United States Patent

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[33] **Canada**
[31] **37,706**

[54] **TURNOVER APPARATUS**
10 Claims, 2 Drawing Figs.

[52] **U.S. Cl.** **214/1QA, 198/33AD**
[51] **Int. Cl.** **B65g 7/00**
[50] **Field of Search** ..... 214/1 R, 1 RA, 1 R7, 130, 130 A, 130 C, 313, 314; 198/219, 33 R4

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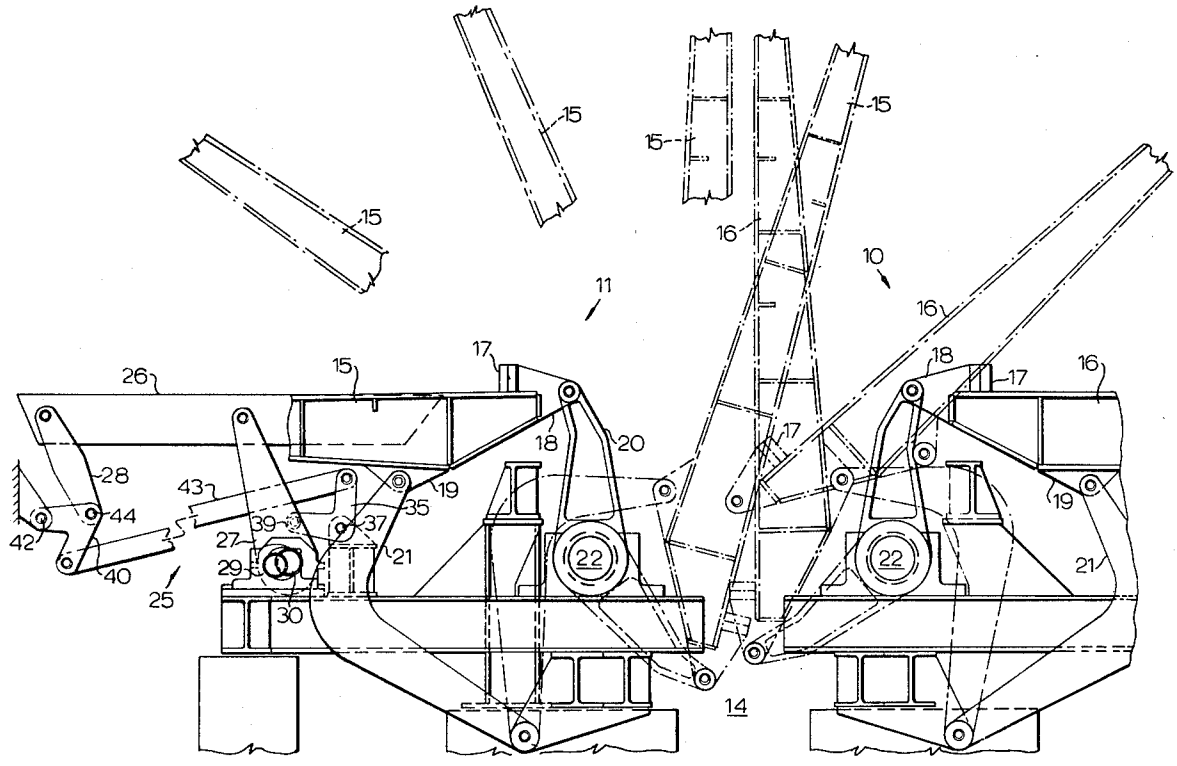
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ABSTRACT: The disclosure of the present invention relates to a device for turning a rolled steelplate from a faceup to a facedown position, where the plate is caused to pass from an horizontal receiving position to an intermediate vertical position and, finally, to an horizontal discharge position. The device includes two tipping arms, one located in the receiving position and the other in the discharge position, adapted to be brought into the intermediate position for effecting a turning and transferring of the plate. The arms are mounted on separate rotatable shafts located in the intermediate position where they are connected to inboard arms so constructed and located as to cause the inboard edge of the plate to drop down below the receiving position. Additional arms are connected to the outboard end of the tipping arms.



