

[72] Inventor: **Francis Gallucci, North Huntingdon Township, Pa.**

[22] Filed: **Oct. 30, 1970**

[21] Appl. No.: 85,588

[52] U.S. Cl.....214/6 G, 198/24, 271/DIG. 4

[51] **Int. Cl.**.....**B65g 57/10**

[58] **Field of Search** 198/24; 193/38; 271/DIG. 4;
214/6 G, 6 P, 6 DK, 6 D, 6 A, 6 M, 6 N, 6.5, 6 F

[56] **References Cited**

UNITED STATES PATENTS

2,047,272	7/1936	Kimball et al.....	214/6 G
2,127,670	8/1938	Backus.....	214/6 G
2,658,630	11/1953	Melin.....	214/6 G
3,519,143	7/1970	Kochalski	214/6 N

FOREIGN PATENTS OR APPLICATIONS

559,522	7/1958	Canada.....	214/6 A
1,256,155	12/1967	Germany.....	214/6 DK

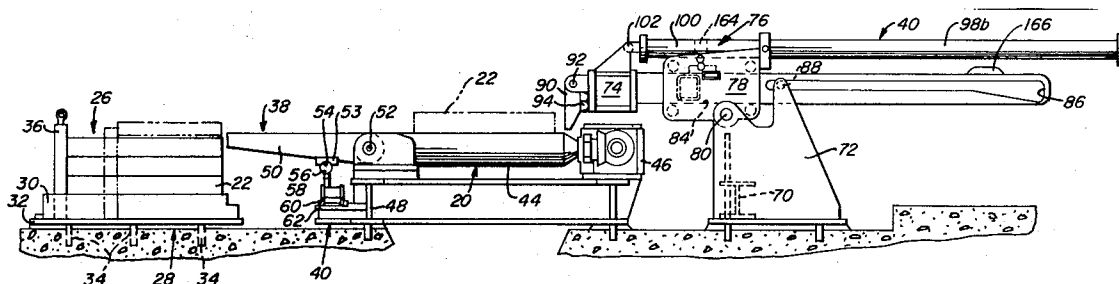
Assistant Examiner—Robert J. Spar

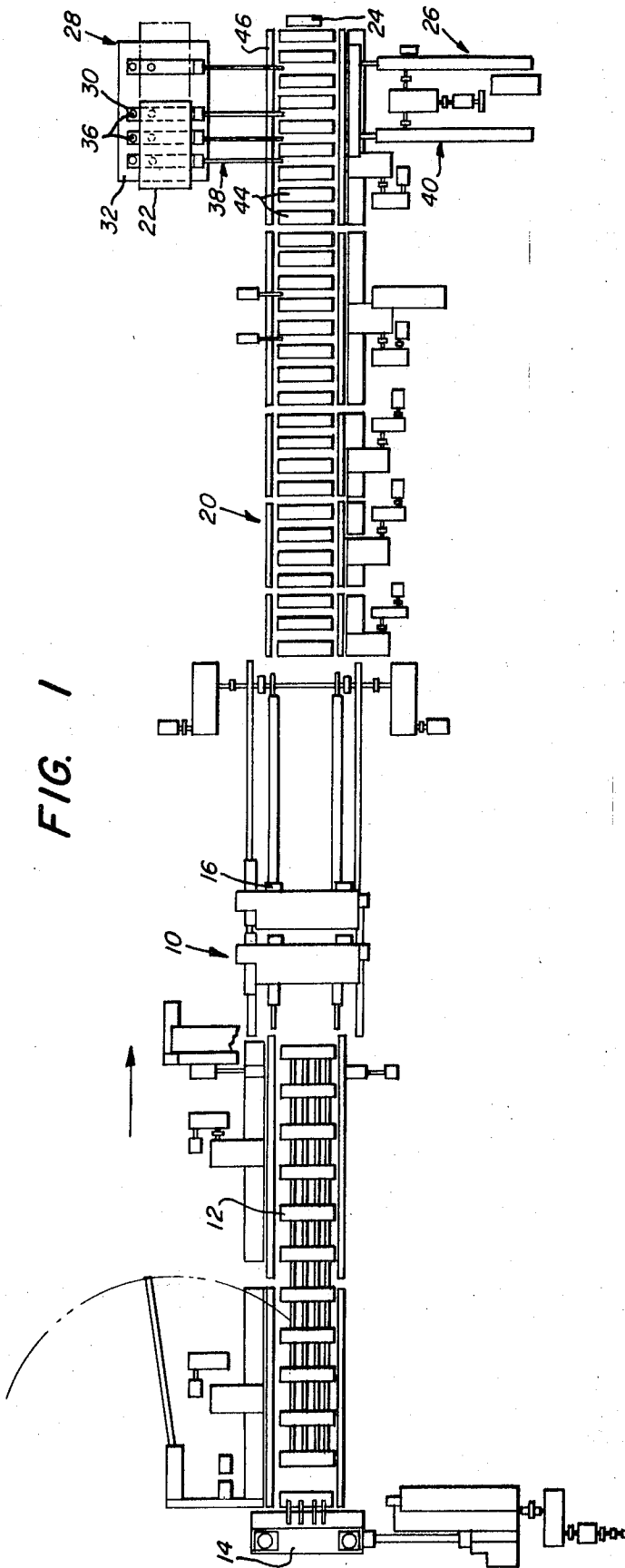
Attorney—Robert J. Leek, Jr.

[57] **ABSTRACT**

A stacking device for a longitudinal member being transported along a predetermined path of movement is disclosed. Arresting means are disposed along the predetermined path of movement for arresting the longitudinal member adjacent to a preselected location. The stacking device has a stacked supporting means adjacent the preselected location on one side of the predetermined path of movement. A movable guide means is disposed on the one side of the predetermined path of movement and is operable to guide longitudinal member from the predetermined path of movement and are reciprocable between a rest position and a stacking position to move the longitudinal member from the predetermined path of movement over the guide means and onto the stack supporting means. Elevating means are connected to the movable guide means for moving the guide means, after delivery of the longitudinal member to the stack supporting means, so that the guide means is aligned with the top of the stacked longitudinal member preparatory for the transfer of another longitudinal member by the stacking device onto the stacked longitudinal member on the stack-supporting means.

33 Claims, 25 Drawing Figures





INVENTOR
FRANCIS GALLUCCI
By *[Signature]*
Attorney

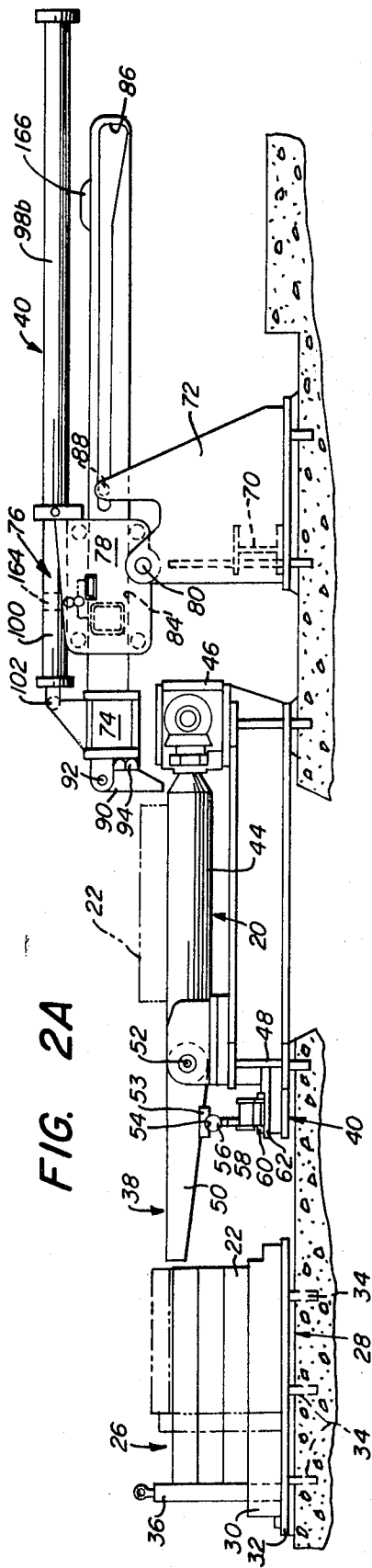
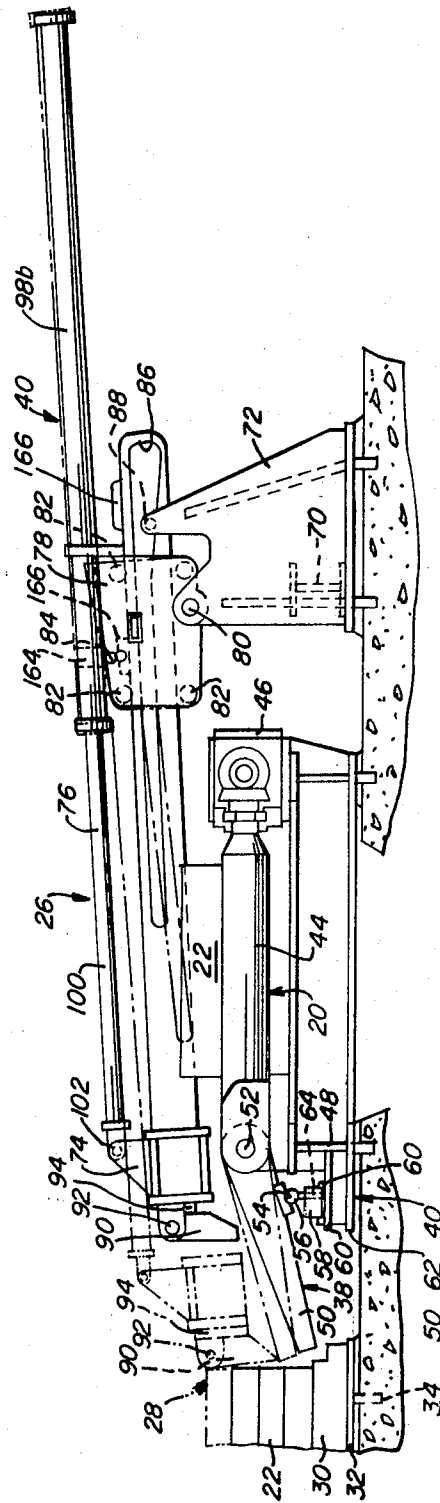


