This invention relates to feed tables for rolling mills or the like, and more particularly to traveling tilting tables of the type used for conveying and manipulating billets, slabs, blooms, bars, or other articles for the purpose of feeding them to the passes of the mills and receiving them therefrom.

One of the objects of the invention is to provide novel means for operating a feed table of this type, means for effecting the various movements thereof, and also means for effectively balancing and cushioning the table during its tilting movements.

Another object of the invention is the provision of novel manipulating mechanism for the billets or other articles to be conveyed by the table, comprising cooperating laterally shifting mechanism and turning or "kick-up" mechanism, each capable of independent operation or both capable of simultaneous operation to move the article to the proper position to be fed to the mill. A related object is to provide in this connection a guide resiliently and adjustably mounted upon the table to cooperate with the manipulating mechanism in moving the articles thereon.

Further objects and purposes will be apparent from the following specification when read in connection with the accompanying drawings, in which one embodiment of my invention is illustrated by way of example.

In the drawings:

Figure 1 is a side elevation of a traveling table embodying the principles of my invention showing its operative relation to a rolling mill and in which certain parts are omitted or shown diagrammatically for the sake of clearness;

Figure 2 is a plan view of the table with the operator's platform removed;

Figure 3 is a side elevation of the table shown in Figure 2;

Figure 4 is a transverse cross-sectional view taken on line 4—4 of Figure 2;

Figure 5 is an enlarged transverse cross-sectional view taken on line 5—5 of Figure 2 and illustrating the movement of the manipulator mechanism;

Figures 6, 7 and 8 are sectional views showing the movements of the manipulator mechanism;

(a) handling a relatively flat article such as a slab;

(b) Figures 9, 10 and 11 are sectional views showing the movements of the manipulator in handling a billet or bloom; and

Figure 12 is a diagrammatic view of one of the manipulators, showing the limiting positions of the shifter mechanism at which the turning or "kick-up" mechanism may be operated.

Referring particularly to Figure 1 of the drawings, the numeral 10 designates a rolling mill unit or stand of rolls which may be one of a series of such units mounted side by side at spaced intervals upon the shoes 11 carried by the foundations 12. The rolling mill illustrated is of the three-high type, having a pass or a series of passes for the articles to be rolled between the lowest roll and the middle roll and also between the middle and the top rolls. In order to convey the billets or other articles to the proper positions to be presented to the passes, there is provided a traveling tilting table designated generally by the numeral 13. The table device comprises essentially the main frame or carriage 14 and the tilting conveyor or table 15. The main frame or carriage 14 is provided with wheels 16 adapted to travel on the tracks 17 disposed in parallel relation to the stands of rolls 10. Mounted upon the carriage 14 at any convenient point, but preferably near the rear end thereof, is the elevated operator's platform 18 which is provided with the usual control devices and access to which may be obtained in any desired manner.

To effect the lateral travel of the carriage along the tracks 17, certain of the wheels 16 are geared or otherwise operatively connected to the cross-travel shaft 20 as at 21. Shaft 20 is driven by means of the electric motor 22 through the transmission mechanism comprising gear train 23, shaft 24 and gear train 25. The motor shaft is controlled by the magnetic brake 26. The wheels 16 are provided with the conventional journal boxes 27 and guards or fenders 28.

The tilting table 15 is provided with trunnions 30 which are adapted to rotate in bearings 31 carried by the rear end of the carriage 14. The forward end of the carriage 14 is provided with the spaced vertical guides 33 which are adapted to slidably receive between them the downwardly projecting member 36 secured to the table 15 near its forward end. The member 36 is provided with the gibbs or wear plates 37.

Received in bearings 39 near the forward end of the carriage 14 is the transverse crank shaft 40 provided with the crank portions 41. A bracket 42 is rotatably mounted on the crank portions 41 and is adapted to rotatably receive at its upper end the cross-shaft 43 secured between the side beams 44 of the table 15. The crank shaft 40 is rotated by means of the motor 45 through the worm gearing 46, the motor shaft being controlled by the magnetic brake 47. It will be readily apparent that when the crank shaft 40 is rotated, the forward end of the table 15 may be raised and lowered, thus tilting the table about the trunnions 30. By these means, the forward end of the table may be positioned adjacent the passes between the bottom and middle rolls or between the middle and top rolls of the mill as desired.

