Nov. 18, 1969 I. M. PITCHFORD ET AL 3,478,899

METAL CHARGING APPARATUS

Filed April 18, 1967 4 Sheets-Sheet 1

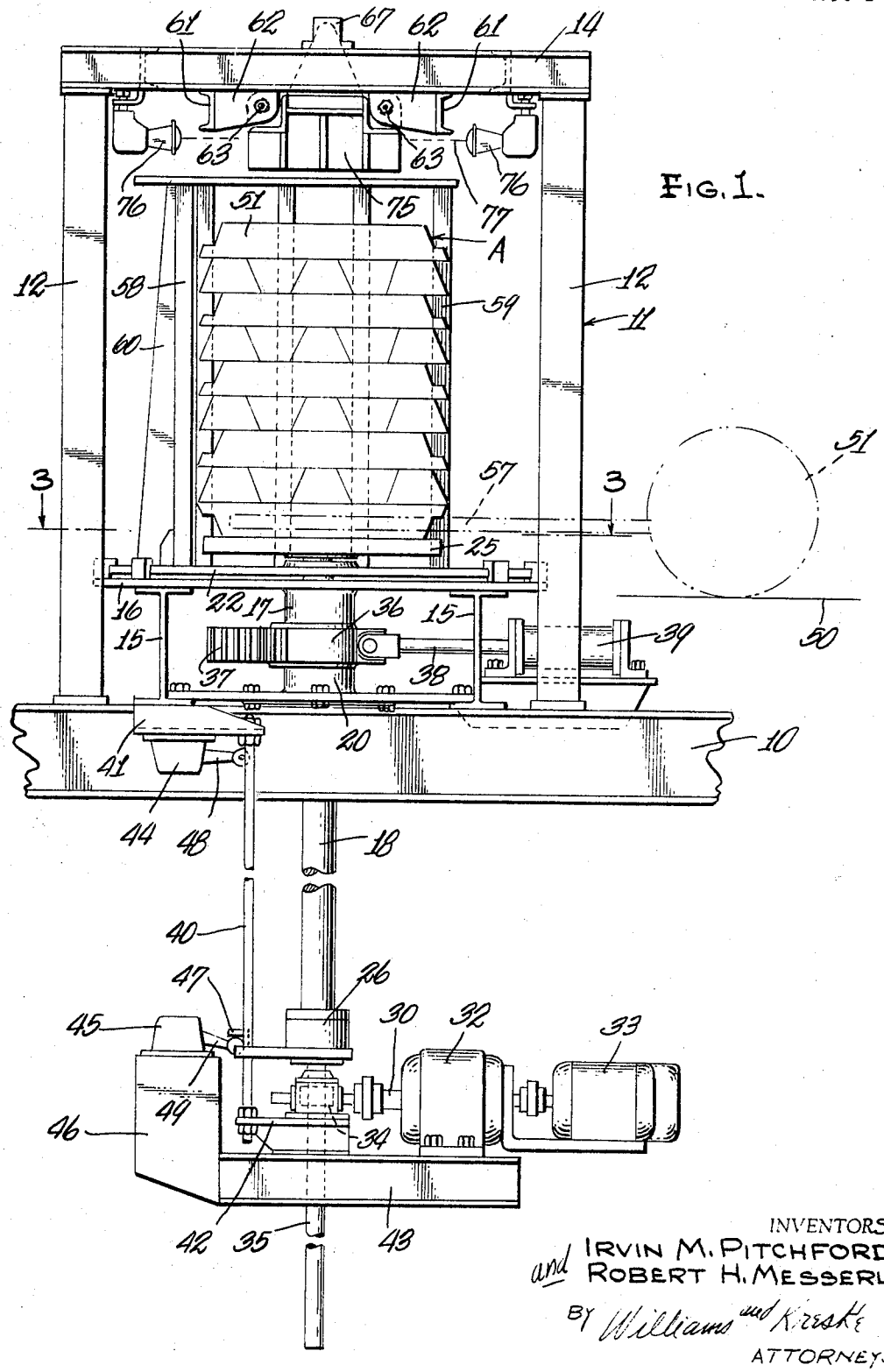


FIG. 1.