FIG. 2C

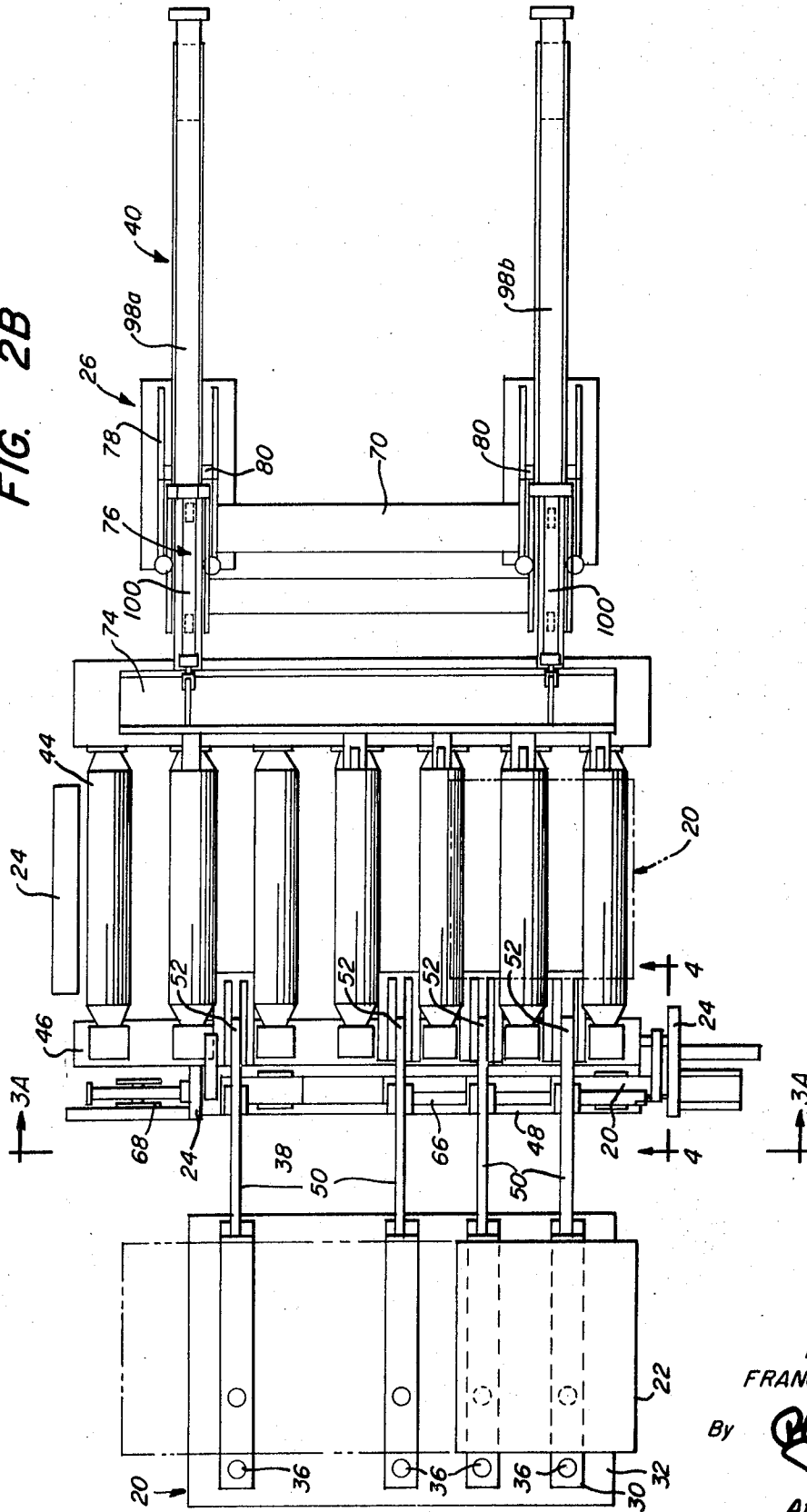


INVENTOR
FRANCIS GALLUCCI

By

Francis Gallucci
Attorney

FIG. 2B



INVENTOR
FRANCIS GALLUCCI

By

[Signature]

Attorney

FIG. 3A

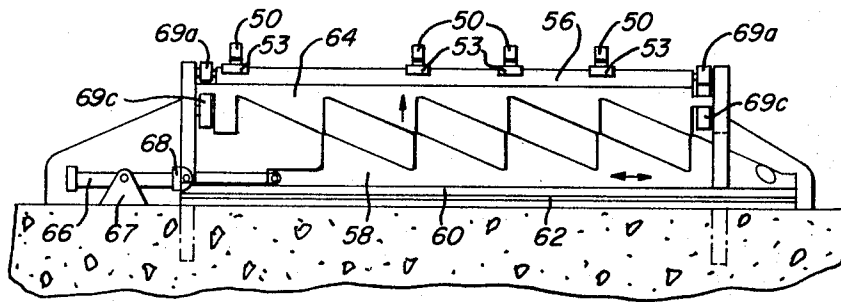


FIG. 3B

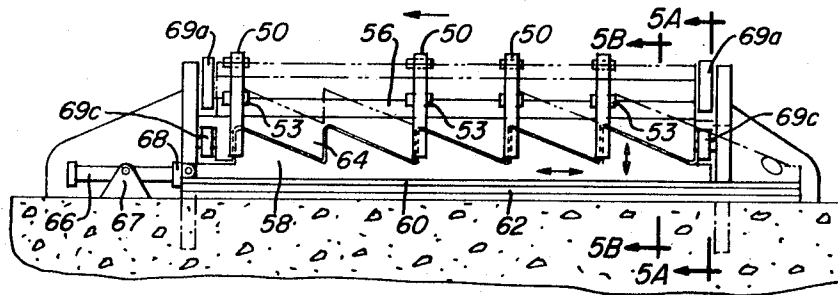
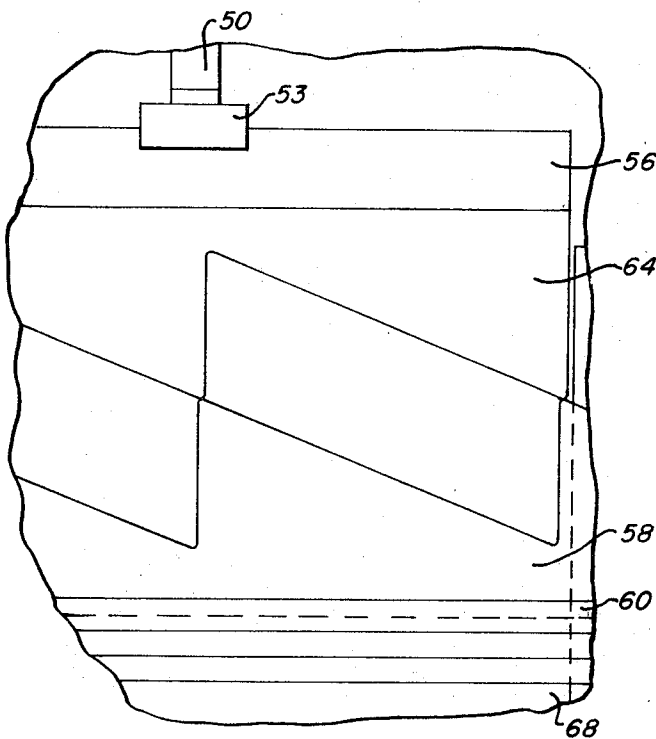