In order to balance the weight of the table 15 and to cushion the device against shocks incident
to the raising and lowering of the table, there is
provided a pneumatic device which will now be
described. At the forward end of the carriage 14
upon either side of the guides 35, there are dis-
posed the cylinders 50 which are adapted to re-
ceive the hollow plungers 51. Suitable packing
52 is clamped between the rings 53 by means of the
clamping devices comprising collars 54 and
55 to provide a fluid tight fit between the
walls of the plunger 51 and those of the cylin-
der 50 at the upper end thereof. Since the table 15
moves through an arcuate path when tilted, and
the plungers 51 move vertically in the cylinders 50,
there is provided a relatively loose connection be-
tween them which comprises the shafts 56 which
occupy the hollow tapered interior of the plun-
gers 51 and rest at their lower ends upon the seat
57 at the bottom of the hollow plungers. The up-
per ends of these shafts 56 are pivotally received
in the sockets 58 secured to the lower flanges of the
side beams 44 of the table.
To provide the proper balance and resiliency
for this mechanism, a suitable fluid, such as com-
pressed air, is supplied to the cylinders 50 by
means of the compressor 60 carried by the car-
riage 14. The air is forced into the balancing
tank 61 through the conduits 62 and from there
it may pass to and from the cylinders 50 through
the conduits 63. By means of suitable valves
and controls, the fluid may be supplied to the
tank 61 and cylinders 50 at the proper pressure
and vented therefrom in such manner as to bal-
ance the weight of the table 15 and the articles
10 carried thereby so as to relieve the lifting mecha-
nism from undue strain.

The table 15 is provided with the driven rollers
65, the reduced ends of which are mounted in the
bearings 66. The rollers 65 are operatively con-
ected by means of the bevel gears contained in
housings 67 to the longitudinal shifting 68. This
shifting 68 is driven by means of the motor 69
through the gearing encased in the housing 70.
The motor 69 and gearing 70 are carried by a
lateral extension 71 of the rear end of the table.
15 A platform or run-way 72 may be provided
above the shifting 68, as illustrated in Figures 4
and 5. The bearings 66 for the rollers 65 are car-
ried by the side frames 75 and 76, which are
mounted on the beams 44. Above the level of
the rollers 65, the side frame 75 is provided with
the guide or guard 77 and the opposite side frame
76 and resiliently the movable
side guide or guard 78. At intervals the
side frames 76 are provided with upstanding en-
larged portions 80 which alternate with the roller
bearings 66. At corresponding intervals there is
rigidly secured to the side guard 78 the members
81 which are adapted to be inserted in the recess
82 in the portions 80. The members 81 are pro-
vided with hollow projecting portions 83 which
are adapted to enter the reduced recess 84 of the
portion 80. The part 83 of the member 81 is
provided with a recess 85 which is adapted to
contain the coil spring 86 which bears against
10 the wall 87 of the portion 80 and the inner wall
88 of the element 81 and tends to constantly urge
the members 80 and 81 apart. A bolt 90 having
a head 91 received in the recess 82 of the mem-
ber 81, passes through the opening 93 in the
wall 88, through the recess or chamfer 85 and
through the opening 94 in the wall 87. Threaded
upon the projecting outer ends of the bolts 90
are the nuts 95. These bolts 90 serve to secure
the guide 78 to the portions 80 of the side frames
76 against the compression of the spring 86 and
by the proper adjustment of the nuts 96 the nor-
15 mal position of the side guard 78 may be de-
termined. It will thus be seen that the outer
side guard 78 is provided with buffer or cush-
ioning mechanism by means of which any shocks
that it might sustain incidental to the manip-
ulation of articles carried by the table may be
absorbed and dissipated.

