

Jan. 4, 1944.

R. J. HARRY

2,338,285

TURN-OVER DEVICE

Filed Oct. 30, 1942

5 Sheets-Sheet 1

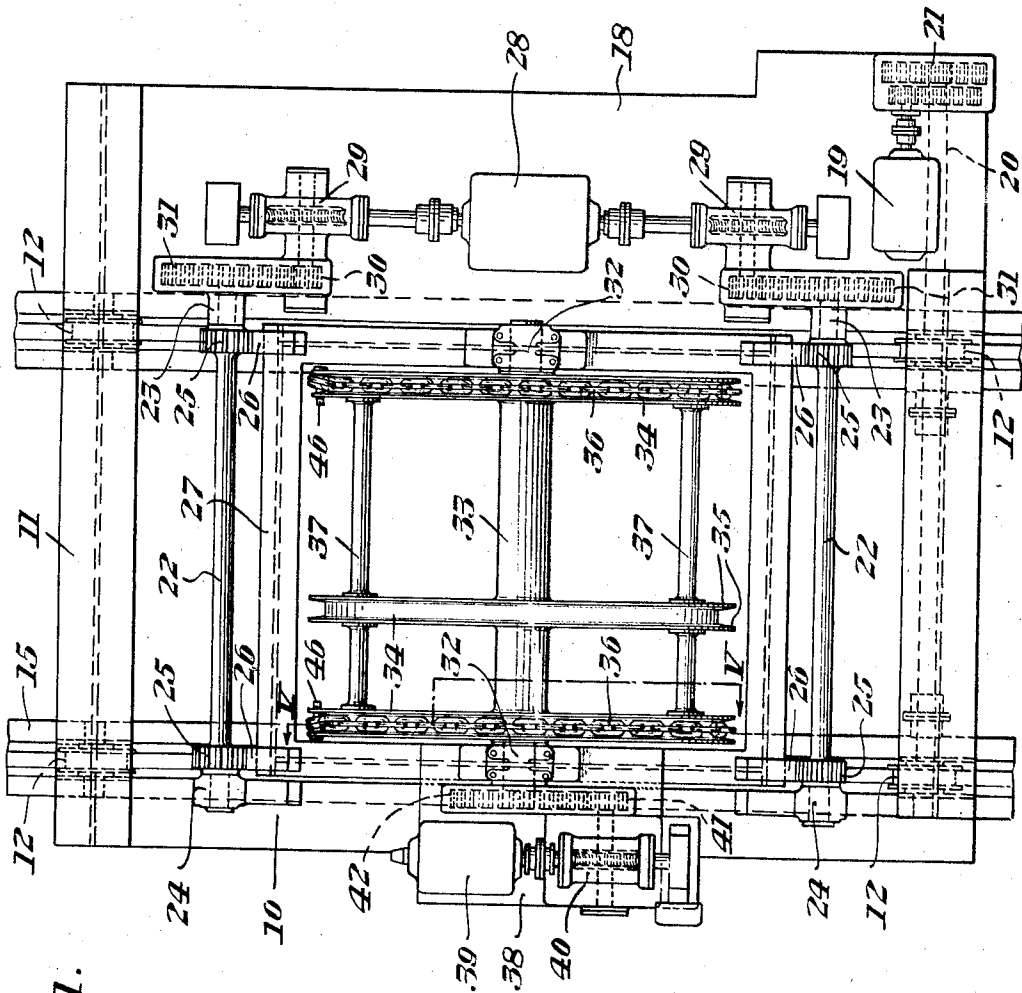


Fig. 1.

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Fig. 2.