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METAL CHARGING APPARATUS

Filed April 18, 1967 4 Sheets-Sheet 2

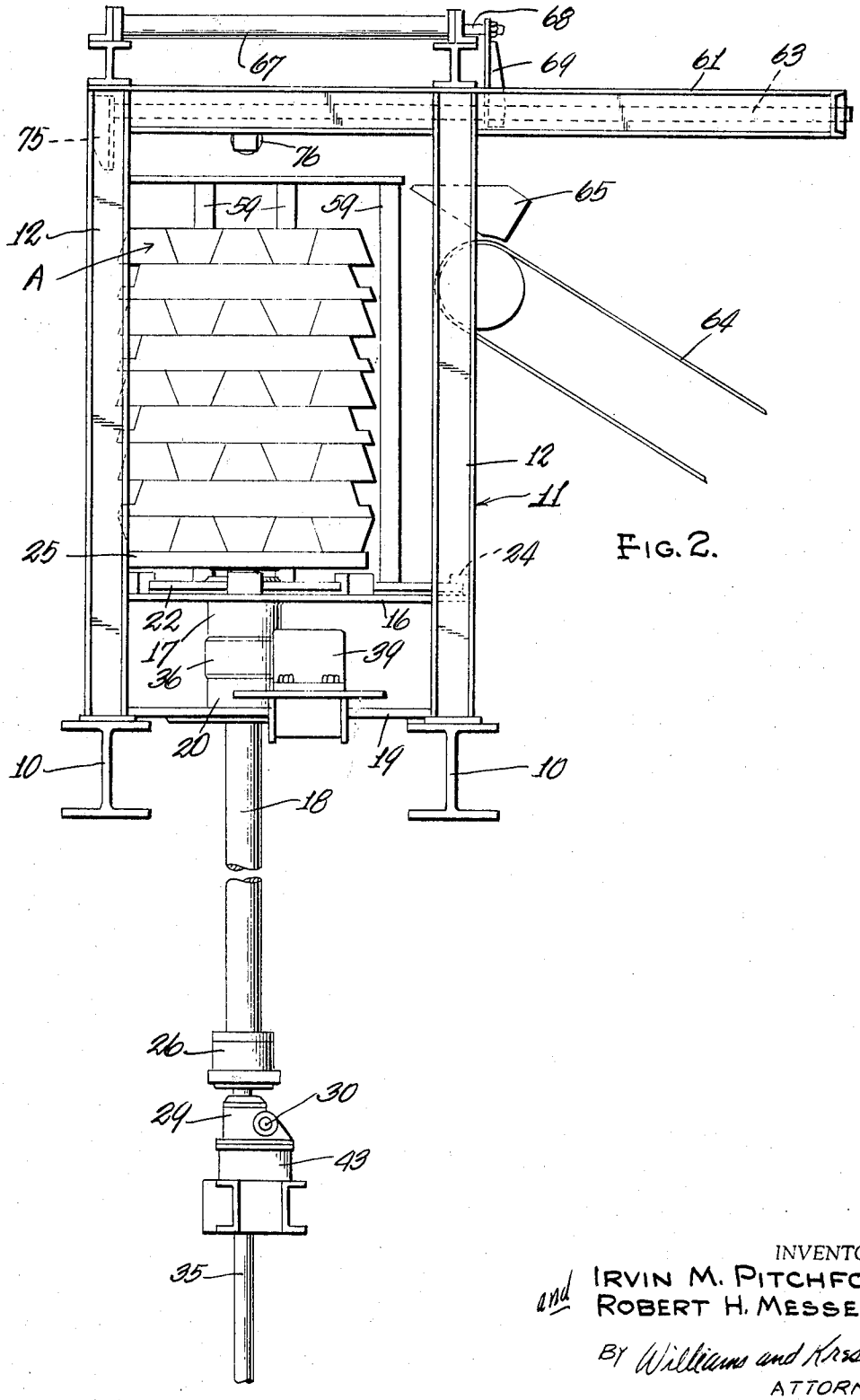


FIG. 2.

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METAL CHARGING APPARATUS

Filed April 18, 1967 4 Sheets-Sheet 3

FIG. 3.