FIG. 3C



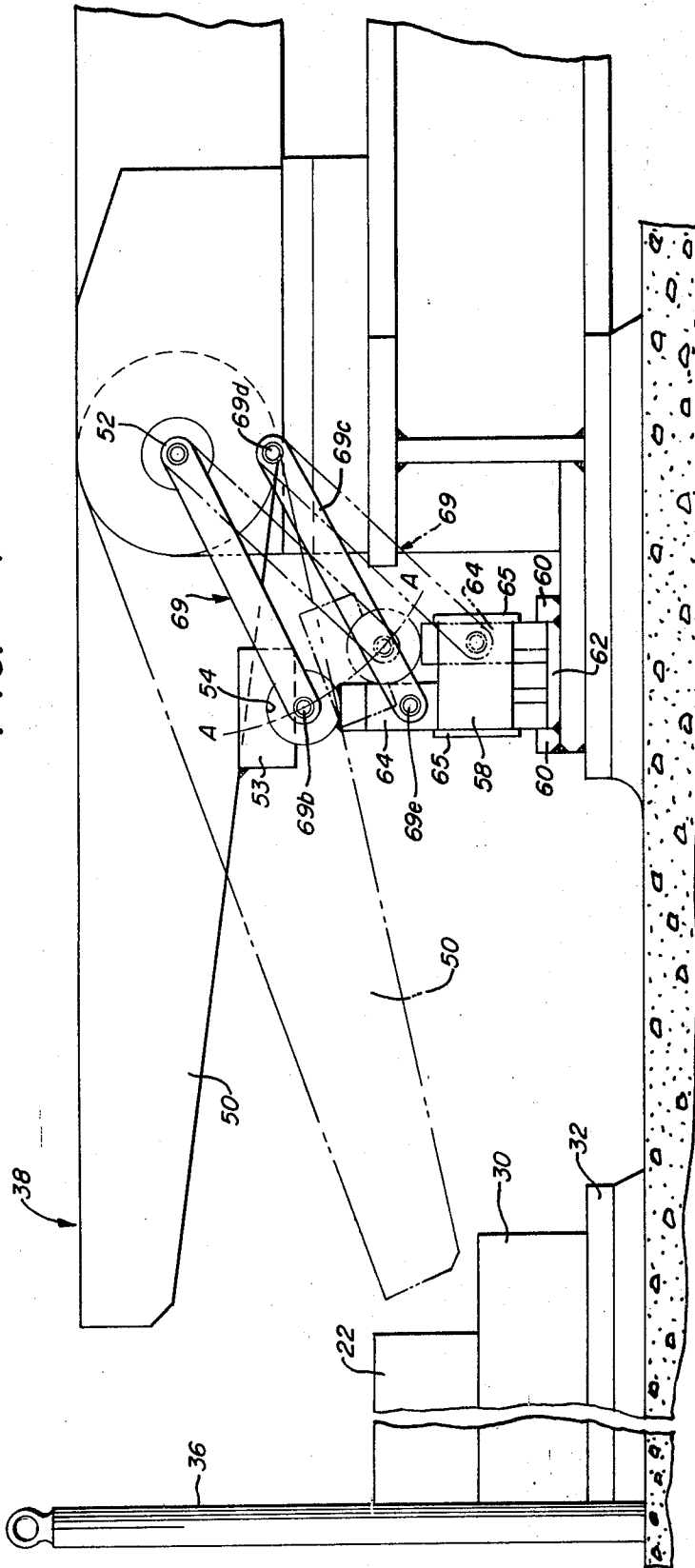
INVENTOR
FRANCIS GALLUCCI

By

[Signature]

Attorney

FIG. 4

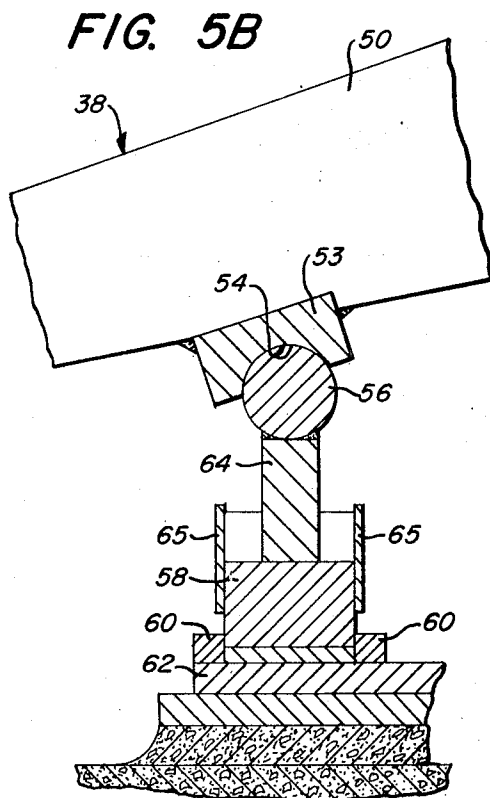
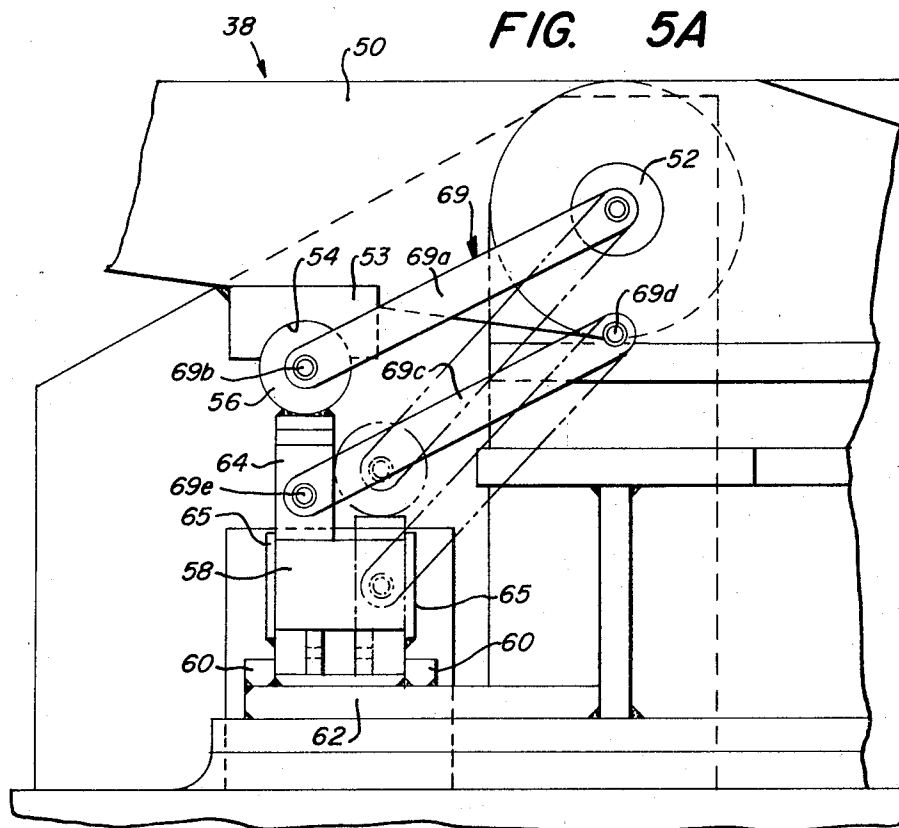


INVENTOR
FRANCIS GALLUCCI

By

[Signature]

Attorney



INVENTOR
FRANCIS GALLUCCI

By

[Signature]