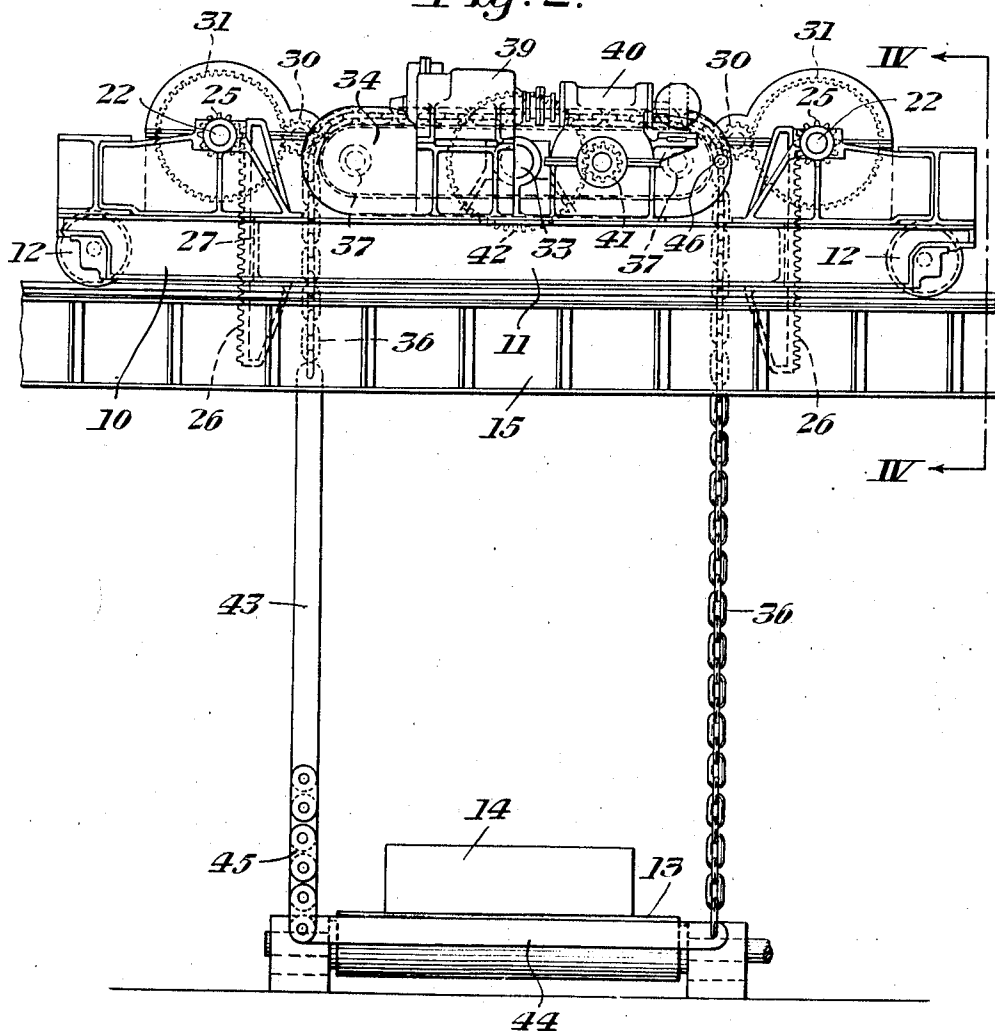
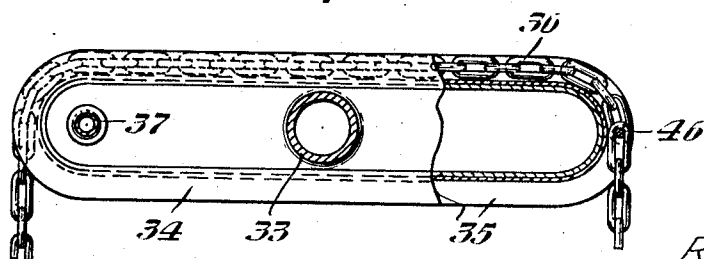


Fig. 5.