For the purpose of shifting the billets or other
articles carried by the table from side to side
thereof and also for rotating or inverting them
for their proper presentation to the roll paths,
there is provided the manipulating mechanism
which will now be described. At suitable inter-
10 vals the side beams 44 of the table 15 are pro-
vided with the castings 100 which extend from
one of these beams to the other. These castings
are provided with bearings 101 and 102 which are
adapted to rotateably receive the longitudinally
extending rock shafts 103 and 104 respectively.
Keyed to the rock shaft 103 at suitable inter-
vals are the collars 105 of the swinging mem-
bers or levers 106. The rock shaft 103 is sus-
ceptible of rotation through an arc which will
permit the member 106 to move from the solid
blue position to the dotted line position shown
in Figure 5. These limits of movement corre-
15 spond to the positions designated C and A in
Figure 12.

The member 106 is adapted to pass through an
opening in the block 107 which is mounted for
reciprocation along the member 106. The mem-
ber or block 107 is preferably provided with the
stepped portion 108. Pivotally connected to the
block 107 as at 109 is the link 110 which is piv-
otted at its opposite end to the crank arm 111 as
at 112. The crank arm 111 is provided with a
15 sleeve portion 113 which is keyed to the shaft 104.
When both the shifting member 106 and the
crank arm 111 are in their lowermost positions
the various elements are disposed as shown in
the full line position in Figure 5, in which the
block 107 will be extended slightly along the
member 106 and both of members 106 and 107
will be disposed below the level of the upper
surfaces of the rolls 65.

15 The right hand end of the shaft 103, as shown
in Figure 2, is provided with the segmental bevel
gear 115 which is adapted to mesh with the seg-
mamental gear 116 carried by the crank 117 which
is mounted upon the frame of the table 15 for
pivot movement as at 118. The crank 117 is
provided with a pair of spaced arms 119 which
are pivoted to the connecting rod 120 as at 121.

Mounted in bearings 122 carried by the carriage
14 is the crank shaft 123 provided with the crank
portion 124 which is pivotally connected to the
left hand end of the connecting rod 120 as seen
in Figures 1 and 3. Crank shaft 123 is driven
by the motor 125 by means of the worm gear 126
and is controlled by the magnetic brake 127. The
rock shaft 104 is similarly provided at its right
hand end as shown in Figure 2 with the bevel
segmental gear 128 which meshes with the gear
129 carried by the crank 130 which is pivoted to
the frame of the table as provided with the arms 132 which are pivotally
connected to the connecting rod 133 as at 134. A
145 crank shaft 135 is mounted in bearings 136 car-
rried by the carriage 14 and is provided with the
crank portion 137 which is pivotally connected
to the opposite end of the connecting rod 133.
Shaft 135 is driven by the motor 138 through the
150
worm gear 139 and is controlled by the magnetic brake 140. It will thus be seen that by means of the mechanism just described, the rock shafts 103 and 104 may be independently rotated in either direction and at any position of the tilting table 15.

In Figure 12, letters A and B indicate the limits of movement of the shifting member 106 between which the "kick-up" member 107 can operate.

Figures 6, 7, and 8 illustrate some of the movements of the shifting member 106 and the "kick-up" member 107 when handling a piece of flat work, such as a slab or plate, indicated by the numeral 150 in Figure 6. In this Figure the manipulator is shown in its lowermost retracted position. Figure 7 illustrates the use of the shifting member 106 alone for raising the slab 150 from the position shown in Figure 8 to one in which it is resting upon its edge. Figure 8 illustrates the use of a "kick-up" member 107 in turning said slab 150.

Figures 9, 10, and 11 show the manipulator as used in connection with handling a billet or bloom 160. In Figure 9, the shifting member 106 has been used alone to move the billet 160 laterally of the table 15 against the side guard 78. In Figure 10, the shifting member 106 occupies the same position as in Figure 9, but the "kick-up" member 107 is shown extended and in the act of rotating the billet 160 about its longitudinal axis through contact with the corner and sides of the billet by the stepped portion 108 of the member 107. Figure 11 shows the shifting member 106 in an intermediate position and the "kick-up" member 107 still further extended along the member 106 with the corner edge of the billet engaged by the lowermost ledge of the stepped portion 108.

Although but a few of the possible positions and uses to which the manipulator mechanism can be put have been illustrated, many other functions and combinations of uses of the two article engaging members 106 and 107 will occur to persons skilled in the art.