Attorney

FIG. 7

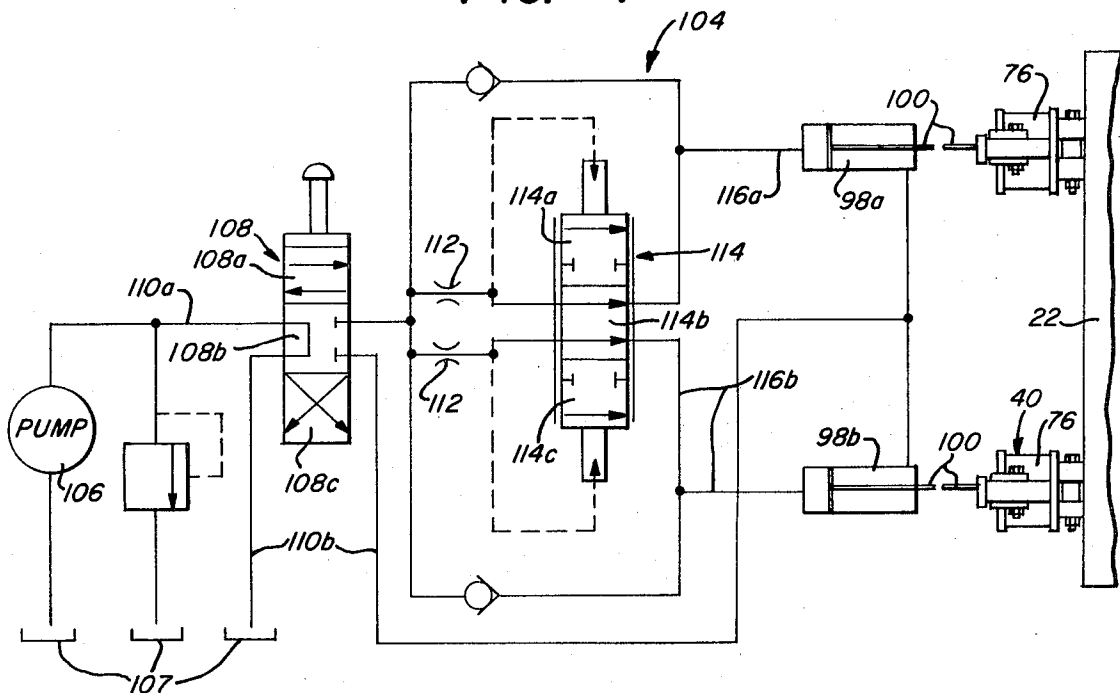


FIG. 6A

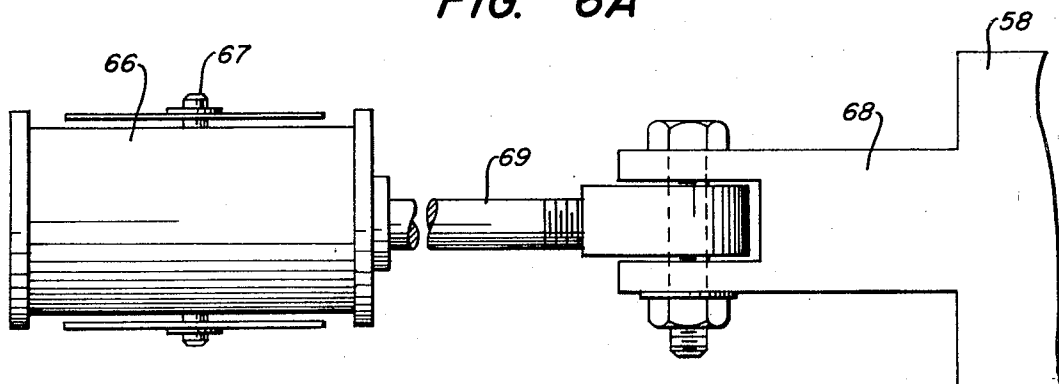
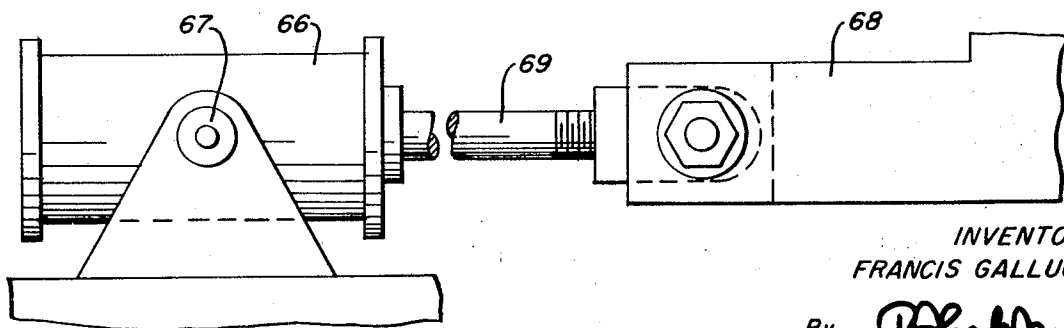


FIG. 6B



INVENTOR
FRANCIS GALLUCCI

By 
Attorney

FIG. 8A

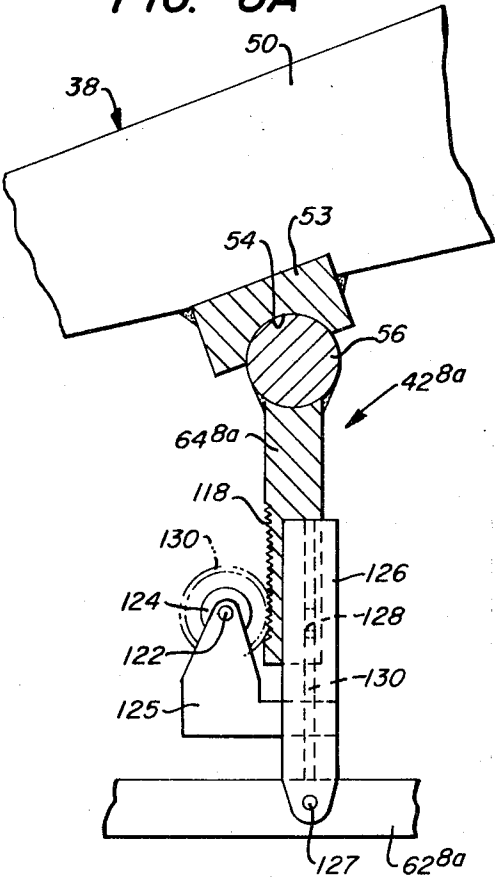


FIG. 8B

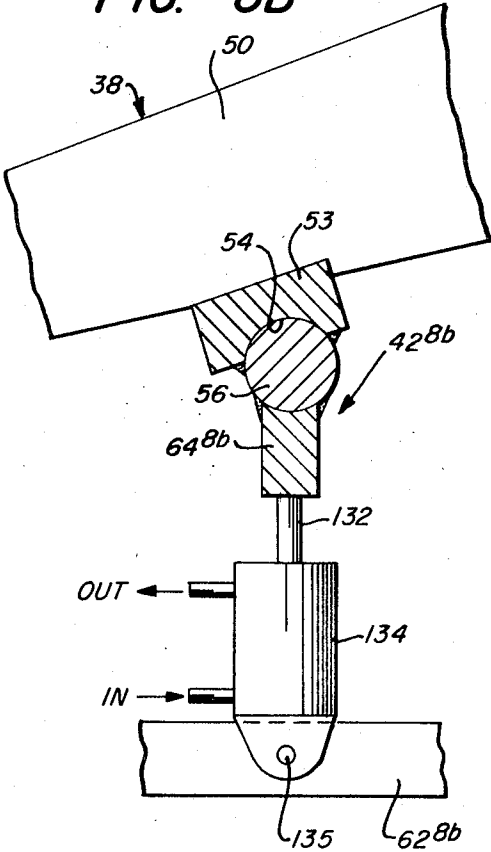
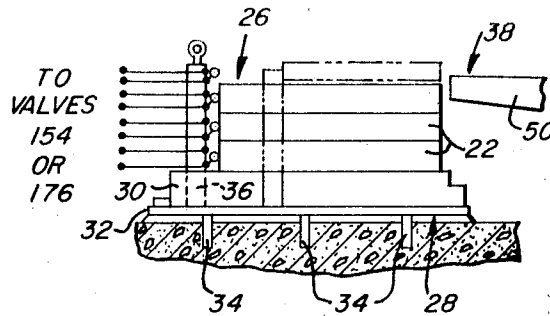
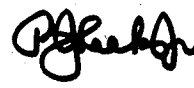