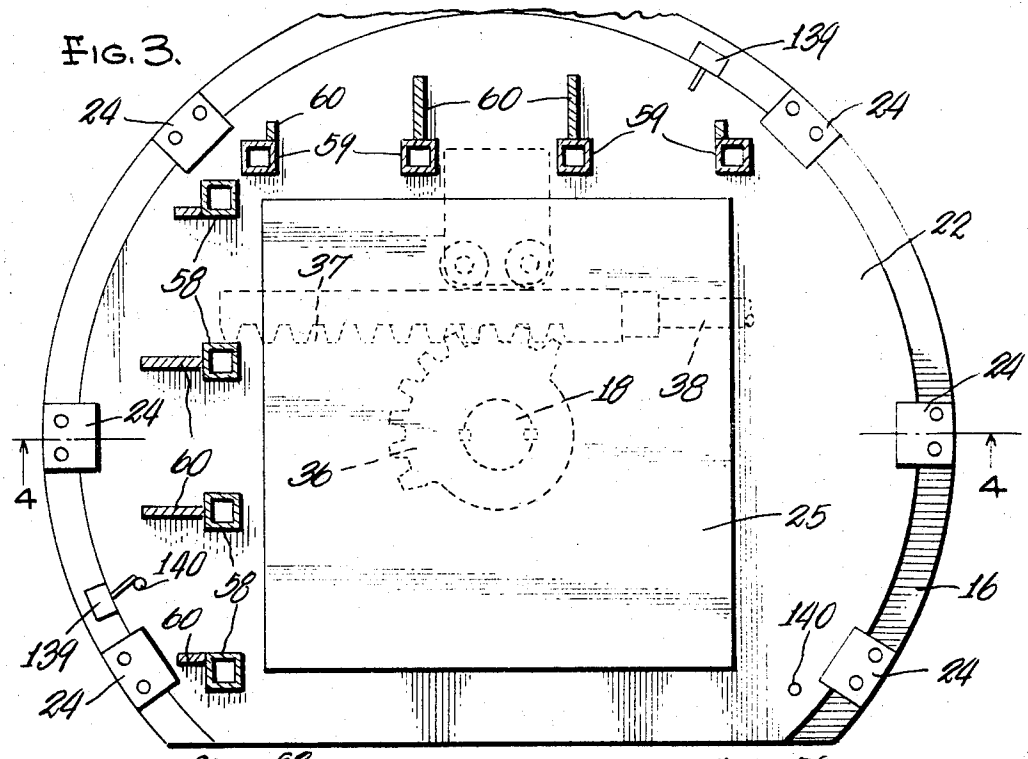
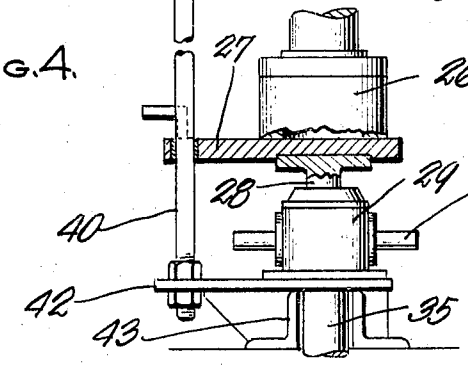


FIG. 4.



