of bearings 49 is carried by each of the bearing brackets 48, and a longitudinal shaft 50 is mounted in the bearings 49 and provided with sprocket rollers 51 of the same construction as the rollers 32. It will be apparent that there are three pairs of oppositely disposed sprocket rollers 32 and 51.

At the inner sides of each of the end bearing brackets 48 a forwardly extending arm 48*a* is secured to the front of the planer. The tops of the arms 48*a* are disposed slightly forward of and below the tops of the rollers 51.

An endless chain 52 is provided for each pair of oppositely disposed sprocket rollers 32 and 51, the respective chains each extending over and engaging the sprocket portions of the rollers and extending loosely down into the pit 7. The roller portions of the rollers 32 and 51, which are all in the same horizontal plane, are equipped with rubber tires in order to reduce the tendency of the plates carried by the device to slip during the operation therof, as hereinafter described.

The right end of the shaft 50 (as viewed in Fig. 3) is extended beyond the end of the planer 2. A suitable bearing 53 is provided for this end of the shaft 50 and is mounted on the front wall of the planer. A gear wheel 54 is keyed to the shaft 50 at its extended right end.

A supporting block 55 is provided below and to the side of the gear wheel 54. A reversible motor 56 and a bearing block 57 are mounted on the block 55. The motor 56 is provided with a drive shaft 58 mounted in the block 57 having a worm 59 keyed to its rear end. A shaft 60 is mounted in the block 57 and extends at its left end as viewed in Fig. 3, in the direction of the gear wheel 54 parallel to the shaft 50. A worm wheel 61 is keyed to the shaft 60 and is in mesh with the worm 59. A pinion 62 is keyed to the extended end of the shaft 60 and is in mesh with the gear wheel 54. It will thus be seen that the reversible motor 56 is adapted to drive the shaft 50 and rollers 51 in either direction, as desired.

Interposed in the shaft 21 and in the shaft 31 are friction clutches 63 and 64 respectively. These clutches may be of any well-known construction, those shown in the preferred embodiment being of a type such as that illustrated in United States Patent No. 1,855,643, issued to Matthews, April 26, 1932, omitting the centrifugal engaging means and manual control means of the patented device. The clutches 63 and 64 are in constant pressure engagement and slipping or relative movement of the clutch parts occurs only when one part is definitely held against movement while a motor continues to turn the other part. The purpose of the clutches is to permit this slipping between the parts of

the shafts connected by the clutches at times when one of such shaft parts is being turned by one of the motors and the other shaft part is prevented from turning, as hereinafter further explained.

Suitable controls are provided for each of the reversible motors 19, 38 and 56, hereinbefore described, whereby the driving of these motors in forward or reverse direction may be controlled by a single operator. More particularly a control 65 is provided for the motor 19, a control 66 for the motor 38 and a control 67 for the motor 56. The electric wire connections between these controls and their respective motors are indicated in Fig. 3.

In the operation of the device one or more plates are placed thereon as shown in Fig. 6. This may be done by the use of a crane in the usual manner. Two plates are shown on the device in the figures. The motors 56 and 19 are thereupon driven, being controlled by their respective controls 67 and 65, so as to move the plates toward the planer. During this operation the motor 38 is idle and it will be understood that the clutches 63 and 64 will provide for any undesirable variations in speeds between the bridge and rollers 51 although the operator will to a certain extent regulate these speeds by suitable maniplations of the controls. During this operation it will be understood that the runs of the chains between the oppositely disposed rollers will be kept taut by the chains moving over the sprocket portions of the rollers 51.

Suitable removable stops 3*a* are provided in a line longitudinally on the table 3, and in order to square up the plates at this stage, the plates will be moved against these stops. This may be accomplished by stopping the motor 19 just before the plates reach the stops, and starting the motor 38 so that the rollers 51 and 32 will move the plates the remainder of the way against the stops. The motors will then be stopped and the stops removed. The motors 19 and 56 are then again started and the plates moved to their desired positions for planing, as shown in Fig. 1. The motors are then stopped and the jacks 4 are brought to closed position so as to securely hold the plates for the planing operation. The bevelling operation or cutting of the edges of the plates will thereupon be accomplished by the planer in the usual manner. Upon completion of this bevelling operation the jacks are brought to open position. The motors 19 and 56 are driven in a direction reverse to that above mentioned when feeding the plates to the planer. The plates and bridge are thus brought back to the positions shown in Fig. 6.