Furthermore, it will be apparent that various changes and modifications can be made in the embodiment illustrated without departing from the scope of the invention as defined in the subjoined claims.

Having thus described the invention, what is claimed as new and desired to be secured by Letters Patent is:

1. In a self-contained feed table arrangement for rolling mills, or the like, in combination, a movable supporting carriage, a tilting table mounted on said carriage, means for tilting said table, a pneumatic device mounted on said carriage for effecting said tilting movement, and means also mounted on said carriage for supplying gaseous fluid to said device.

2. In a self-contained feed table arrangement for rolling mills or the like, comprising a traveling carriage, a table supported by said carriage for tilting movement in a vertical plane, and means for effecting said tilting movement of said table, the combination of a cylinder mounted upon said carriage, a plunger disposed for reciprocation in said cylinder, means providing a loose connection between said plunger and said table, a balancing tank in communication with said cylinder, and a compressor for supplying fluid to said balancing tank and said cylinder, said tank and said compressor also being mounted on said carriage.

8. In a feed table arrangement for rolling mills or the like, a carriage, a tiltable table pivoted near one end of said carriage, means for tilting said table, a pair of cylinders vertically disposed upon said carriage near the other end and adapted in pairs of inwardly facing guides disposed between said cylinders, a guide frame extending downwardly from said table and arranged to cooperate with said guides, a plunger disposed for vertical reciprocation within each of said cylinders, a socket in each of said plungers extending substantially the entire length thereof and terminating in a seat at its lower end, a seat disposed upon the under surface of said table that is disposed between said sockets, the seats on the under surface of said table being adapted to bear upon the upper ends of said shafts, and means carried by said carriage to supply fluid to said cylinders.

4. In an article handling device for rolling mills or the like, a manipulator comprising a reciprocating article engaging member and another article engaging member carried by said oscillating member and bodily movable with respect thereto.

5. In an article handling device for rolling mills or the like, a manipulator comprising a pivotally mounted article engaging member and another article engaging member mounted for longitudinal reciprocation thereon.

6. In an article handling device for rolling mills or the like, a manipulator comprising a pivotally mounted article engaging member, an article engaging block carried by said arm and slidably thereon, and independently operable means for swinging said arm about its pivot and for sliding said arm block along said arm.

7. In an article handling device for rolling mills or the like, a manipulator comprising a pivotally mounted article engaging member, an article engaging block carried by said arm and slidable thereon and provided with a series of steps for engaging said articles, and independently operable means for swinging said arm about its pivot and for sliding said block along said arm.

8. In an article handling device for rolling mills or the like, a table, a member pivoted at a point beneath said table and adapted to swing laterally therefrom in a vertical plane to move articles from one side of said table to the other, a block slidable along said swinging member at any point during a portion of its movement and adapted to engage said articles from beneath.

9. In an article handling device for rolling mills or the like, a table, a member pivoted at a point beneath the top of said table and at one side of the longitudinal center line thereof, said member being adapted to swing laterally in a vertical plane to move articles from one side of said table to the other, a block slidable along said swinging member at any point beneath the top of said table and at the opposite side of the longitudinal center line from the pivot point of the first named member.

10. In an article handling device for rolling mills or the like, a main supporting frame, a table movably mounted on said frame, a manipulator carried by said table and movable therewith, and comprising a laterally swinging article shifting member and a cooperating article engaging member mounted for longitudinal reciprocation upon said shifting member, power means...
10 for actuating said manipulator mounted on said frame, and operative connections between said power means and said manipulator so arranged that the manipulator may be actuated at any position of the table.

11 In a feed table for rolling mills or the like, in combination, a traveling carriage, a tilting table pivotally mounted on said carriage, a manipulator carried by said table comprising a pair of longitudinal rock shafts mounted in bearings beneath the top of said table, a swinging article shifting member carried by one of said rock shafts, a reciprocating article engaging member slidingly mounted on said shifting member, a swinging arm carried by the other of said rock shafts, a link connecting said arm with said reciprocating article engaging member, crank arms mounted on said table and operatively connected with said rock shafts, independently operable power means mounted on said carriage, crank arms mounted on said carriage and operatively connected with said power means, and connecting rods joining said frame supported crank arm and said table mounted crank arm, whereby said article shifting member and said reciprocating article engaging member may be independently actuated at any position of said tilting table.