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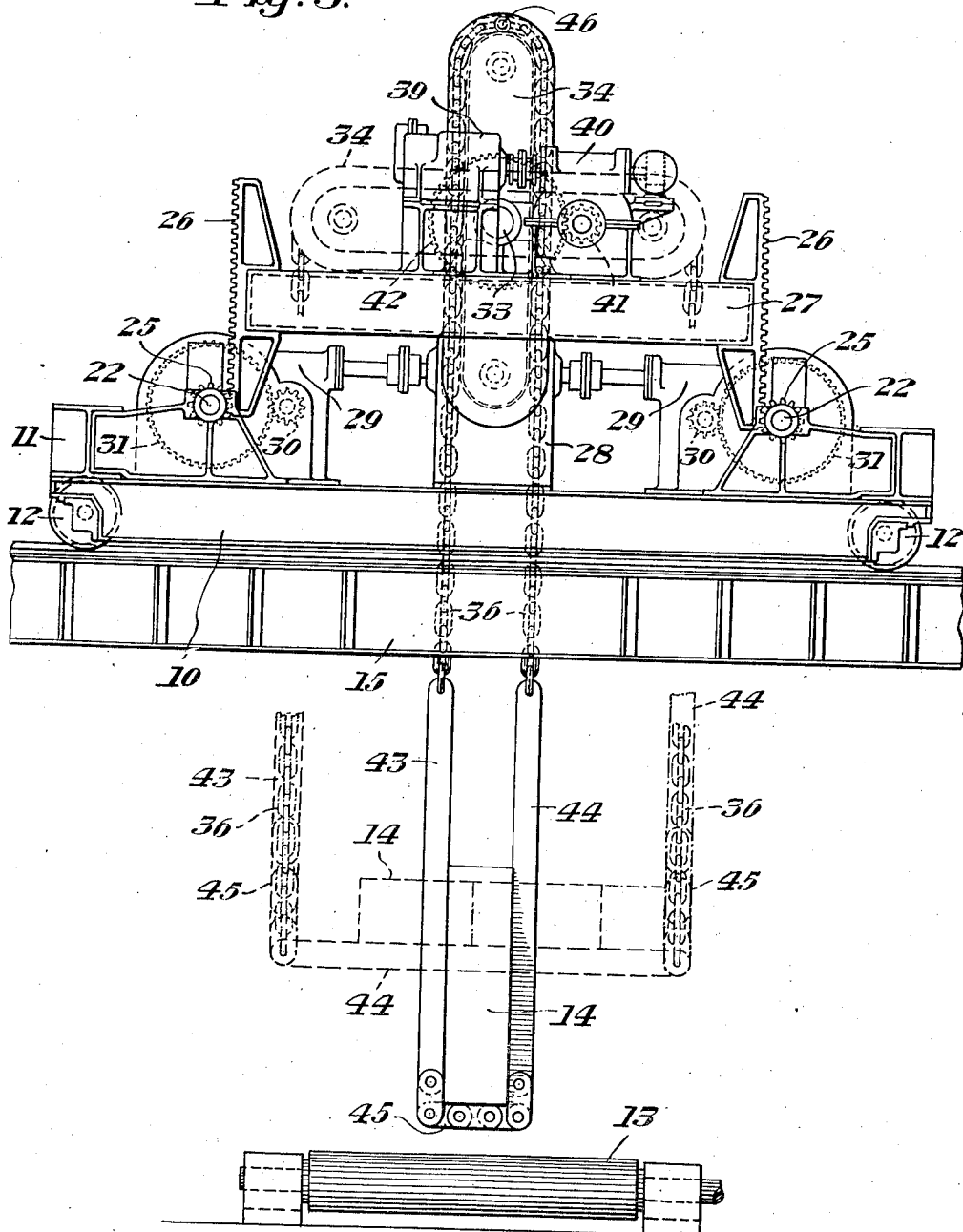
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Fig. 3.