FIG. 10

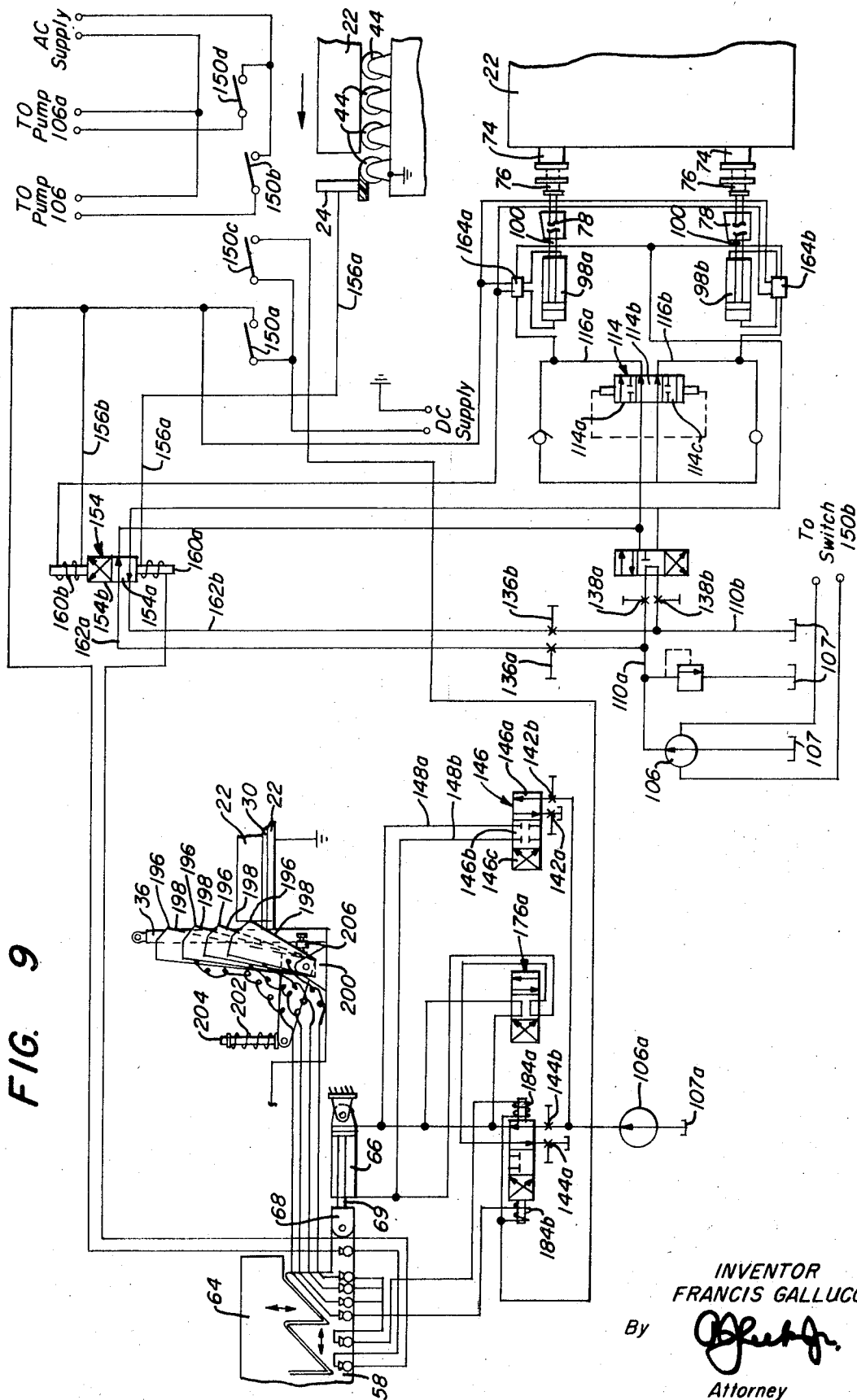


INVENTOR
FRANCIS GALLUCCI

By 

Attorney

FIG. 9



INVENTOR
FRANCIS GALLUCCI

By

Francis Gallucci

Attorney

FIG. 9A

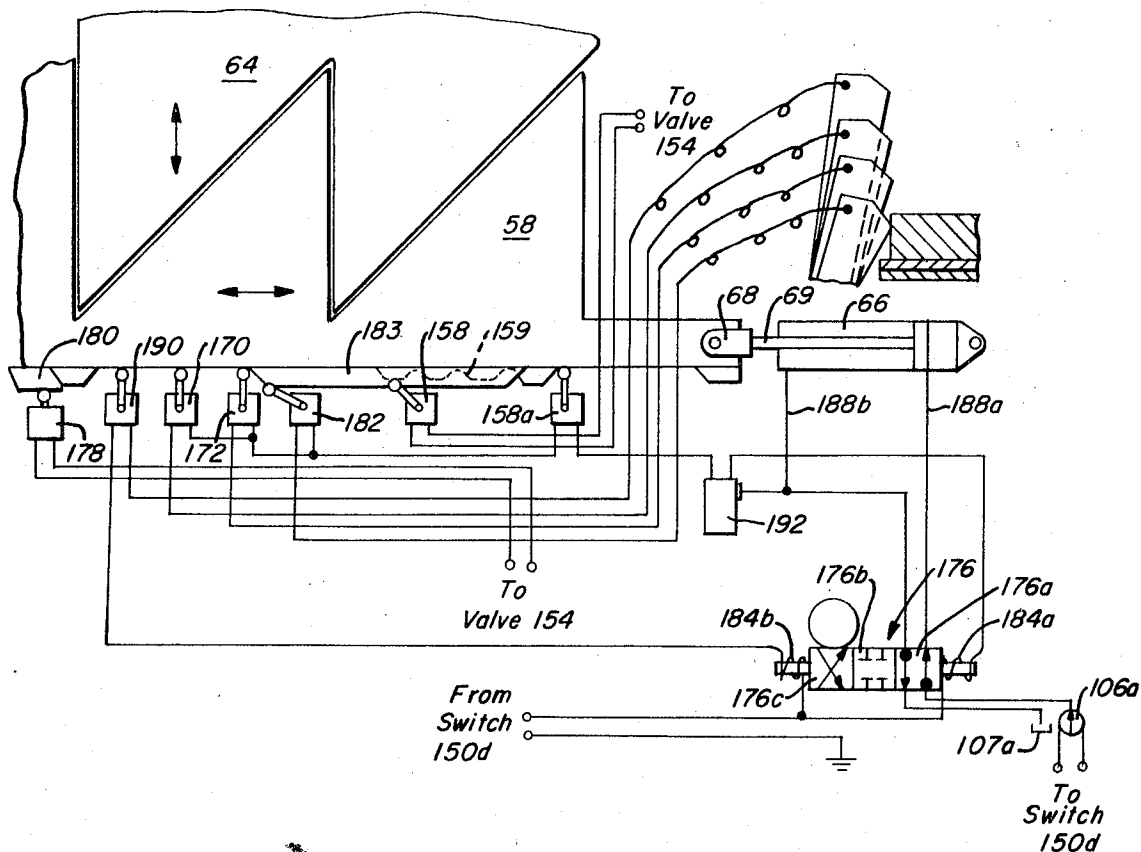
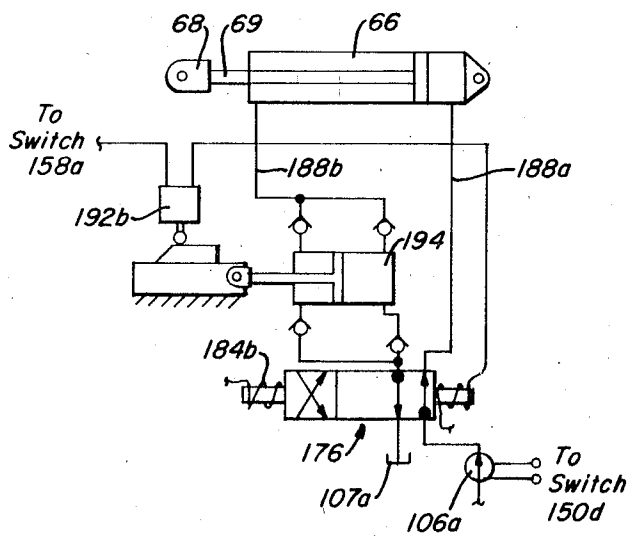


FIG. 9B



INVENTOR
FRANCIS GALLUCCI

By 

Attorney

FIG. 9C

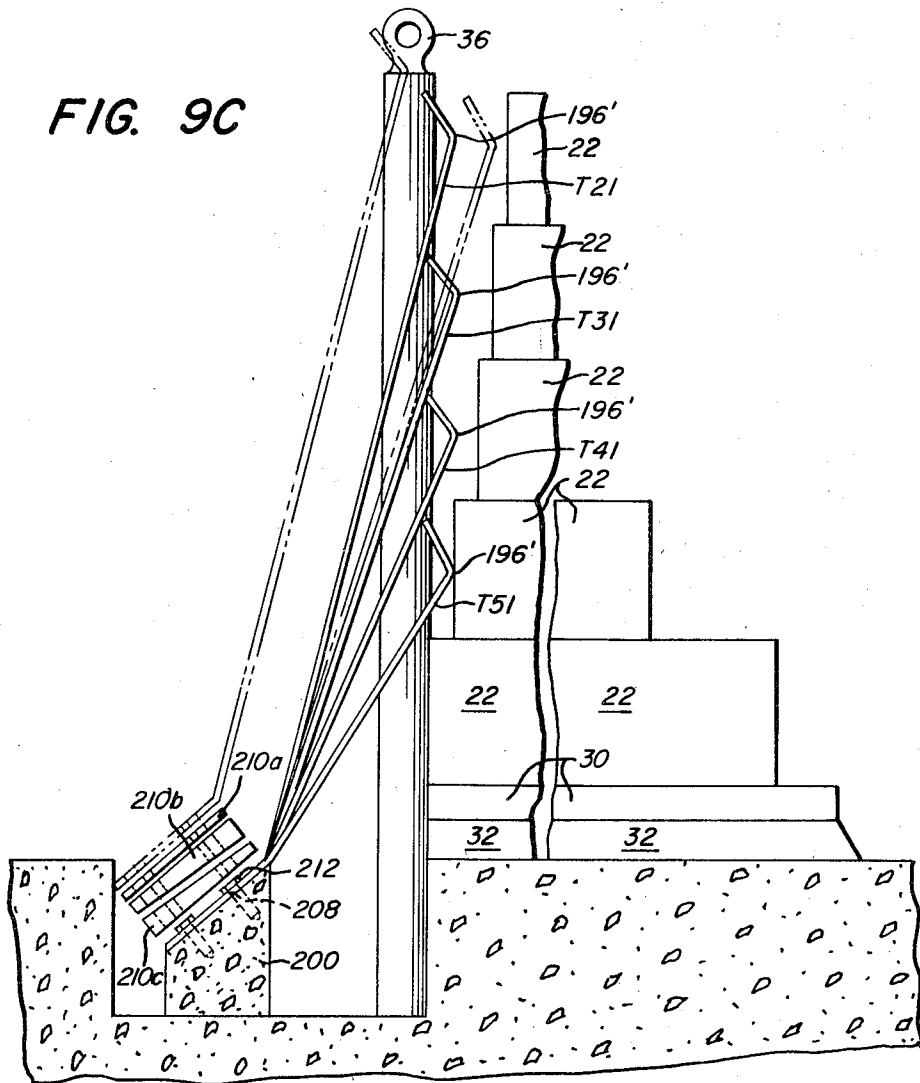


FIG. 9D

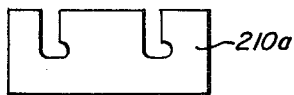


FIG. 9F



FIG. 9H



FIG. 9E

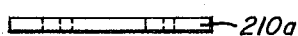
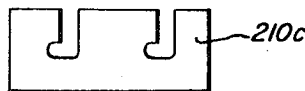


FIG. 9G



INVENTOR
FRANCIS GALLUCCI

By

[Signature]

Attorney

STACKING DEVICE

BACKGROUND OF THE INVENTION

Heretofore, when steel slabs were rolled into plates of various widths and thicknesses, the finished plates were sheared to length as they moved onto tables for transfer to the storage area. When the sheared plates reached the storage area, they were removed from the tables by an overhead crane and piled by the crane on skids. The crane had to remove the piles of sheared plates from the tables rapidly enough to prevent succeeding sheared plates from blocking the flow of sheared plates onto the table and thereby causing shutdown of the rolling mill. Conventional apparatus for accomplishing this transfer is complicated and expensive. The crane requires about 1-½ minutes to remove a slab. With a slab speed of about 5 feet/minute and a slab having a 5-foot length only about 1.1 minutes/cut slab is permitted.