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SHEET 1 OF 2

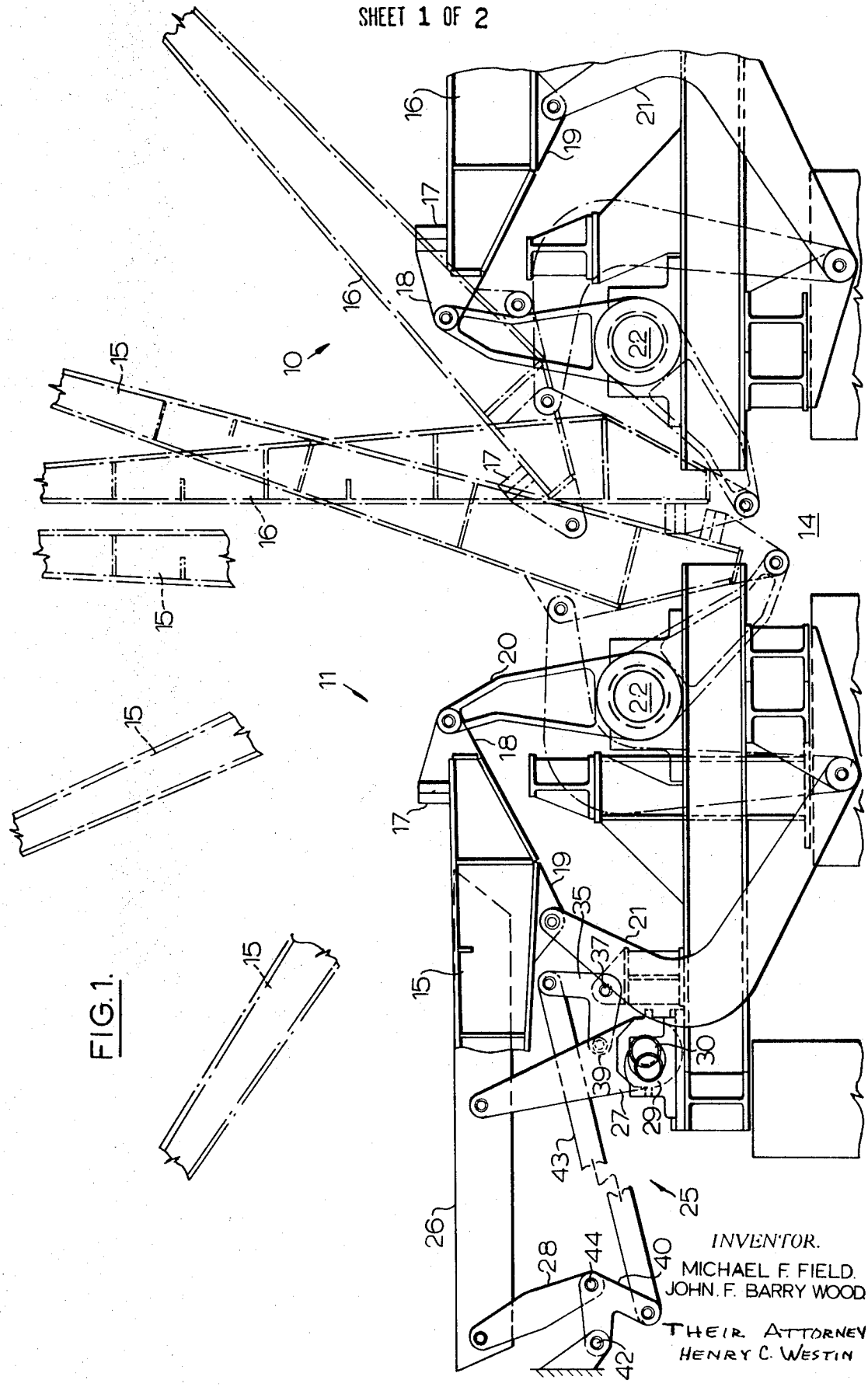


FIG. 1.