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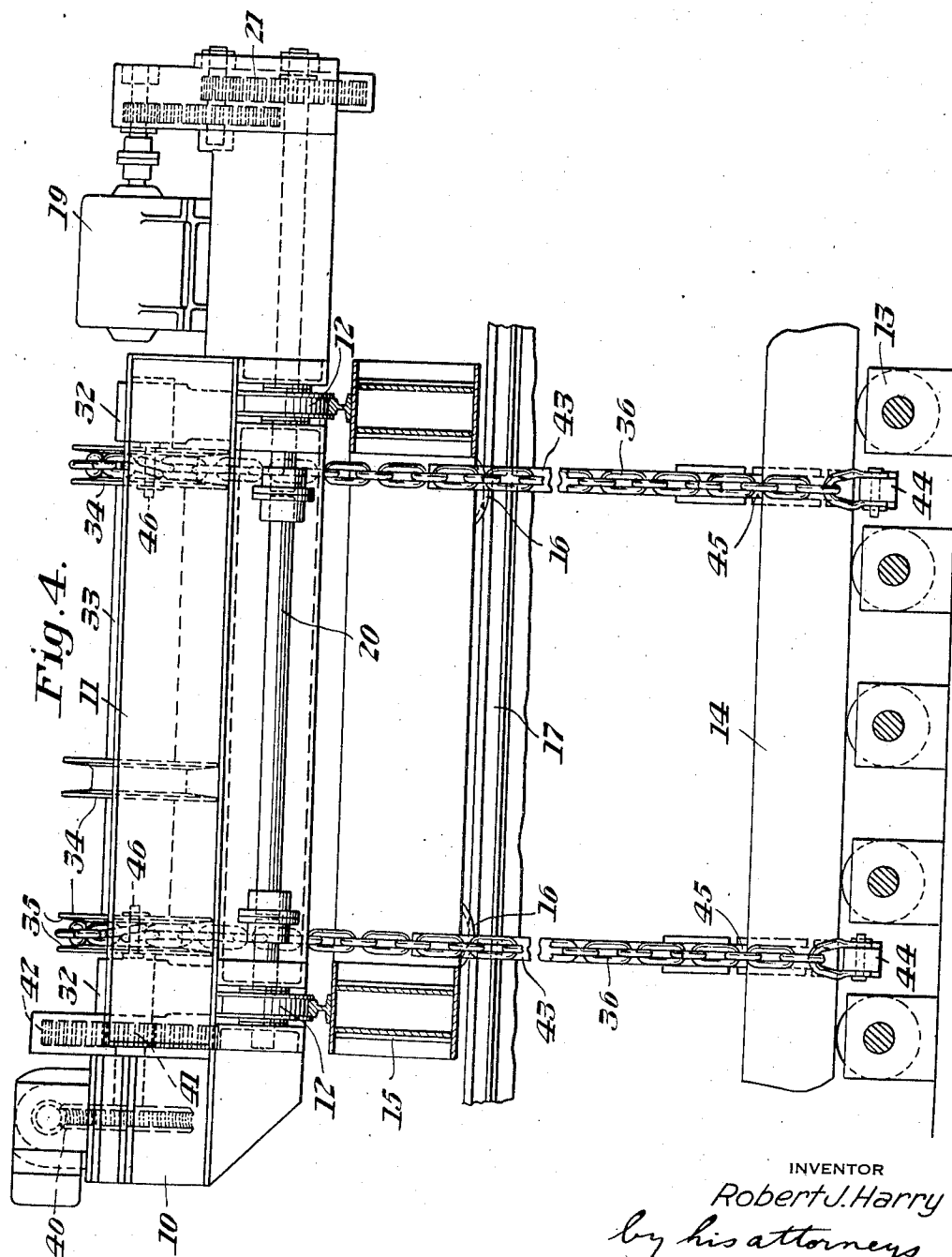
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Fig. 6.