Conventional devices are of the type shown in the following patents:

U.S. Pat. No.	Inventor	Issued
2,127,670	Backus	8/23/38
2,958,433	Burthenshal	11/1/60
3,176,858	Johnson	4/6/65
3,181,684	Miller	5/4/65
3,199,651	Lobbik	8/10/65
3,202,262	Jones	8/24/65

OBJECTS OF THE INVENTION

It is the general object of this invention to avoid and overcome the foregoing and other difficulties of and objections to prior art practice by the provision of improved stacking apparatus which:

1. is simple and rugged in construction;
2. is low in manufacturing cost and maintenance cost;
3. is efficient in operation;
4. has a minimum of moving parts;
5. has a minimum number of antifriction bearings;
6. has a long operational life; and
7. is positionable under no load conditions.

BRIEF SUMMARY OF THE INVENTION

The aforesaid objects of this invention, and other objects which will become apparent as the description proceeds are achieved by providing an improved stacking device for a longitudinal member being transported along a predetermined path of movement. Arresting means are disposed along the predetermined path of movement for arresting the longitudinal member adjacent a preselected location. The stacking device has a stacked supporting means adjacent the preselected location on one side of the predetermined path of movement. A movable guide means is disposed on the one side of the predetermined path of movement and is operable to guide the longitudinal member from the predetermined path of movement to the stack supporting means. Transfer means are adjacent the preselected location on the other side of the predetermined path of movement and are reciprocable between a rest position and a stacking position to move the longitudinal member from the predetermined path of movement over the guide means and onto the stack-supporting means. Elevating means are connected to the movable guide means for moving the guide means, after delivery of the longitudinal member to the stack-supporting means, so that the guide means is aligned with the top of the stacked longitudinal member preparatory for the transfer of another longitudinal member by the stacking device onto the longitudinal member on the stack-supporting means.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

For a better understanding of this invention, reference should be had to the accompanying drawings wherein like numerals of reference indicate similar parts throughout the several views and wherein:

FIG. 1 is a plan view of a portion of a continuous casting line and showing the run out table extending from the straightening roll, the slab-cutting device, the cut slab run out table, a marking station adjacent the cut slab run out table and the improved stacking device of the present invention;

FIG. 2A is a side elevational view showing the transfer device in the retracted or rest position adjacent the cut slab run out table, a stack-supporting means disposed on one side of the cut slab run out table, a guide means mounted on the other side of the run out table, stack-supporting means on the same side as the guide means and elevating means connected to the guide means, such guide means being shown in position preparatory for the delivery of a supporting means but omitting for clarity the pantograph device connecting the upper vertical wedge to the guide arm;

FIG. 2B is a plan view of the apparatus shown in FIG. 2A;

FIG. 2C is a view similar to FIG. 2A showing the transfer means in the slab delivery position and showing the fourth slab stacked on the three prior slabs on the stack-supporting means;

FIG. 3A is an end elevational view partially in section taken along the line 3A—3A of FIG. 2B in the direction of the arrows, showing the elevating means in position preparatory for the delivery of a fourth slab onto the three stacked slabs already piled on the stack-supporting means and also showing portions of the pantograph linkage;

FIG. 3B is a view similar to FIG. 3A showing the elevating mechanism in the down position similar to that shown in FIG. 2C;

FIG. 3C is an enlarged fragmentary view of a portion of the elevating device shown in FIG. 3A;

FIG. 4 is an enlarged side elevational view of the guide means and elevating means showing the guide means (in dotted lines) in position after delivering the first slab to the stack-supporting means, showing the guide means in position for delivery of the fourth slab onto the piled slabs on the stack-supporting means, showing also the arcuate path of movement of the connection between the vertical wedge means and the guide member and the horizontal movement between the vertical wedge member and the horizontal wedge member to produce the arcuate oscillating movement of the guide arm and also showing the pantograph linkage;

FIG. 5A is a fragmentary enlarged side elevational view taken along the lines 5A—5A of FIG. 3B in the direction of the arrows and showing the pantograph linkage between the frame portions of the elevating means, the guide arm, and the vertical wedge member;

FIG. 5B is a fragmentary enlarged view, partially in vertical section of the elevating means;

FIG. 6A is a fragmentary plan view showing the connection details between the horizontal wedge member and the operating means or drive means for the elevating means;

FIG. 6B is a side elevational view of the apparatus shown in FIG. 6A;

FIG. 7 is a diagrammatic or schematic view of the reciprocating means for the transfer device;

FIGS. 8A, 8B are views similar to FIG. 5B of alternative elevating means drive means;

FIG. 9 is a schematic view of an alternative electrical and hydraulic control means for the stacking device;

FIG. 9A is an enlarged fragmentary view of a portion of the circuit and control means shown in FIG. 9;

FIG. 9B is a fragmentary schematic view of an alternative pressure circuit breaker;

FIG. 9C is a fragmentary side elevational view of an alternative embodiment of trip arms;

FIG. 9D is a plan view of a flat shim employed on the insulated base to position the contact point on the trip arms;

FIG. 9E is a side elevational view of the flat shim shown in FIG. 9D;

FIG. 9F is a view similar to FIG. 9E of a tapered shim;

FIG. 9G is a plan view of a reverse shim;

FIG. 9H is a side elevational view of the reverse shim shown in FIG. 9G; and

FIG. 19 is a view similar to FIG. 9C showing an alternative embodiment of the control means utilizing switches in lieu of the trip arms and the switches which are operated by the lower horizontal reciprocable wedge of the elevating means.

Although the principles of this invention are broadly applicable to the stacking of longitudinal members, such as plates, beams, billets, structurals, and the like, this invention is particularly adapted for use in conjunction with a continuous casting line for producing plate slabs and hence it has been so illustrated and will be so described.

DETAILED DESCRIPTION

With specific reference to the form of this invention illustrated in the drawings, and referring particularly to FIG. 1, a portion of a continuous casting line is indicated generally by the reference numeral 10. This portion 10 of the continuous casting line shows a cutoff approach table 12 extending from the straightening roll 14 to the slab cutting apparatus 16, suitably of the acetylene torch type or the like. The cutoff approach table 12 conveys a strand 18 (not shown in FIG. 1) to the slab-cutting apparatus 16 where such strand 18 is cut into a predetermined length. A cut slab runout table 20 conveys the cut slabs 22 (not shown in FIG. 1) from the slab cutting apparatus 16 to a stop 24 (FIG. 1) of the disappearing type or the like along a predetermined path of movement adjacent a preselected location, such as a stacking device 26 of the present invention.

STACKING DEVICE 26

As shown in FIGS. 1, 2A, 2B and 2C, the stacking device 26 has a stack supporting means 28 (FIGS. 1, 2A-2C) adjacent the preselected location on one side i.e., the left side as shown in FIGS. 1, 2A-2C) of the predetermined path of movement (i.e., cut slab rim out table 20). The means 28 comprises a bed plate 30 (FIGS. 1, 2A-2C) suitably formed of concrete or the like, mounted on a steel plate 32 (FIGS. 1, 2A-2C) upstanding from supports 34 (FIGS. 1, 2A, 2C). Stop means, such as the posts 36 (FIGS. 1, 2A, 2B) or the like, limit the support transfer movement of the longitudinal members or plate slabs 22 (FIGS. 1, 2A, 2C) as hereinafter explained.

Movable guide means 38 (FIGS. 1, 2A-2C) are disposed on one side of the predetermined path of movement of the cut plate slabs 22 i.e., the left or same side as the means 28) and are operable to guide the longitudinal members or cut plate slabs 22 or the like from their final position as determined by the stop 24 (FIG. 1) on the cut slab runout table 20 to the stack supporting means 28 (FIGS. 2A-2C).

Transfer means 40 (FIGS. 1, 2A-2C) are disposed adjacent the preselected location or cut slab runout table 20 (above described) on the other side of the predetermined path of movement of the cut plate slabs 22 on the cut slab runout table 20 (i.e., right-hand side of table 20) and is reciprocable between a rest position shown in the solid lines of FIGS. 2A, 2B and a stacking position shown in the dotted line position of FIG. 2C to move a cut plate slab 22 from its arrested position on the cut slab runout table 20 over the guide means 38 onto the stack supporting means 28.

Elevating means 42 (FIGS. 2A, 2C) are connected to the movable guide means 28 for moving the guide means 38, after delivery of a cut plate slab 22 to the stack-supporting means 28, so that the movable guide means 38 is aligned with the top of the stacked cut plate slab 22 preparatory for the transfer of another cut plate slab 22 by the transfer device 40 of the stacking device 26 onto the last stacked cut plate slab 22 on the stack supporting means 28.

CUT SLAB RUNOUT TABLE 20

The cut slab runout table 20 shown in FIGS. 1, 2A-2C has a plurality of rollers 44 journaled in a frame 46 and powered in the usual manner by drive means, not shown in such Figures.

MOVABLE GUIDE MEANS 38

The movable guide means 38 (FIGS. 1, 2A-2C, 5B) has a guide means frame 48 and a plurality of guide members 50 oscillatable between a zero layer position (shown in the solid line in FIG. 2C) to a preselected layer position shown either in solid lines in FIG. 2A or dotted lines in FIG. 2C. Each guide member 50 is pivotable on the guide means frame 48 at 52 (FIGS. 2A-2C, 4, 5A) and carries a block 53 (FIGS. 2A-2C, 4, 5A) secured to its under portions, as by welding or the like. Each block 52 is provided with an arcuate groove 54 (FIGS. 2A, 2C, 4, 5) engageable with a cylindrical rodlike connecting member 56 (FIGS. 2A-2C, 3A-3B, 4, 5A, 5B) of the elevating means 42.