12 In a device of the class described, in combination, a supporting frame, a tilting table pivotally connected to said frame near one of its ends, rock shafts extending longitudinally of said table, article manipulating members operably connected with said rock shafts, crank arms mounted on said table relatively near its pivot point and operatively connected to said rock shafts, power means on said frame, crank arms mounted on said frame at points nearer the opposite end of said table than said first named crank arms, elongated connecting rods joining said frame supported crank arms with said table mounted crank arms, whereby said manipulating members may be actuated at any position of said table.

13 In a conveyor, in combination, a side guide, a frame member projecting upwardly outwardly beyond said side guide, an inwardly facing recess formed in said frame member, a member rigid with said side guide and adapted to enter said recess, a securing bolt adapted to pass through said member, said recess, and said frame member and to project outwardly beyond said frame member, a coil spring disposed in said recess and adapted to urge said members apart, and nuts threaded upon the projecting ends of said bolts and adapted to be tightened thereon against the pressure of said spring whereby said side guide may be adjusted laterally of said conveyor.

14 In a self-contained feed table arrangement for rolling mills or the like, in combination, a traveling support carriage, a tilting table pivotally mounted on said carriage and provided with driven rolls for moving articles longitudinally thereof, a crank for tilting said table, a pair of parallel longitudinally extending rock shafts mounted in bearings beneath the rolls of said table, power means for independently rocking said shafts mounted on said carriage, cranks and connecting rods for transmitting motion from said power means to said rock shafts, article manipulators adapted to operate between certain of said rolls and comprising swinging article engaging members associated with one of said rock shafts and a reciprocating article engaging member carried by each of said swinging members and operatively connected to the other of said rock shafts, a resiliently and adjustably mounted side guide for said table adapted to cushion and absorb shocks received incidental to moving said articles, said manipulators adapted to operate at any position of said table and power means carried by said carriage for effecting the travel thereof, and for tilting said table, as well as for actuating said manipulators.

15 In a self-contained feed table for rolling mills or the like, in combination, a traveling support carriage, a tilting table carried by said carriage, means on said carriage for tilting said table, a pneumatic balancing and shock absorbing means entirely supported upon said carriage and comprising a cylinder, a plunger adapted for reciprocation within said cylinder and connected with said table, a balancing chamber communicating with said cylinder for the reception and compression of the gaseous fluid from said cylinder when said plunger is in its lowermost position, whereby the weight of said table is substantially balanced and the operation of said tilting means is facilitated.

16 A side guide arrangement for a conveyor or the like comprising, in combination, a guide member, a relatively stationary frame member disposed outwardly beyond said guide member, a series of inwardly opening chambers formed in said frame member, a series of elements projecting from said guide member and adapted to slidably fit within one of said chambers, said elements having recessed ends, a coil spring adapted to be disposed within each of said recessed ends and to be compressed between the interior end walls of one of said recesses and of its corresponding chamber, and means for connecting said guide member and said frame member for relative movement permitted by the compression of said springs.

17 In a feed table arrangement for rolling mills or the like, a support, a tilting table carried by said support, means for tilting said table, a guide frame projecting downwardly from said table, a pair of laterally spaced balancing members on a laterally facing support, pistons resiliently received within said cylinders and adapted to contact with said table at laterally spaced points, inwardly and mutually facing guide members each respectively formed integrally with one of said cylinders, and a guide frame carried by said table between said pistons, projecting downwardly therefrom, and slidably received between said guide members.

18 In a completely self-contained feed table for rolling mills or the like, in combination, a traveling support carriage, a tilting table pivotally mounted upon said carriage, means on said carriage for tilting said table, and pneumatic balancing and shock absorbing apparatus entirely supported upon said carriage and comprising a compressed air cylinder, a plunger for reciprocation within said cylinder and connected to said table, a balancing tank freely communicating with said cylinder for the reception and compression of the air from said cylinder when said plunger is in its lowest position, whereby the weight of said table is substantially balanced and the operation of said tilting means is facilitated, and an air compressor mounted on said carriage for maintaining the necessary air pressure in the system.

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