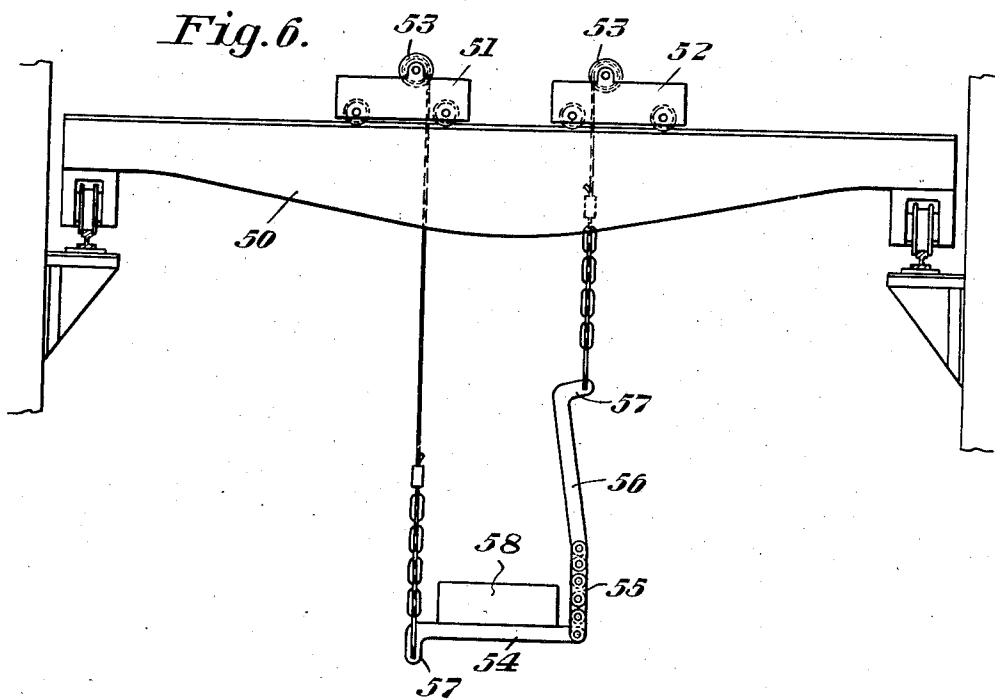
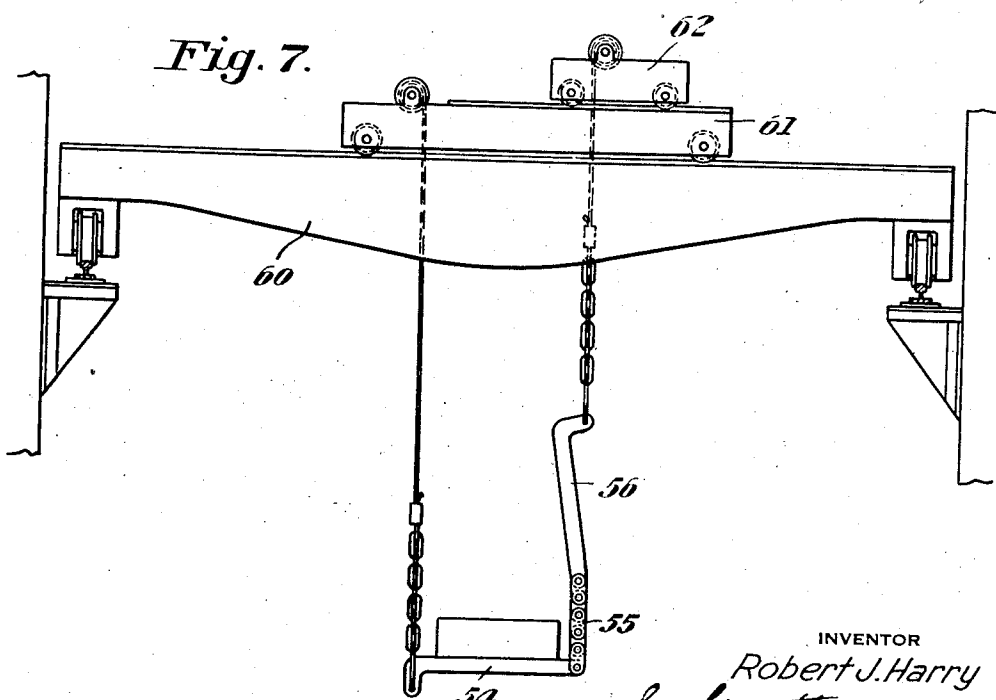


Fig. 7.



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UNITED STATES PATENT OFFICE

2,338,285

TURNOVER DEVICE

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Application October 30, 1942, Serial No. 463,906

12 Claims. (Cl. 214—1)

This invention relates to apparatus for handling large masses and, in particular, to a device for turning over slabs of steel at a slabbing mill although it has other applications.

It is necessary in the rolling of steel to turn over slabs at the slabbing mill to insure that both sides are free from scale. Present mill practice contemplates the rolling of slabs of such size that turning them over presents a serious problem. Turn-over devices of certain forms have been known heretofore but have been characterized by serious shortcomings and it is the object of my invention, therefore, to provide an improved turn-over device particularly adapted for handling slabs of large size adjacent a slabbing mill.

In a preferred embodiment of the invention, I provide a pair of spaced lifting arms, rigidly connected and rotatable about a central transverse axis. The arms are grooved so that suspending slings may be trained about them. The slings include rigid links adapted to have broadside engagement with the slabs. The arms are journaled on a frame adapted to be disposed above the slab to be turned. The frame is movable vertically whereby to raise a slab from a support such as a roller table, on which it is resting, preparatory to tilting the slab and actually turning it through 180° by rotation of the arms. The vertically movable frame is itself preferably carried on a car or other traveling support, conveniently the trolley of a bridge crane spanning the floor on which the slabbing mill is located.