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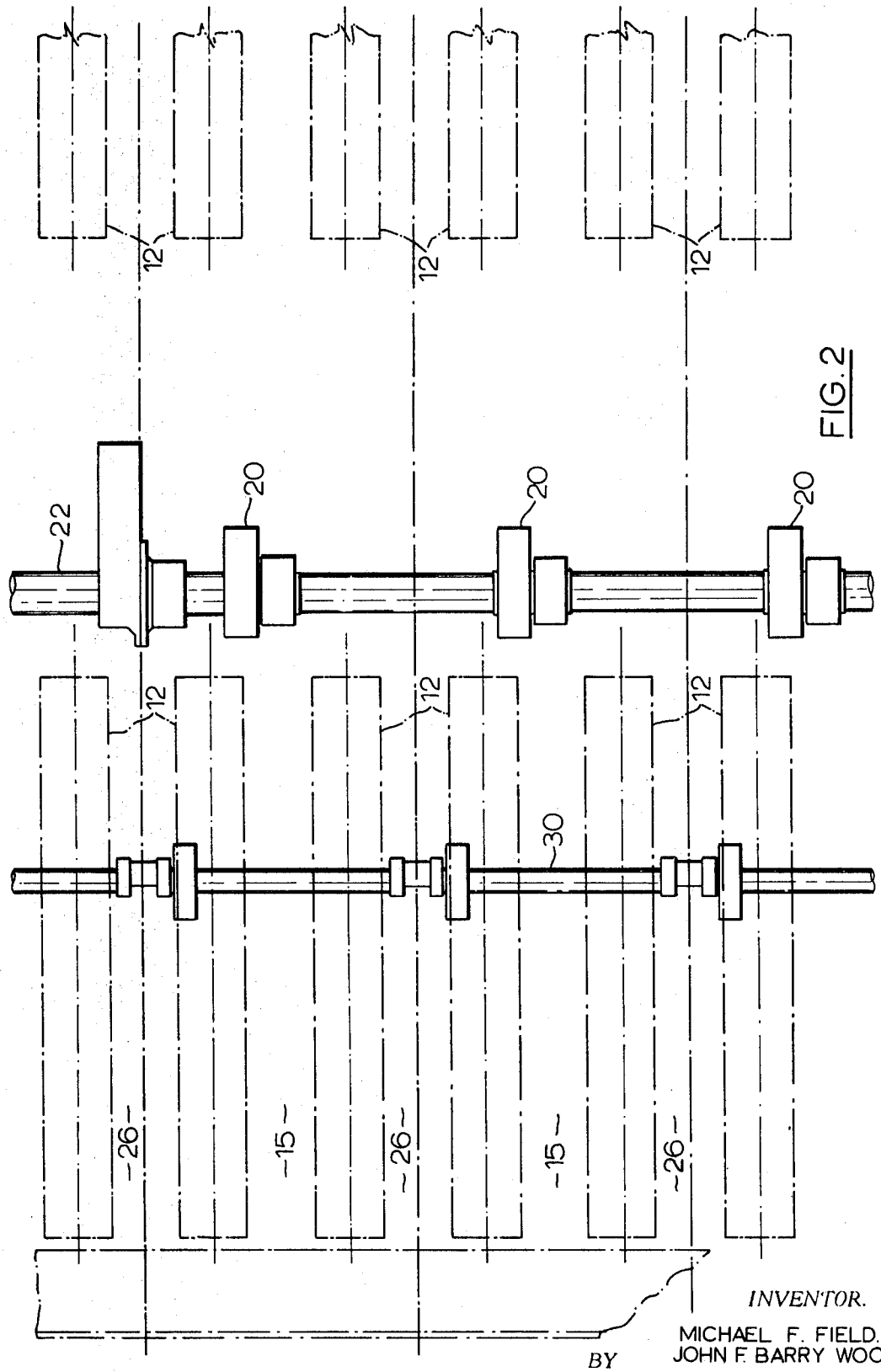


FIG. 2

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TURNOVER APPARATUS

This invention is directed to plate-positioning means and, in particular, to a plate rollover for use in a plate mill.

In the operation of plate mills in which steelplate is passed through rolling mills in reducing the thickness of the plate to the desired value, it is necessary to turn the plate from a faceup to a facedown position. Owing to the large sizes and weights involved, the size of structure necessary for such handling operations becomes excessive, while the apparatus provided must permit handling of the plate without undue bruising or scoring.

The present invention provides a plate rollover by means of which a plate may be moved from a first rolling table zone to an adjacent rolling table zone, being transferred from a faceup position to a facedown position, while effecting the tipping of the plate to provide positive support at all times, and to economize in the necessary expenditure of energy by lowering the center of gravity of the plate when in a vertical condition to a position less than half the width of the plate, thereby minimizing the torque requirements of the rollover mechanism. The subject rollover may be used for inspection and shipping purposes, and/or in conjunction with a rolling mill.

In addition there is provided a reversible plate-shuffling gear for lateral repositioning of the plate relative to the table rolls and the rollover mechanism by a lifting and nonjamming traverse motion whereby direct and bruising impingement against the sides of the plate is avoided. By providing shuffle bars on which a plate may skid, jamming impingement of the plate sides against fixed structure is avoided, with the plate sliding over the top surfaces of the shuffle bars when any side contact occurs.