The motor 56 is then stopped and the motors 38 and 19 are driven in suitable directions to move the bridge further forwardly as shown in Fig. 7. During this movement of the bridge the rollers 32 revolve in an opposite direction to the wheels 15. The rollers 51 do not revolve, the chains being thereby locked on the sprocket portions of the rollers 51. During this operation the plates do not move forwardly with the forward movement of the bridge but the chains move around the sprocket portions of the rollers 32 lengthening the runs of the chains between the oppositely disposed rollers, and the rollers 32 roll beneath the plates until they finally leave the plates at their forward edges, these edges of the plates then resting entirely on the chains. At these positions of the plates relative to the chains the bridge reaches substantially the position shown in Fig. 7. The motor 19 is then stopped and the motor 38 continued, whereupon the chains are further moved about the rollers 32 permitting the plates to take the tilting positions shown in Fig. 7.

This lowering continues and the motor 19 is driven to move the bridge toward the planer, the plates in due course taking the positions shown in Fig. 8, and subsequently the positions shown in Fig. 9, whereupon the motors 19 and 38 are stopped. In the latter positions the plates take tilting positions in the opposite directions due to the arms 47 bearing against the lower portion of the adjacent plate, and the arms 48*a* bearing against the upper portion of the adjacent plate. The upper ends of the plates thereupon fall over against the rollers 32.

The motors 19 and 56 are then driven in suitable directions to move the bridge away from the planer and raise the lower ends of the plates, giving the plates the angular positions shown in Fig. 10. The forward movement of the bridge is continued until it reaches the position of Fig. 11, which is its outermost position for the size of the plates being turned, whereupon the motor is stopped. The rotation of the rollers 51 is continued until the plates assume substantially horizontal positions, the plates in their upward movement being guided by the arms 48*a* as shown in Fig. 11. The longitudinal edges of the plates have now been reversed and the plates have been turned over.

As soon as the plates have reached this substantially horizontal position the motor 19 is driven to move the bridge in the direction of the planer, thereby causing the plates to ride up on the rollers 51 and on to the planer as shown in Fig. 6, the driving of the motor 56 being continued during this movement. The plates are thereupon ready to be positioned, as aforedescribed, for bevelling the edges thereof opposite to those first bevelled, and when the second bevelling operation is completed the motors are operated so as to bring the plates back to the position shown in Fig. 6, the operation cycle being thus completed. The plates are then removed from the device by a crane or other suitable apparatus.

While in describing the operation of the device a particular sequence of operations has been set forth for reversing and manipulating a plate (or plates) when the plate is to be operated upon by a machine such as a planer, it will be understood that the operator may, by suitable manipulation of the various controls, vary the sequence of operations to adapt the invention to different uses as he may find it desirable, the main use of the invention being to reverse or turn the plate over. Moreover, while various parts of the turn-over device are shown in the present instance secured to the planer, it will be understood that such parts may be secured to framework forming a part of the turn-over device.

While mention has been made during the description of the operation of the device of certain functions of the clutches 63 and 64, it will be understood that should excessive strains be placed upon the chains during any manipulation of the controls 65, 66 and 67, the clutches will provide a slippage and thereby prevent any injury to the device.

It will be apparent from the foregoing description that this invention provides a safe means for turning over the plates, which means may be controlled by a single operator. While an approved embodiment of the invention has been hereinbefore described, it will be apparent that

many and various changes and modifications may be made thereto in its form, structure and arrangement of parts, and it will be understood that all such changes and modifications as fall within the spirit of the present invention are contemplated as a part of the invention as defined in the appended claims.