ELEVATING MEANS 42

The elevating means 42 shown in FIGS. 2A-2C, 3A-3C, 4, 5A and 5B has a horizontal wedge member 58 (FIGS. 2A, 2C, 3A-3C, 4, 5A, 5B) reciprocable horizontally as indicated by the arrows in FIGS. 3A, 3B, in suitable guides 60 (FIGS. 2A, 2C, 3A-3C, 4, 5A, 5B) provided in an elevating mechanism frame 62 (FIGS. 2A, 2C, 3A-3C, 4, 5A, 5B). In addition, a vertical wedge member 64 (FIGS. 2A, 2C, 3A-3C, 4, 5A, 5B) engages the horizontal wedge member 58 and is reciprocable in a vertical plane (as indicated by the arrows in FIGS. 3A, 3B) by means of the cylindrical connecting member 56 to elevate or retract the guide member 50 to the desired position. The lower horizontal wedge 58 has guides 65 (FIGS. 4, 5A, 5B) to retain the narrower upper vertical wedge 64 thereon during the vertical and sideways reciprocating movement of the wedge 64 on the lower wedge 58 as shown particularly in FIGS. 4, 5A, 5B. It will be understood from a consideration of FIGS. 4, 5A, 5B that this horizontal reciprocation of the vertical wedge member 64 on the horizontal wedge member 58 provides the arcuate path of movement indicated by the arcuate line A-A in FIG. 4. The operating means utilized to drive the elevating mechanism 42 is suitably a fluid cylinder 66 (FIGS. 3A, 3B, 6A, 6B) pivoted at 67 on the frame 62, and having its piston 69 (FIGS. 6A, 6B) connected by a clevis means 68 shown in FIGS. 3A, 3B, 6A and 6B to either of the horizontal wedge member 58 or the vertical wedge member 64. In the showing of FIGS. 3A, 3B, 6A, 6B and in FIGS. 2B, the fluid cylinder 66 is connected to the horizontal wedge member 58.

As shown in FIGS. 3A, 3B, 6A, 6B, a pantograph device 69 provided with a first link 69a extending between the guide arm pivot 52 and a connection 69b with the cylindrical connecting member 56. A second link 69c extends from a pivot point 69d on the frame 62 to a connection point 69e on the upper vertical wedge 64. The pantograph device 69 moves from the solid line upper position (FIGS. 4, 5A) to the lower dotted line position (FIGS. 4, 5A).

TRANSFER DEVICE 40

The transfer device 40 (FIGS. 2A-2C) has a transfer device frame 70 (FIGS. 2A-2C) mounted on supports 72 (FIGS. 2A, 2C) upstanding from the floor portions of the plant or operating facility. Such transfer device 40 has a transfer head 74 (FIGS. 2A-2C) carried by ram members 76 (FIGS. 2A-2C) (between the normal rest position of the transfer device 40 shown in FIG. 2A and the transfer position shown in the dotted lines of FIG. 2C) by a guide member 78 (FIGS. 2A-2C) pivotable on the frame supports 72 at 80 (FIGS. 2A-2C) and provided with guide means, such as rollers 82 or the like adjacent a guide slot 84 (FIGS. 2A, 2C) in the guide member 78. The rollers 82 engage or ride on the ram members 76.

In addition, each ram member 76 is provided with a guide slot 86 (FIGS. 2A, 2C) and the frame 70 carries a cam roller 88 (FIGS. 2A, 2C) which roller 88 rides in such guide slot 86. The forward or left-hand end of the transfer head 74 as viewed in FIGS. 2A-2C carries transfer members or fingers 90 pivotable

at 92 on the transfer head 74 for engagement with a cut plate slab 22 during the transfer operation.

It will be understood that during the transfer movement of the cut plate slab 22, each transfer finger 90 rests against a stop 94 on the transfer head 74. During retracting movement of the transfer head 74 from the transfer position shown in FIG. 2C in the dotted lines and the normal rest position shown in solid line in FIG. 2A, each transfer finger 90 is free to pivot in a clockwise direction on the pivot 92. If such transfer finger should engage an obstacle, such as a cut plate slab 22 on the cut slab runout table 20, the finger 90 will pivot away from such obstacle and avoid damage to both the finger 90 and the transfer device 40.

The reciprocating means 96 for reciprocating the transfer head 74 between the rest position shown in FIG. 2A and the dotted line transfer position shown in FIG. 2C may be fluid cylinders 98a, 98b, or the like, each having its piston 100 pivotally connected at 102 (FIGS. 2A, 2C) on the transfer head 74. The operating means 104 for controlling the action of the fluid cylinder 98 is shown in detail in FIG. 7.

OPERATING MEANS 104

The operating means 104 shown in FIG. 7 has a fluid supply means, such as a pump 106 or the like, which pump 106 pumps a fluid such as oil, air, or the like, from reservoirs 107 to a valve means, such as a three-position, four-way valve 108. The valve 108 has an advancing section 108a, a blocking section 108b and a retracting section 108c. Such valve 108 is shown in the blocking position in FIG. 7. When, for example, the valve 108 is moved to the advancing position so that the advancing section 108a is in communication with the lines 110a, 110b from the pump 106 and the reservoirs 107, fluid flows through volume control orifices 112 to a flow divider means 114. This flow divider 114 has a first divider section 114a for piston 98a, a dual flow section 114b for both pistons 98a, 98b, and a second divider section 114c for the piston 98c. Lines 116a, 116b carry the automatically controlled flow of fluid to the appropriate end of the hydraulic cylinders or fluid cylinders 98a, 98b to cause the desired predetermined operation of the transfer device 40.

ALTERNATIVE EMBODIMENTS

It will be understood by those skilled in the art that alternatively as shown in FIG. 8A, the upper wedge 64 of FIGS. 1-7 is replaced by a rack 118, driven by a pinion 120 on a shaft 122. The shaft 122 is driven by a motor 124 mounted on brackets 126 extending from a guide 126. The rack 118 is keyed at 128 to a slot 130 in the guide 126 and pivoted.

In FIG. 8B, a plate 64^{8b} is driven by a piston 132 of a fluid cylinder 134 and pivoted at 135.

Referring now to FIG. 9 and the alternative electrical and hydraulic control means or operating means 104⁹, the cylinders 98a, 98b can be manually controlled to operate the transfer means or device 40.

MANUAL CONTROL OF TRANSFER MEANS 40

During manual control of the transfer means 40, the manual two-way valves 136a, 136b (FIG. 9) are closed to cut out the automatic circuit. In order to activate the manual control, two-way valves 138a, 138b are open to cut in the manual controls. When the manual valve 140 is moved to a position where lines 110a, 110b communicate with section 140a of valve 140, the ram members 76 will advance. As the ram members 76 advance, the transfer fingers 90 push the slab 22 across the roll table 20 (FIGS. 2A-2C) and down the guide arms 50. Moving the valve 140 to a position where reversing section 140c of the valve 140 aligns with lines 110a, 110b, the cylinders 98a, 98b will reverse and retract the ram members 76 to the edge of the roll table 20 (FIGS. 2A-2C) and await the next slab 22. Leaving blocking section 140b in communication with lines 110a, 110b, the rams 76 will not move either way (FIGS. 2A-2C).

MANUAL CONTROL OF GUIDE MEANS 38

In like manner, the same type manually operated valve can be used to activate the cylinder 66 (FIGS. 3A, 3B, 6A, 6B) to raise or lower the guide members 50. First manual valves 142a, 142b (FIG. 9) are opened and manual valves 144a, 144b are closed. This cuts out the automatic circuit and activates the manual circuit. Then by moving the manual valve 146, so section 146a aligns with lines 148a, 148b, cylinder 66 will raise guide arms 50. By moving the valve 146 so that reversing section 146c aligns with lines 148a, 148b, the guide arms 50 will be lowered. The valve 146 will be spring centered when free, and block both circuits by having blocking section 146b opposite lines 148a, 148b. With circuits to cylinder 66 blocked, no fluid flows and the guide arms 50 will remain at whatever elevation they are in.