A complete understanding of the invention may readily be obtained from the following detailed description and explanation thereof which refer to the accompanying drawings illustrating the preferred embodiment above mentioned and modifications. In the drawings,

Figure 1 is a plan view showing certain portions in part only;

Figure 2 is a side elevation;

Figure 3 is a view similar to Figure 2 showing the parts in alternative positions;

Figure 4 is a view partly in section along the plane of line IV—IV of Figure 2 with parts in elevation;

Figure 5 is a partial section along the plane of line V—V of Figure 1;

Figure 6 is a diagrammatic view showing the modification; and

Figure 7 is a view similar to Figure 6 showing a further modification.

Referring now in detail to the drawings, a car 10 including a frame 11 and wheels 12 journaled

thereon is adapted to move back and forth above the path of a slab traveling from a heating furnace to a slabbing mill. Such path is usually along a roller table indicated diagrammatically at 13, the position of a slab thereon being indicated at 14. The car 10 may conveniently be carried on a bridge crane 15 itself provided with wheels 16 adapted to travel along runways 17 at the sides of the building in which the conveyor 13 and the slabbing mill are located.

The car 10 has a platform 18 on which is mounted a driving motor 19. The motor is connected to the cross shaft 20, on which the wheels 12 at one end of the car are fixed, by reducing gearing 21. The motor 19 thus serves to drive the car back and forth along the crane girders.

The car 10 has cross shafts 22 adjacent each end thereof journaled in bearings 23 and 24. The shafts 22 have pinions 25 secured thereto adjacent the bearings. These pinions mesh with racks 26 secured adjacent the corners of a frame 27 disposed between the shafts 22. As a result, the frame 27 may be raised and lowered, being maintained in a horizontal plane at all times, by rotating the shafts 22 in opposite directions at the same speed.

For driving the shafts 22, I provide a motor 28 on the platform 18. The motor is connected to the worms of worm-wheel reducing gears 29. The worm gears drive the shafts 22 through pinions 30 and gears 31. The reduction gears 29, the pinions 30 and gears 31 are identical so that operation of the motor 28 causes the frame 27 to be raised or lowered while maintaining it in a horizontal plane at all times.

The frame 27 has bearings 32 in which a shaft 33 is journaled. The shaft is provided with lifting arms 34 each of which extends in opposite directions from the shaft and has spaced flanges 35 similar to those of a sheave extending around the entire periphery thereof to serve as guides for slings 36 disposed thereon. The arms 34 in addition to being secured to the shaft 33 are connected by tie bars 37. The several arms are thus maintained rigidly in proper relation to each other and turn simultaneously on rotation of the shaft 33.

The frame 27 carries a platform 38 extending laterally thereof. A motor 39 mounted on the platform is adapted to drive the shaft 33 through a worm and worm-wheel reduction gear 40, a pinion 41 and a gear 42 which is secured on the shaft.

The slings 36 are preferably composed of chains and include rigid links 43 and 44 adapted

to have broadside engagement with a slab such as that shown in 14, and intermediate plate links 45. The slings are anchored to the arms 34 adjacent one end thereof as by through-pins 46.

With the foregoing description of the apparatus in mind, the following explanation of operation may readily be understood.

In the rolling of slabs on a slabbing mill, a slab is discharged from a heating furnace and advanced to the mill over a roller table such as that shown at 13. After a few preliminary passes of the slab through the mill it is desirable to turn the slab over to make sure that all scale loosened from the surfaces by the preliminary passes is removed before the rolling proceeds further. When this stage of the rolling has been reached, the crane 15, the car 10 and the frame 27 are positioned as shown in Figure 2 so that the links 44 of the slings 36 lie between adjacent rollers of the table 13 and below the plane tangent to the rollers. The roller table is then operated to position the slab above the links 44, as illustrated in Figure 4.

When the slab has been placed in position for turning over, as described above, the motor 28 is operated to drive the shafts 22 in such direction as to raise the frame 27. This position of the frame 27 is illustrated in Figure 3. The arms 34 remain in the horizontal position indicated in dotted lines in Figure 3 until the frame has been raised. The links 43, 44 and 45 also remain in their original relation as shown in dotted lines. When the frame has been fully raised, the motor 39 is operated to turn the shaft 33 and with it the arms 34. Figure 3 shows the positions of the parts after the arms have been rotated through 90°. It will be apparent that as the links 44 tilt, the slab slides downwardly into engagement with the links 45 and eventually the links 43 engage one side of the slab, the links 44 remaining in engagement with the other side. As the rotation of the shaft 33 continues, the arms 34 return to horizontal position 180° from the starting position. The links 44 and 45 and slab 14 are then in the positions indicated in chain lines in Figure 3. The car 10 may then be operated to center the slab above the roller table 13 and the motor 28 operated to lower the frame 27. The slab will thereby be replaced on the roller table in the same position in which it was originally except that it has been reversed side for side. The slab is then ready for further rolling and after it has advanced over the roller table to the mill, the turn-over apparatus may be moved out of the way until needed again.