The invention claimed and desired to be secured by Letters Patent is:

1. A device for handling metal plates to effect a turning over of the plates comprising plate conveyor means; a supporting means for said conveyor means; a second supporting means for said conveyor means oppositely disposed to the first said supporting means, at least one of said two supporting means being rotatable; means for preventing said conveyor means from slipping relative to either of said two supporting means; and manually controlled power operated means selectively operable for bodily moving one of said two supporting means relative to the other to vary the distance therebetween and for rotating at least one of said two supporting means for varying the length of said plate conveyor means between said two supporting means, whereby a plate may be reversed by turning said plate in a single direction from a horizontal position to a vertical position and further to a horizontal position again.

2. A device for handling metal plates to effect a turning over of the plates comprising plate conveyor means; a supporting means for said conveyor means; a second supporting means for said conveyor means oppositely disposed to the first said supporting means, at least one of said two supporting means being rotatable; means for preventing said conveyor means from slipping relative to either of said two supporting means; manually controlled power operated means selectively operable for bodily moving one of said two supporting means relative to the other to vary the distance therebetween and for rotating at least one of said two supporting means for varying the length of said plate conveyor means between said two supporting means, whereby a plate may be turned in a single direction from a horizontal position to an approximately vertical position; and means operable when said plate has been turned to an approximately vertical position inclined in one direction, by said movement of one of said two supporting means bodily toward the other, to further turn said plate in said single direction from said approximately vertical position inclined in one direction to an approximately vertical position inclined in the opposite direction, whereby said varying of the distance between said two supporting means and the length of said plate conveyor means therebetween may then be again effected to further turn said plate in said single direction to a horizontal position again.

3. A device for handling metal plates to effect a turning over of the plates comprising plate conveyor means; a supporting means for said conveyor means; a second supporting means for said conveyor means oppositely disposed to the first said supporting means, at least one of said two supporting means being rotatable; means for preventing said conveyor means from slipping relative to either of said two supporting means; manually controlled power operated means selectively operable for bodily moving one of said two supporting means relative to the other to vary the distance therebetween and for rotating at least one of said two supporting means for varying the length of said plate conveyor means between said two supporting means, whereby a plate may be turned in a single direction from a horizontal position to an approximately vertical position; plate engaging means fixed relative to one of said two supporting means; and plate engaging means fixed relative to the other of said two supporting means, said two plate engaging means extending between said two supporting means, and one of said two engaging means being disposed above the other, whereby when said plate has been turned to an approximately vertical position inclined in one direction said two engaging means will, upon said movement of one of said two supporting means bodily toward the other, tilt said plate to further turn said plate in said single direction to an approximately vertical position inclined in the opposite direction, whereby said varying of the distance between said two supporting means and the length of said plate conveyor means therebetween may then be again effected to further turn said plate in said single direction to a horizontal position again.

4. A device for handling metal plates to effect a turning over of the plates comprising plate conveyor means; a supporting means for said conveyor means; a second supporting means for said conveyor means oppositely disposed to the first said supporting means, each of said two supporting means being rotatable; means for preventing said conveyor means from slipping relative to either of said two supporting means; separate conveyor means associated with each of said two supporting means and rotatable for horizontally conveying a plate independently of the first said conveyor means; and manually controlled power operated means selectively operable for bodily moving one of said two supporting means relative to the other to vary the distance therebetween and for rotating at least one of said two supporting means for varying the length of the first said plate conveyor means between said two supporting means, whereby said plate may be reversed by turning said plate in a single direction from a horizontal position to a vertical position and further to a horizontal position again and for rotating at least one of the two said separate plate conveyor means to horizontally convey said plate independently of the first said conveyor means.

5. A device for handling metal plates to effect a turning over of the plates comprising a rotatable supporting means; a second rotatable supporting means; plate conveyor means extending between and supported by said two supporting means; separate plate conveyor means; means for preventing the first said conveyor means from slipping relative to either of said two supporting means; and manually controlled power operated means selectively operable for bodily moving one of said two supporting means relative to the other to vary the distance therebetween and for rotating at least one of said two supporting means for varying the length of the first said conveyor means between said two supporting means and for driving said separate conveyor means, whereby a plate may be reversed by the first said conveyor means turning said plate in a single direction from a horizontal position to a vertical position and further to a horizontal position again, and said plate may be conveyed horizontally by said separate conveyor means independently of the first said conveyor means.