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METAL CHARGING APPARATUS

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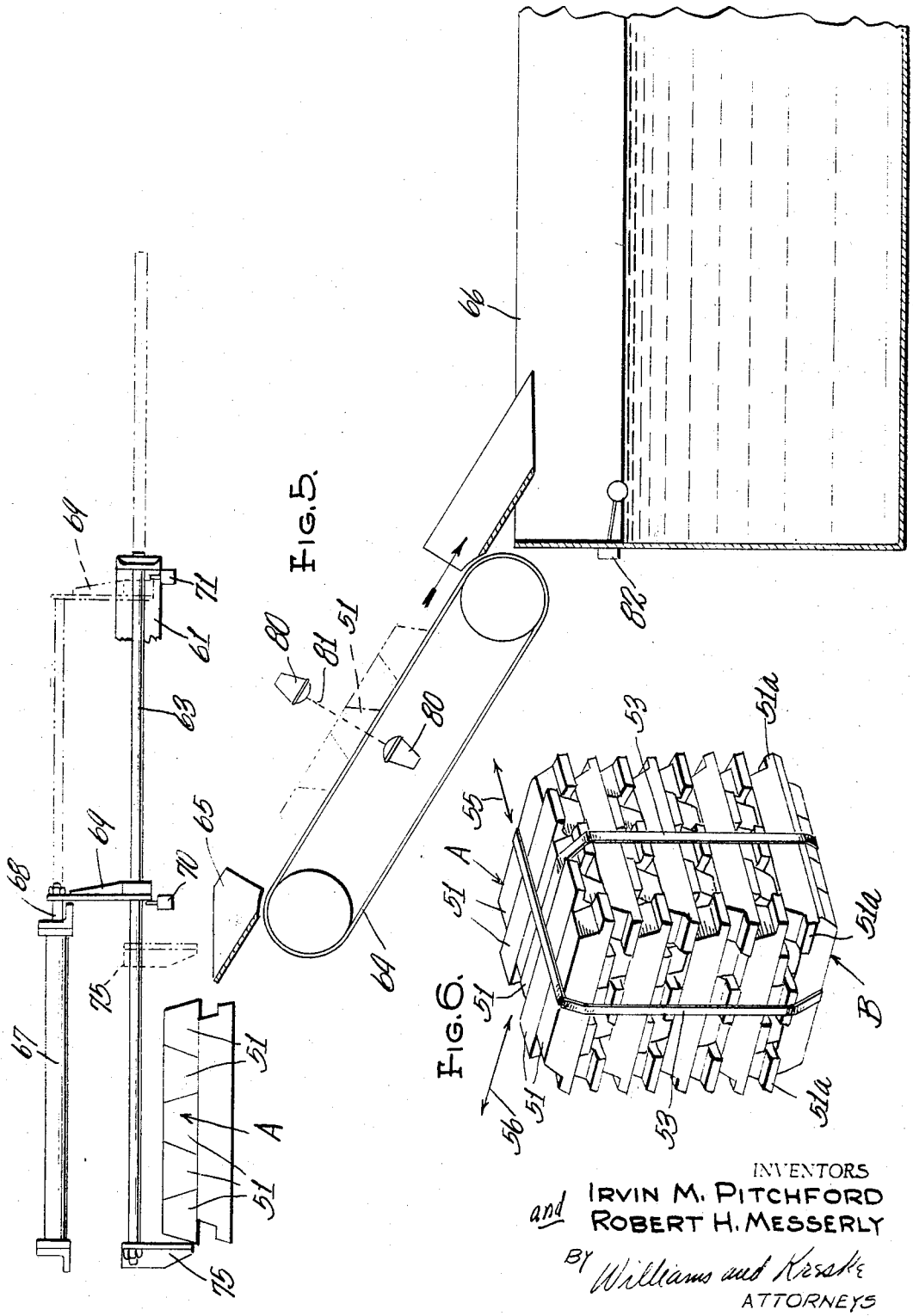


FIG. 5.

FIG. 6.

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METAL CHARGING APPARATUS

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Int. Cl. B65g 59/02; B65h 7/18
U.S. Cl. 214—8.5 9 Claims

ABSTRACT OF THE DISCLOSURE

A metal slab feeding machine for feeding slabs which are stacked in superimposed layers with adjoining layers movable horizontally in different directions and fed a layer at a time to slab melting furnace. The stacked slabs are carried on a platform which is movable vertically to horizontally align the topmost layer of slabs with a fixed feeding path and which is rotated about a vertical axis to angularly position the line of movement of the topmost layer of slabs in coincidence with the fixed feeding path.

Our invention is particularly useful in feeding metal bodies, such as ingots, in slab form, to a melting furnace or pot. Customarily, the metal bodies or slabs are stacked in superimposed layers and bound together with steel straps to form a bundle of known size and weight and quantity. The slabs may be strapped to a pallet, or may be strapped to each other without a pallet as herein shown, and in either event may be conveniently moved by a fork lift truck of the type commonly used in metal handling operations.

The metal bodies may be aluminum, zinc, or other metal or metal alloy, and may be fed to a furnace to provide a feed for further refining, or may be fed to a melting kettle and continuously consumed therefrom, as in the case of galvanizing. Our invention makes it possible to operate either a furnace, kettle or pot so that charging, melting and consumption take place generally simultaneously and continuously and particularly to minimize radical fluctuations in metal, both in temperatures and levels.

In present day packaging of pure and alloy ingots, the latter are in slab form and have recessed areas so that when they are superimposed in layers, adjoining layers nest and interlock to form a more rigid package and to minimize the size of the package. The nesting and interlocking has caused problems in charging ingots from the pack to the furnace, and our invention has provided an economical and highly useful solution to the problem.

In the drawings accompanying this specification and forming a part of this application, there is shown an embodiment which our invention may assume, and in these drawings:

FIGURE 1 is a side elevational view of a machine embodying our invention,

FIGURE 2 is a view similar to FIGURE 1 but taken at ninety degrees therefrom,

FIGURE 3 is a fragmentary enlarged sectional view corresponding generally to the line 3—3 of FIGURE 1.