The present invention thus provides in a plate rollover having a first plate location zone, a second plate location zone and an intermediate zone therebetween, and elongated plate support means extending outwardly substantially horizontally from the intermediate zone across at least a portion of the first zone to provide a coplanar plate support surface, the improvement comprising inboard tipping means connected with an inner portion of the support means adjacent the intermediate zone to provide transverse inward and downward displacement of the inner end of the support means, and outboard tipping means connected with the support means at a position located outwardly of the first tipping means, to provide transverse inward and upward displacement of the outer end of the support means whereby in operation a plate located on the support means may be moved from a starting datum in the first zone towards the second zone, into an inclined attitude extending as far as the vertical while maintaining the center of gravity of the plate at a height above the datum less than half the width of the plate.

The plate rollover thus provided further includes a plurality of plate-shuffling means located between adjacent ones of the elongated plate support means, and means to transverse the shuffling means substantially parallel with the support means in nonjamming plate shuffling relation.

Certain embodiments of the present invention are described, reference being had to the accompanying drawings wherein:

FIG. 1 is a sectional elevation of an embodiment according to the present invention; and

FIG. 2 is a plan view of a portion of the embodiment illustrating the spatial relationships of the individual components.

Referring first to FIG. 1 there is illustrated a rollover embodiment for inspection and shipping purposes, having a first roll table 10 and a second roll table 11, each table having a plurality of table rolls 12. An intermediate zone 14 extends between the table 10 and 11.

Each of the tables 10 and 11 is equipped with a tipping means 15 comprising a plurality of tipping arms 16 of composite braced structure including an inboard plate stop 17 and attachment brackets 18, 19 by means of which an inboard radius arm 20 and an outboard radius arm 21 are pivotally attached to the tipping arm 15.

Each of the tipping means 15 of the respective first and second tables is rotatably mounted on a respective tipping shaft 22 located in the intermediate zone 14 adjacent the inboard ends of the table rolls 12.

Plate-shuffling means 25 are illustrated in relation to the second roll table for purposes of convenience, and comprise a plurality of lifting bars 26 interposed between alternate adjacent ones of the table rolls 12. The lifting bars 26 have an inboard support arm 27 and outboard support arm 28. The inboard arm 27 is crank mounted at its lower end 29 for rotation about the axis of a shuffle actuating shaft 30.

A bellcrank 35 is pivotally mounted at 37, having one of the arms of the crank 35 pivotally attached at 39 to the inboard support arm 27. A corresponding outboard bellcrank 40 is pivotally mounted at 42, being connected for substantially parallel movement with the crank 35 by way of a connecting rod 43. The outboard shuffle support arm 28 is pivotally mounted at 44 to the bellcrank 40.

In operation of the shuffling means 25 rotation of the actuating shaft 30 produces orbital displacement of the lifting bars 26. The bar 26, which remains substantially horizontal in operation moves between a lower position beneath the level of the table rolls 12 and the tipping arms 16 to an upper position in plate-lifting relation above the upper level of the table rolls 12 or the arms 16, while moving leftward or rightward, away from or towards the intermediate zone 14 in dependence upon the direction of rotation of the shuffle-actuating shaft 30.

Upon entry of a plate into the vicinity of the rollover by way of the roll tables, actuation of the appropriate table-shuffling means in an inboard direction shuffles the plate against the backstop 17 of the respective tipping arms. Actuation of the related tipping shaft 22 then raises the plate in an inclined relation towards the intermediate zone 14, the inboard edge of the plate being dropped down below the top level of the table rolls. As the tipping arms move towards a vertical position, the tipping arms 16 of the other roll table may be actuated upwardly into a position substantially parallel with the other set of tipping arms on the adjacent table and the two arms may then be moved past the vertical position to transfer the plate onto the tipping arms of the other table, by means of which the plate may then be lowered onto the table surface. If desired, the shuffling means 25 of the other table then may be actuated to displace the plate in an outward direction away from the stop 17, for facedown movement away from the rollover.

Owing to the mode of operation of the tipping means in effecting transfer of the plate whereby the center of gravity of the plate when in the vertical position is raised to a height less than half the width of the plate, the power and structural requirements of the rollover are effectively reduced.

The shuffling means 25, while providing lift up of the plate from off the table rolls also permits skidding of the shuffle-lifting bars 26 in relation to the plate under surface, so that damage to the plate edges, the shuffling apparatus and the tipping portion of the rollover is substantially precluded when plate steps are contacted.

While the preferred embodiment incorporates the use of inboard and outboard radius arms 20, 21 in supporting relation with the tipping arms 16, it is contemplated that a suitable curved track or tracks may be substituted for these arms, with the provision of suitable roller means connected with the arm 16.