6. A device for handling metal plates to effect the turning over of the plates comprising plate conveyor means; a supporting means for said conveyor means; a second supporting means for said conveyor means oppositely disposed to the first said supporting means, each of said two supporting means being rotatable; means carried by each of said two supporting means, rotatable therewith and engaging said conveyor means, preventing said conveyor means from slipping relative to either of said two supporting means and insuring movement of said conveyor means upon appropriate rotation of either of said two supporting means, whereby the length of said conveyor means between said two supporting means may be varied; and manually controlled power operated means selectively operable for bodily moving one of said two supporting means relative to the other to vary the distance therebetween and for rotating at least one of said two supporting means for varying the length of said plate conveyor means between said two supporting means, whereby a plate may be reversed by turning said plate in a single direction from a horizontal position to a vertical position and further to a horizontal position again.

7. A device for handling metal plates to effect a turning over of the plates comprising plate conveyor means; a supporting means for said conveyor means; a second supporting means for said conveyor means oppositely disposed to the first said supporting means, each of said two supporting means being rotatable; means for preventing said conveyor means from slipping relative to either of said two supporting means; separate manually controlled power operated means for each of said two supporting means for rotating same selectively operable for varying the length of said conveyor means between said two supporting means; and manually controlled power operated means operable for bodily moving one of said two supporting means relative to the other to vary the distance between said two supporting means, whereby a plate may be reversed by turning said plate in a single direction from a horizontal position to a vertical position and further to a horizontal position again.

8. A device for handling metal plates to effect a turning over of the plates comprising plate conveyor means; a supporting means for said conveyor means; a second supporting means for said conveyor means oppositely disposed to the first said supporting means, each of said two supporting means being rotatable; means for preventing said conveyor means from slipping relative to either of said two supporting means; separate manually controlled power operated means for each of said two supporting means for rotating same selectively operable for varying the length of said conveyor means between said two supporting means; manually controlled power operated means operable for bodily moving one of said two supporting means relative to the other to vary the distance between said two supporting means, whereby a plate may be reversed by turning said plate in a single direction from a horizontal position to a vertical position and further to a horizontal position again; and friction clutch means disposed between at least one of said power operated means and its operatively connected parts permitting slipping between said power operated means and said operatively connected parts under loads beyond a predetermined amount.

9. A device for handling metal plates to effect a turning over of the plates comprising plate conveyor means; a supporting means for said conveyor means; a second supporting means for said conveyor means oppositely disposed to the first said supporting means, each of said two supporting means being rotatable; means for preventing said conveyor means from slipping relative to either of said two supporting means; separate manually controlled power operated means for each of said two supporting means for rotating same selectively operable for varying the length of said two conveyor means between said supporting means; manually controlled power operated means operable for bodily moving one of said two supporting means relative to the other to vary the distance between said two supporting means, whereby a plate may be reversed by turning said plate in a single direction from a horizontal position to a vertical position and further to a horizontal position again; and separate friction clutch means, one disposed between the last mentioned power operated means and its operatively connected parts and another disposed between one of said separate power operated means and its operatively connected parts permitting slipping between said operatively connected parts and their respective power operated means.

10. A device for handling metal plates to effect a turning over of said plates comprising plate conveyor means; a supporting means for said conveyor means; a second supporting means for said conveyor means oppositely disposed to the first said supporting means; means for varying the length of said conveyor means between said two supporting means; and driving means selectively operable for bodily moving one of said two supporting means relative to the other to vary the distance therebetween and for operating said length varying means, whereby a plate may be reversed by turning said plate in a single direction from a horizontal position to a vertical position and further to a horizontal position again.

GEORGE K. HULL.
RALPH L. DRAKE.