FIGURE 4 is a fragmentary sectional view corresponding to the line 4—4 of FIGURE 3,

FIGURE 5 is a schematic view illustrating operation of certain parts of our improved machine, and

FIGURE 6 is a perspective view of a bundle or stack of slabs which are fed by our machine.

DETAILED DESCRIPTION

The improved machine is preferably supported upon steel beams 10—10 which may form part of the structure in which the machine is housed. A structural framework 11 is supported on the beams 10 and comprises upright channels 12 having their lower ends secured to the beams 10 in any suitable manner, such as by welding or bolts (not shown). The upper ends of the channels are tied together by cross-channels 14 to provide a rigid and substantial super-structure for our improved machine.

Beams 15—15 extend cross-wise of the beams 10 and are rigidly secured thereto in any suitable manner. A supporting plate 16 is secured to the upper flanges of the cross-beams 15, the plate having a downwardly directed hub 17 to provide an upper bearing for an upright shaft 18. A complementary plate 19 is secured across the lower flanges of the cross-beams 15, this plate supporting a hub 20 which forms a lower bearing for the shaft 18.

The shaft 18 has diametrically opposed keyways 21—21, and a plate 22 is keyed to the shaft and is rotatable therewith. Flat bearing strips 23 are secured to the plate 16 and provide bearing surfaces for the outer peripheral portions of the plate 22 to accommodate downward thrust upon the latter. Toe clamps 24 are bolted to the plate 16 and hold the plate 22 against vertical separation from the bearing strips 23.

The shaft 18 has a platform 25 welded to its upper end, the platform preferably being square in plan, as seen in FIGURE 3. The shaft 18 extends downwardly through the bearings 17, 20, to a thrust bearing 26. An arm 27 extends laterally from the bearing 26 for a purpose to be described. Elevating means for the platform 25 includes a stub shaft 28 which extends upwardly from a worm gear housing 29, the gear being rotated by a worm (not shown) which is secured to the shaft 30 of a reversible gear motor 32 and subjected to the action of a brake 33 to prevent over-travel of the shaft 18.

The worm gear in the housing 29 rotates a nut 34 which is threaded on an upright shaft 35, the upper end of the latter bearing against and being fixed to the thrust bearing housing 26. The nut 34 and shaft 35 constitute a screw jack, and any commercially available jack may be used, such as the Duff-Norton jack, Series 1800, Model 1810, herein schematically illustrated. When the motor 32 is rotated in one or the other of its directions, the nut 34 is rotated accordingly and the shaft 18 moved up or down as the case may be to raise or lower the platform. Power means for effecting platform rotation includes a gear 36 keyed to the shaft 18 and rotated by a rack 37, in turn attached to the rod 38 of a fluid cylinder 39, and rotates the gear 36 in accordance with movement of the piston in the cylinder 39. In the present embodiment, gear rotation is limited to a ninety degree movement and any suitable means, such as abutments on the rod 38 and stops on a stationary part of the machine, may be used. In the present embodiment, the rotation is limited by means of limit switches 139 (see FIGURE 3) which are mounted on the stationary plate 16 and are engageable with respective pegs 140 which project from the rotatable plate 22. The limit switches effect actuation of a fluid valve (not shown) which controls flow of fluid to the rod and blank ends of the cylinder 39 and thus effects proper reciprocation of the rod 38.

A guide rod 40 has its upper end connected to a support 41 depending from the beam 10, and its lower end connected to a support 42 which is mounted on a base 43 which in this embodiment also supports the motor-brake units 32–33. A limit switch 44 depends from the support 41 and a similar limit switch 45 extends upwardly from a bracket 46 extending from the base 43. The rod 40 slidably guides the arm 27 and the latter carries an abutment 47 which engages one or the other of arms 48, 49 of the respective limit switches 45, 45. Engagement of the abutment 47 with the arm 49 actuates the limit switch 45 to stop rotation of the motor 32 in the direction which lowers the platform 25, and engagement of the abutment

with the arm **48** actuates the limit switch to stop rotation of the motor **32** in the direction which elevates the platform **25**.