It will be apparent that the invention is characterized by numerous advantages. In the first place, it provides a simple yet highly effective mechanism for handling slabs which would otherwise be extremely difficult to manipulate. The apparatus may readily be designed to carry safely the largest slabs for which rolling mills are designed. The slab is under perfect control at all times during the turning and there is no violent shock produced at any time since one set of the long links of the two slings engages the slab in its vertical position and lowers it slowly therefrom to the horizontal position.

The ability to move the turn-over device entirely out of the way is a great advantage since it facilitates repairs as the table or mill when necessary and for the further reason that any maintenance of the turn-over device itself does not necessitate shutting down the mill. The en-

tire freedom of movement by which the entire apparatus is characterized, furthermore, makes it possible to pick up a slab at any point and "spot" it precisely at any desired location. A further important advantage is that the turn-over device may be used to hold suspended a slab which must be returned to the furnace for reheating while another slab passes over the roller table to the mill. This avoids the loss of rolling time which would otherwise be involved in returning a slab to the furnace for reheating. This is particularly important where the rolling cycle requires reheating of the slabs before the rolling is completed.

The invention may also be employed, with appropriate modifications, to dispose slabs on edge for edge rolling. The invention is also applicable to the handling of plates for the purpose of inspection, after the rolling thereof has been completed. At present, the practice is to place plates on trestles. This requires that the inspector crawl under the plates to inspect the bottom surface. My turn-over device could be used in the manner described to place opposite surfaces of a plate successively on top for easy examination.

Figure 6 illustrates a slight modification of the invention. As there illustrated, a bridge crane 50 is provided with two trolleys shown diagrammatically at 51 and 52. Each trolley has a winch 53 thereon, the two winches controlling slings each of which includes rigid links 54 and 56 connected by intermediate links 55. The links 54 and 56 have offsets 57 at the ends thereof secured to the suspension from the winches, which may be chains, cables or part chain and part cable as shown.

The modification of Figure 6 is used in much the same manner as the preferred embodiment, i. e., the crane and trolleys are positioned so that the rigid links of the slings engage the bottom of a slab such as that shown at 58. The winches 53 of both trolleys are then operated to raise the slab above the roller table on which it normally rests. When the slab has thus been raised, the winch on the trolley 52 is stopped. Continued operation of the winch on trolley 51 tilts the links 54 and the slab 58 resting thereon. Simultaneously, the trolleys should be moved somewhat closer together as the links 54 approach the vertical. When the slab has thus been turned to 90°, the winch on the trolley 51 is stopped and the winch on trolley 52 is caused to pay out, thereby lowering the links 56 and completing the turning of a slab. The offsets 57 on the links insure that the slab will be turned past the "dead-center" position regardless of whether it is being turned clockwise or counter-clockwise.

Figure 7 shows a further modification in which a bridge crane 60 is provided with a trolley 61 traveling therealong and a trolley 62 traveling on the trolley 61. Both trolleys have winches which together suspend lifting slings similar to those of Figure 6 and the operation is the same as that described for the latter.

The modified forms of the invention are characterized by the several advantages of the preferred embodiment previously mentioned. A further advantage common to all forms of the invention is the fact that when the apparatus has been operated through a turning cycle, it is immediately in condition for another operation, without the necessity of a preliminary reversal. That is to say, the turning operation may be effected equally as well, regardless of whether the parts are in one extreme position or the other.

In other words, it makes no difference in which direction the slab is actually turned since it is turned through 180° in both cases.

A further advantage of the preferred embodiment arises out of the provision of three sets of arms 34 spaced apart by different distances. By using various combinations of arms (either the two outer arms as shown, or either of the outer arms with the intermediate arm), slabs of various lengths may be easily handled.

As shown, the links 43, 44, 54 and 56 are somewhat longer than the slab is wide and the links 45 and 55 are about as long as the slab is thick. The arms 34 also correspond generally in length to the slab width and in width to the slab thickness.