It will be understood that the reduced plate headroom requirement will additionally reduce the necessary headroom provision, with consequent reduction of building and crane elevations.

In accordance with the provisions of the patent statutes, we have explained the principle and operation of our invention and have illustrated and described what we consider to represent the best embodiment thereof.

We claim:

1. In a plate rollover having a first plate location zone, a second plate location zone and an intermediate zone therebetween, and elongated plate support means extending

outwardly substantially horizontally from said intermediate zone across at least a portion of said first zone to provide a coplanar plate support surface, the improvement comprising inboard tipping means connected with an inner portion of said support means adjacent said intermediate zone to provide transverse inward and downward displacement of the inner end of said support means, and outboard tipping means connected with said support means at a position located outwardly of said first tipping means, to provide transverse inward and upward displacement of the outer end of said support means, whereby in operation a plate located on said support means may be moved from a starting datum in said first zone towards said second zone, into an inclined attitude extending as far as the vertical while maintaining the center of gravity of said plate at a height above said datum less than half the width of the plate.

2. The plate rollover as claimed in claim 1, wherein said tipping means includes an inboard radius arm and an outboard radius arm each pivotally attached to said plate support means, said outboard radius arm being of greater length than said inboard arm, and shaft means rotatably supporting said arms for rotational displacement about a common axis.

3. The plate rollover as claimed in claim 1, wherein said tipping means includes at least one curved track, and means connecting said track with said plate support means to provide predetermined changes in elevation of a portion of said plate support means on operation of said tipping means.

4. The plate rollover as claimed in claim 1 in combination with a plurality of table rolls for transporting said plate, the upper plate support plane defined by said rolls lying above said plate support means when in a lowered condition.

5. The plate rollover as claimed in claim 1 including second elongated plate support means extending outwardly from said intermediate zone across at least a portion of said second plate location zone, having inboard tipping means and outboard tipping means to provide lowering of the inner end of said plate support means and raising of the outer end of said plate support means on movement thereof towards said intermediate zone, and plate support control means whereby said first zone support means and said second support means may be raised into adjacent plate transfer relationship, whereby a said plate may be transferred from a faceup condition in one said zone to a facedown condition in the other said zone.

6. The plate rollover as claimed in claim 5 including first plate-shuffling means in said first zone and second plate-shuffling means in said second zone, and means to traverse said shuffling means substantially parallel with said plate support means to provide substantially horizontal displacement of a said plate relative to said intermediate zone.

7. The plate rollover as claimed in claim 1 including a plurality of plate-shuffling means located between adjacent ones of said elongated plate support means, and means to traverse said shuffling means substantially parallel with said support means in nonjamming plate shuffling relation.

8. The plate rollover as claimed in claim 7 wherein said plate-shuffling means each includes a substantially horizontal plate-lifting bar, inboard and outboard support means connected thereto, and shuffler driving means to provide vertical and horizontal displacement to said support means to drive the top surface of said lifting bar in a path having horizontal and vertical components of reciprocating motion, whereby in operation an upper portion of said bar is raised from beneath into lifting and nonjamming transverse engaging relation with a said plate located in said zone.

9. The plate rollover as claimed in claim 8 wherein said support means includes an inboard and an outboard connecting rod each extending downwardly from said lifting bar, and reversible crank means connected in driving relation with the connecting rods, whereby said lifting bar may be selectively operated in plate-traversing relation towards or away from said intermediate zone.

10. A plate rollover for transferring a plate from a first roll table to a second roll table, comprising; plate-shuffling means having a plurality of plate-lifting bars extending between alternate adjacent ones of the rolls of a said table and means to traverse said bar substantially parallel with the rolls in plate-raising and frictional positioning relation relative to a zone intermediate said first and second tables; and plate support means extending from said intermediate zone across said first and said second tables, each having a plurality of individual arms extending between alternate adjacent ones of said rolls in alternating relation with said lifting bars, and located below the top surface of said table rolls when in the lowered condition; arm-tipping means including an inboard radius arm and an outboard radius arm of greater length attached to each said tipping arm and a pair of tipping shafts located in said intermediate zone in substantially parallel relation having the radius arm of the respective said first and second table-tipping means attached thereto to provide synchronized operation for each said plate support means; and control means for operating said tipping shafts whereby a plate on one table may be raised in a faceup condition to a position tilted towards said intermediate zone, secured in a vertical position between the two said plate support means, and lowered in a facedown condition to the other said table.