The plates **16** and **22**, and the platform **25** in its lower position, are slightly above the floor line **50** (see FIGURE 1) so that a fork lift truck, a wheel **51** of which is shown, may deposit a strapped bundle of metal bodies, such as ingots and slabs, upon the platform. The bundle, as seen in FIGURE 6, may consist of a plurality of slab layers, and each layer may consist of a plurality of slabs. The top layer A consists of five slabs **51**, three facing up and two facing down. The next layer also consists of five slabs (although it may be less or greater in number) with slabs alternately facing up and down. The arrangement of the top two layers is continued downward through the succeeding layers. In the embodiment disclosed, the lowermost layer B is reversed from the above procedure but only so that it provides end extensions **51***a* under which the forks of a lift truck may engage. The layers of slabs are firmly connected together, as by steel straps **53**, and the bundle thus formed is termed "self-palletized" since it requires no pallet. If desired, the layers of slabs may be strapped to a pallet.

The slabs **51** are usually formed with notches or nesting and locking surfaces to increase the rigidity and decrease the size of the bundle, and although this is desirable for shipping and handling purposes it has posed serious difficulties in feeding the slabs to a furnace because adjoining layers of slabs may be moved horizontally only in different directions. With reference to FIGURE 6, the top layer A of slabs **51** may be moved in the horizontal direction shown by the arrow **55** while the next lower layer of slabs may be moved horizontally only at right angles in the direction of the arrow **56**. Our improved machine is ideally suited to feed successive layers of slabs, despite the condition just referred to. However, our machine is equally adapted to feed layers of slabs which are not interlocked.

As seen in FIGURE 1, the fork lift truck has been moved to the position indicated by one of its wheels and the forks **57** have deposited a bundle of slabs on the platform **25**. Guides are provided to assist the fork lift operator to properly position the bundle upon the platform and in the present embodiment a row of square tubes **58** (see especially FIGURE 3) extend upwardly from the plate **22** to define one side against which the slab bundle may be abutted. A similar row of square tubes **59** extend upwardly from the plate **22** to define a side at right angles to the side defined by the tubes **58**. Since the tubes **58**, **59** extend upwardly some distance, suitable guessets **60** are welded thereto for reenforcement purposes and the tops of the tubes **58**, **59** are connected together for rigidity.

Spaced channels **61** are rigidly secured to and extend downwardly from the cross beams **14**, and facing gussets **62** are welded to the channels to form bearings for respective slide rods **63**, **63**. The rods provide support and movement for means for charging the slabs **51** to an associated apparatus of any suitable character. In the presently disclosed embodiment, the slabs **51** are moved onto a conveyor **64** as best seen in FIGURE 5 (a short guide slide **65** directing such movement), and the conveyor delivers the slabs to a furnace **66**.

A fluid cylinder **67** is supported by the beams **14**, the cylinder rod **68** having an arm **69** secured to it and depening therefrom, the lower end of the arm being widened to straddle the slide rods **63**, **63** and is fastened thereto to reciprocate the same. Limit switches **70** and **71** may be arranged to define the extreme positions of the slide rods **63**. As an example, the limit switch **70** may be carried by a stationary part of the machine and be engaged by the arm **69** to define the rearward or retracted position of the rods **63**, whereas the limit switch may be carried by one of the channels **61** and be engaged by the arm **69** to define the outermost or extended position of the slide rods **63**.

A pusher plate **75** is secured to adjoining ends of the slide rods and is adapted to engage and push against the uppermost layers of slabs **51**, and to move such slabs in the direction toward the conveyor **64**, when fluid under pressure is admitted to the blank end of the cylinder **67** to extend the rod **68** and consequently the slide rods **63**, to the position seen in phantom lines in FIGURE 5. When the pusher **75** has traveled far enough to deliver the slabs to the conveyor (such as the position shown in phantom) the actuator of the limit switch **71** will have been engaged by the arm **69** to reverse the valve controlling fluid to the cylinder so that fluid flow is to the rod end of the cylinder to retract the cylinder rod **68** (and slide rods **63**) until the pusher reaches its position shown in full lines. At that time the actuator of limit switch **70** is engaged to close the valve for the cylinder **67**, and thereby stop movement of the cylinder rod.

As best seen in FIGURE 1, two photoelectric cells **76** are adjustably supported from the cross beams **14** and are so arranged that a light beam **77** between them establishes the upper extent of the upper layer of slabs **51**. Accordingly, the motor **32** drives the screw-jack arrangement to elevate the platform until the upper surface of the upper layer of slabs breaks the beam **77** between the cells **76** and this immediately effects a circuit to the motor **32** to stop rotation thereof, the brake **33** operating to halt movement quickly and thus prevent overtravel of the platform **25**.