Although I have illustrated and described but a preferred embodiment of the invention with modifications, it will be understood that it may be embodied in forms other than those shown in the drawings without departing from the spirit of the invention or the scope of the appended claims.

I claim:

1. A turn-over device for slabs or the like comprising a pair of spaced, parallel, lifting arms rigidly connected, means mounting said arms for rotation about a central transverse axis from one substantially horizontal position to the reverse position, means for raising and lowering said mounting means, and a sling trained along each of said arms and depending therefrom, each sling including a pair of rigid links adapted to have broadside engagement with the faces of a slab or the like.

2. A turn-over device for slabs or the like comprising a pair of spaced, parallel, lifting arms rigidly connected, means mounting said arms for rotation about a central transverse axis from one substantially horizontal position to the reverse position, means for raising and lowering said mounting means, and a sling trained along each of said arms and depending therefrom, each sling including a pair of rigid links adapted to have broadside engagement with the faces of a slab or the like, and intermediate links between said two first-mentioned links, said intermediate links being adapted to engage an edge of the slab.

3. A turn-over device for slabs or the like comprising a pair of spaced, parallel, lifting arms rigidly connected, a frame in which said arms are mounted for rotation about an axis transverse thereto and positioned centrally thereof, means for raising and lowering said frame, and a sling trained along each of said arms and depending therefrom.

4. A turn-over device for slabs or the like comprising a pair of spaced, parallel, lifting arms rigidly connected, means mounting said arms for rotation about a central transverse axis from one substantially horizontal position to the reverse position, means for raising and lowering said mounting means, and a sling trained along each of said arms and depending therefrom, each sling including at least one rigid link adapted to have broadside engagement with the faces of a slab or the like.

5. A turn-over device for slabs or the like comprising a pair of spaced, parallel, lifting arms rigidly connected, a frame in which said arms are mounted for rotation about an axis transverse thereto and positioned centrally thereof, a wheeled car on which said frame is carried, means on said car for raising and lowering said frame, and a sling trained along each of said arms and depending therefrom.

6. A turn-over device for slabs or the like comprising a pair of spaced, parallel, lifting arms rigidly connected, a frame in which said arms are mounted for rotation about an axis transverse thereto and positioned centrally thereof, vertical racks on said frame, pinions meshing with said racks, means for driving said pinions, and a sling trained along each of said arms and depending therefrom, each sling including a pair of rigid links adapted to have broadside engagement with the faces of a slab or the like.

7. A turn-over device for slabs or the like comprising a pair of spaced, parallel, lifting arms rigidly connected, a frame in which said arms are mounted for rotation about an axis transverse thereto and positioned centrally thereof, means on said frame for rotating said arms, means for raising and lowering said frame, and a sling trained along each of said arms and depending therefrom.

8. In a turn-over device for slabs or the like, the combination with a bridge crane, a trolley traveling along on the crane, a frame mounted on the trolley for vertical movement, means on the trolley for raising and lowering the frame, a pair of spaced, parallel, lifting arms rigidly connected and journaled on said frame, means on the frame for rotating said arms, and a sling trained along each of said arms and depending therefrom, each sling including a pair of rigid links adapted to have broadside engagement with the faces of a slab or the like.

9. The apparatus defined by claim 1 characterized by said links having a length somewhat greater than that of said arms.

10. The apparatus defined by claim 1 characterized by said arms being rounded at their ends and having spaced flanges adapted to confine said slings.

11. The apparatus defined by claim 1 characterized by said arms having rounded ends and a width of the same general order as the thickness of the slabs to be turned.

12. Apparatus for turning over slabs disposed on a roller conveyor table, comprising a bridge crane above said table and traveling longitudinally thereof, a trolley on said crane, a liftable frame on said trolley, lifting arms spaced along said frame and journaled therein for rotation about an axis parallel to said table, and slings depending from said arms including rigid links adapted to have broadside engagement with opposite faces of said slab and to lie between adjacent rollers of said table beneath said slab when the latter is thereon.

ROBERT J. HARRY.

CERTIFICATE OF CORRECTION.

Patent No. 2,338,285.

January 4, 1944.

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It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 2, first column, line 72, for "repairs as" read --repairs to--; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 8th day of February, A. D. 1944.

(Seal)

Henry Van Arsdale,
Acting Commissioner of Patents.