Two photoelectric cells **80** (see FIGURE 5) are so arranged that a light beam **81** between them is broken when a slab **51** is on the conveyor **64** in position to interrupt the beam. The conveyor is longitudinally open to permit passage of the light beam **81**. A float switch **82** is carried by the furnace **66** and is affected by the level of the molten metal in the furnace. The switch **82** controls operation of the conveyor **64** while the light cells **80** control operation of the motor **32**.

The operation of our improved machine is as follows: The platform **25** is lowered to its lowermost position, if it is not already in this position. As previously stated, this lowermost position is predetermined by the abutment **47** on arm **27** moving the arm **49** of limit switch **45** in a downward direction. A bundle of slabs or ingots is then placed upon the platform by means of the lift truck, and the truck is removed. The bands **53** on the bundle are broken and removed, and the machine is now ready to feed slabs to the conveyor and furnace. A manual switch may be provided to place the control circuit in operating condition and when this switch is closed by an attendant, the motor **32** is energized to cause elevation of the platform **25** and the bundle of slabs carried thereby.

When the top surface of the uppermost layer of slabs breaks the beam **77** between the photo electric cells **76**, the circuit to the motor **32** is interrupted and the brake **33** is actuated to prevent overtravel. The machine is now in position for the pusher bar **75** to push the top layer of slabs **51** onto the conveyor **64**. However, no such action is permitted when slabs are already on the conveyor and in position to break the beam **81** between the photo electric cells **80**.

When the float switch **82** is actuated by a drop in the level of molten metal in the furnace below a predetermined level, the conveyor will be operated to deliver one or more slabs to the furnace until the furnace level is again up to the predetermined point whereupon the float switch is actuated to halt operation of the conveyor.

When the slabs **51** on the conveyor **64** have been moved downwardly to the furnace until the beam **81** between the cells **80** is uninterrupted, the control circuit is then set to permit operation of the slab charging apparatus. In the embodiment, a fluid control valve (not shown) is actuated to introduce fluid under pressure to the blank end of the cylinder **67** while exhausting fluid

from the rod end. This causes an extension of the piston rod **68** and the slide rods **63** and results in movement of the pusher bar from the full to the phantom line positions seen in FIGURE 5. The pusher bar thereby pushes the top layer A of the slabs **51** horizontally over the succeeding layer and the slabs drop onto the short guide slide **65** and then onto the conveyor **64**. When the piston rod has been extended substantially its full stroke, the arm **69** engages the limit switch **71** to reverse the fluid control valve for the cylinder **67** and thereby quickly retract the piston rod **68** and slide rods **63** until the arm **69** engages the limit switch **70**, whereupon the control valve is moved to neutral position to hold the pusher bar in its full line position shown in FIGURE 5 and in readiness to push a succeeding layer of slabs.

When the limit switch **70** is engaged by the arm **69**, the control circuit is effected to actuate a fluid control valve (not shown) to deliver fluid under pressure to one end of the cylinder **39** and to effect one stroke of the piston rod **38** and attached rack **37** in the proper direction to rotate the gear **36**, shaft **18**, plate **22**, platform **25** and the bundle of slabs carried by the latter, until a peg **140** engages and actuates the proper limit switch **139**.

In this embodiment, the rotation is ninety degrees and when the proper limit switch **139** is actuated, the control circuit actuates the valve for the fluid cylinder **39** to neutral position so that the piston in such cylinder is held against return stroke. The return stroke is effected when the succeeding layer of slabs has been moved onto the conveyor **64** and the pusher bar **75** returned to the full line position of FIGURE 5. Thus, the platform **25** is moved to and fro through ninety degrees at the proper times, to first align a top layer, and thereafter a succeeding layer of slabs, with the horizontal movement of the pusher bar.

When the last layer of slabs **51** has been pushed from the platform, the arm **27** will have travelled upwardly sufficiently so that the abutment **47** thereon will have engaged and actuated the arm **48** of the limit switch **44**, and after the last layer of slabs has been pushed from the platform, the control circuit may automatically return the platform **25** to its lowermost position and sound an alarm to indicate that the machine is in readiness for reloading.

We claim:

1. In a machine for feeding metal slabs to a conveyor which in turn feeds the slabs to a melting furnace, and wherein the slabs are stacked in superimposed layers, the improvement comprising means for charging a layer at a time to said conveyor, control means affected by the level of the molten metal in said furnace for controlling operation of said conveyor, and detector means affected by the presence of a slab on said conveyor for controlling operation of said charging means.

2. The construction of claim **1** wherein said control means is a float switch and said detector means comprises a pair of facing photoelectric cells, said float switch and photocells being included in an electric circuit with the motors for said conveyor and said charging means for energizing the conveyor motor when the level in the furnace is below a predetermined amount and for preventing energization of the charging means motor when a slab on said conveyor interrupts a light beam between said cells.

3. A machine for feeding metal slabs to a melting furnace, said slabs being stacked in superposed layers with adjoining layers interengaging to permit horizontal movement thereof only in angularly related rectilinear directions, the improvement comprising a vertically movable platform for supporting the stack, charging means movable horizontal over said stack in a fixed rectilinear path, means for rotating said platform about a vertical axis to align the permitted movement of the topmost layer with said fixed path, actuator means for moving said charging means along said fixed path to cause the same to move said topmost layer over the adjoining layer and toward said melting furnace, a conveyor for receiving slabs fed by said charging means and for conveying said slabs to said melting furnace, means responsive to the level of the slab melt in said furnace for determing the feeding of said slabs by controlling operation of said conveyor, and detector means responsive to the presence of slabs on said conveyor for controlling operation of the means for moving said charging means.

4. A machine for feeding metal slabs to an associated apparatus, said slabs being stacked in superimposed layers with adjoining layers interengaging to permit horizontal movement thereof only in angularly related rectilinear directions, the improvement comprising a vertically movable platform for supporting the stack, charging means movable horizontally over said stack in a fixed rectilinear path, means for elevating said platform to horizontally align the topmost slab layer with said fixed path, means for rotating said platform about a vertical axis to align the permitted movement of the topmost layer with said fixed path, and actuator means for moving said charging means along said fixed path to cause the same to move said topmost layer over the adjoining layer and toward said associated apparatus, said associated apparatus including conveyor for receiving the slabs delivered by said charging means and in turn feeding such slabs to a melting furnace, and further including control means affected by the level of the molten metal in said furnace for controlling operation of said conveyor, and detector means affected by the presence of a slab on said conveyor for controlling operation of said charging means.

5. The construction of claim **4** wherein said control means is a float switch and said detector means comprises a pair of facing photoelectric cells, said float switch and said cells being included in an electric circuit with the motor for said conveyor and the actuating means for said charging means for energizing the conveyor motor when the level in the furnace is below a predetermined amount, and for effecting operation of said actuating means when a slab on said conveyor interrupts a light beam between said cells.

6. In a machine for feeding layers of elongated slabs to an associated apparatus, said machine receiving said slabs in stacked superimposed layers, with the slabs in each layer being angularly related to those of the next adjacent layer to slide horizontally thereon when unstacked from the top, said machine including a frame, a platform mounted for vertical movement in said frame for receiving said stacked slab layers, elevating means for moving said platform vertically as succeeding topmost layers are removed from the stack, and pusher means for removing said successively presented topmost slab layers, the improvement comprising: means mounting said platform in said machine frame to permit rotational movement relative thereto and to said pusher means for aligning successive angularly related slab layers with said pusher means, power means mounted on said machine frame for rotating said platform, and, means connect ing said power means to said platform for effecting rotational movement thereof so as to align each successively elevated topmost layer with said pusher means, said last named means including a slidable connection between said power means and said platform.

7. The improved machine of claim **6** further including control means for effecting synchronized operation of said elevating means, power rotation means, and said layer pusher means.

8. The improved machine of claim **6**, further including stack guide means, and means mounting said guide means for rotation with said platform.

9. The improved machine of claim **8**, wherein said guide means is slidably connected to said platform.

(References on following page)

7

References Cited

UNITED STATES PATENTS

1,928,016	9/1933	Halbach et al.	214—18.2
1,998,985	4/1935	Flynn	214—23
2,993,609	7/1961	Enterline et al.	214—152
3,168,190	2/1965	Nienstedt	198—106 XR
3,356,231	12/1967	Chambran.	

8

FOREIGN PATENTS

711,820 10/1941 Germany.

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U.S. Cl. X.R.

214—18.2