AUTOMATIC OPERATION OF TRANSFER MEANS 40

The main electrical switches 150a for valve 154, 150c, for valve 176 (FIG. 9) are closed, manual valves 136a, 136b are opened, and manual valves 138a, 138b are closed. This cuts out manual control of the transfer means 40 and cuts in the automatic controls for the transfer means 40. DC electrical circuit switch 150b for pump 106, 150d for pump 106a (FIG. 9) are then closed to activate the electric circuits. As the oncoming slab 22 touches a first stop means, such as the stop 24 (FIG. 9), the slab 22 closes an electric circuit from a first valve means such as a valve 154 through a stop 24 and the slab 22 to the frame of the table 20 and ground. The stop 24 is insulated from the table 20 and is connected to the automatic valve 154 by electrical conductors 156a, 156b through a first switch means, such as a safety switch 158 (FIG. 9A), actuated by a first cam means, such as a cam 159 on wedge 58 on the guide means side to the DC circuitry. The electrical impulse passes through a first operating means, such as a solenoid coil 160a on the valve 154 causing the plunger of the valve 154 to shift to a position where section 154a communicates with lines 162a, 162b. This fluid passes through a two-way hydraulic reversing valve 146a, 146b (FIGS. 2A, 2C, 9) to the back end of the cylinders 98a, 98b (FIGS. 2A-2C) to push the slab 22 off the table 20, down the guide arms 50 and against the post stops 36. As the slab 22 touches the stops 36, a cam 166 (FIGS. 2A, 2C) on the guide member trips the two hydraulic reversing valves 164 causing them to reverse the hydraulic flow to the front of the cylinders 98a, 98b thereby causing them to retract the ram members 76, which rams 76 return to the other side of the table 20. A second switch 170 or 172 (depending on which layer of slabs 22) are actuated by cam 183 on the wedge 58 and now reverses the 148 means valve 154 for the next stroke. The ram members 76 are not retracted again until another slab 22 strikes the stop 24 and closes the electric circuit to the solenoid coil 160b on the transfer means four-way valve 154. As a safety measure, the circuit from the stop 24 to a second valve means, such as a guide means automatic control valve 176, is also broken by switch 158 when the guide arms 50 are not down. This prevents the transfer device 40 from kicking a slab 22 off the table 20 and into an already piled slab 22 on the stack supporting means 28. When the top slab 22 is in place and trip arm T₂ (FIGS. 9, 9A) is in contact with a slab 22, switch 178 is opened by a cam 180 on the wedge 58. Breaking the circuit insures that the ram members 76 will not push another slab 22 against the top slab 22 on the pile.

AUTOMATIC OPERATION OF GUIDE MEANS 38

In order to operate the guide means 38 automatically, manual valves 142a, 142b are closed and manual valves 144a, 144b are opened. This activates the automatic circuits and cuts out the manual circuits. Main electric switches 150a for transfer means valve 154, 150b for pump 106, 150c for guide means valve 176, 150d for pump 106a are all closed.

When the slab 22 is pushed against the stops 36, it touches and depresses one of the trip arms T₂-T₅ that is at that par-

ticular level. The bottom slab 22 will touch and depress strip arm T5. This closes a DC electric circuit from the grounded steel base plate 32 through the slab 22 to the particular trip arm of the group T2-T5 which trip arm is insulated from the ground. The trip arm T5, for example, is electrically connected to a second switch means, such as a switch 182. Switch 182 is closed at the proper moment when a second cam means, such as a cam 183 on the wedge 58 strikes it. This closes an electric circuit momentarily to a second operating means, such as a solenoid coil 184a on the valve 176. The solenoid coil 184a causes the valve plunger of the valve 176 to shift to the left so that section 176a aligns with lines 188a, 188b to feed hydraulic fluid to the back end of the cylinder 66, thereby advancing the wedge 58 to the left (FIGS. 9, 9A). Advancing of the wedge 58 raises the top wedge 64 through the wedge action heretofore explained. This, in turn, raises all the movable guide arms 50 (FIGS. 2A-2C) up to the next slab level. Simultaneously switch 158 is opened by cam 159 (shown dotted in FIG. 9A) to prevent the transfer means 40 from discharging another slab 22 until the guide arms 50 are up to another slab level.

The switch 158 closes the circuit to the transfer means 40 at each slab level. When the top slab level is reached, switch 182 reverses the guide means valve 176 by energizing the solenoid coil 184b opposite the end energized by switches 190, 170, 172. In so doing, the reversal of guide means valve 176 permits fluid to flow through line 188b into the rod end of the cylinder 66 causing it to return wedge 58 to the right and lower the guide arms 50. Moving the wedge 58 to the right will also close switches 190, 170, 172 which switches will energize the other solenoid coil 184a on the guide means valve 176. This causes the two coils 184a, 184b to buck one another and it is necessary to open the electric circuit between the switches 190, 170, 172. Opening the circuit is accomplished by use of a pressure switch means, such as a pressure switch 192. As the hydraulic fluid passes from the valve 176 through line 188b to the rod end of the cylinder 66, a branch line of the hydraulic circuit passes fluid into the normally closed pressure switch 192 and breaks the electric circuit. When the cylinder 66 is again reversed to advance the wedge 58, the exhausting fluid is of low enough pressure so that the pressure switch 192 remains closed and the circuit remains closed.

The manual emergency jog valve 176a (FIG. 9) may be used in place of the automatic valve 176.

In FIG. 9B, alternatively a fluid cylinder 194 is used to actuate a cam 196 to operate the pressure switch 192b.

It will be understood that the trip arms T2-T5 (FIGS. 9, 9A) are adapted for easy replacement and adjustment. Such trip arms T2-T5 are plates with a protruding contact point 196 on one edge, with the front edge 198 of the arm T2-T5 sloping away (up and down) from the point 196. The arms T2-T5 are adapted to project the contact point 196 beyond the stops 36 several inches to insure that the slabs 22 make good contact therewith. A contacting slab 22 pushes the contact point 196 back in line with the stops 36. As a trip arm T2-T5 rotates back on the insulated base 200, a collar 201 compresses the coil spring 202. A positioning nut 204 is used to provide a predetermined pressure in the spring 202. A setscrew 206 on the trip arm mounting base 200 is used to control the distance the slab contact points 196 protrude beyond the stops 36. The sloping edges 198 of the trip arms T2-T5 are so shaped to prevent any corners on the slabs 22, when hoisted or lowered, from catching the trip arms T2-T5.

In FIG. 9C, an alternative arrangement of the trip arms T2-T5 is shown. Each trip arm T2'-T5' is a flat length of spring steel that is formed to have contact points 196' on one end and a mounting hole 208 on the other end. There are a plurality, such as, for example, four different lengths of trip arms T2'-T5' to provide for different elevations as the pile of slabs 22 gets higher. Flat shims 210a (FIGS. 9D, 9E), tapered shims 210b (FIG. 9F) and reverse shims 210c (FIGS. 9G, 9H) are used on the base 200 to position the protrusion of the contact points 196' beyond the stops 36. The spring steel in the

trip arms T2'-T5' supplies the necessary spring to keep pressure against the slab 22, but gives a limited amount, as the slab 22 moves into contact with each trip arm T2'-T'. Changing of each trip arm T2'-T5' requires only the loosening of the mounting bolts 212, inserting the chosen slotted shim either 210a, 210b, or 210c and tightening the bolts 212.

It will be understood from the above description of the control or operating means 104⁹ (FIGS. 9, 9A-9H) that such control means 104⁹ can be connected to any one of the transfer means 40, stack-supporting means 28, the movable guide means 38 and the drive means (i.e., operating cylinders 66, 98a, 98b) for controlling the operation of the stacking device 26. For example, in FIG. 10 normally open switches 214, through 214₅ are mounted on the stops 36; are closable by the delivered slabs 22, and are connectable to either the solenoid coils 160a, 160b associated with the valve 154 or the solenoid coils 184a, 184b associated with the valve 176.

SUMMARY OF THE ACHIEVEMENTS OF THE OBJECTS OF THE INVENTION

It will be recognized by those skilled in the art that the objects of this invention have been achieved by providing an improved stacking device 26 for transferring a longitudinal member 22 being transported, for example, by a cut slab run-out tab 20 against a stop means 24 to a stack. The improved stacking device 26 is simple and rugged in construction, is low in manufacturing cost and maintenance cost, is efficient in operation, has a minimum number of antifriction bearings, has a long operational life and is positionable in the desired transfer position under no load conditions.

While in accordance with the patent statutes, preferred and alternative embodiments of this invention have been illustrated and described in detail, it is to be particularly understood that the invention is not limited thereto or thereby.

I claim:

1. A stacking device for a longitudinal member being transported along a predetermined path of movement and having means for arresting said longitudinal member adjacent a preselected location, said stacking device having:

- a. stack-supporting means adjacent said preselected location on one side of said predetermined path of movement;
- b. movable guide means on said one side of said predetermined path of movement and operable to guide said longitudinal member from said predetermined path of movement to said stack-supporting means;
- c. transfer means adjacent said preselected location on the other side of said predetermined path of movement and reciprocable between a rest position and a stacking position to move said longitudinal member from said predetermined path of movement over said guide means onto said stack-supporting means; and
- d. elevating means connected to said movable guide means for moving said guide means, after delivery of said longitudinal member to said stack-supporting means, so that said guide means is aligned with the top of said stacked longitudinal member preparatory for the transfer of another longitudinal member by said stacking device onto said stacked longitudinal member on said stack-supporting means.

In combination:

- a. conveying means for transporting a longitudinal member along a predetermined path of movement;
- b. arresting means adjacent said conveying means for arresting said longitudinal member adjacent a preselected location; and
- c. a stacking device having:

1. stack-supporting means adjacent said preselected location on one side of said predetermined path of movement;
2. movable guide means on said one side of said predetermined path of movement and operable to guide said longitudinal member from said predetermined path of movement to said stack-supporting means;

3. transfer means adjacent said preselected location on the other side of said predetermined path of movement and reciprocable between a rest position and a stacking position to move said longitudinal member from said predetermined path of movement over said guide means onto said stack-supporting means; and
4. elevating means connected to said movable guide means for moving said guide means, after delivery of said longitudinal member to said stack-supporting means so that said guide means is aligned with the top of said stacked longitudinal member preparatory for the transfer of another longitudinal member by said stacking member device onto said stacked longitudinal member on said stack-supporting means.
3. The stacking device recited in claim 1 and having conveying means along said predetermined path of movement.
4. The stacking device recited in claim 1 and having control means connected to one means of said transfer means, said stack-supporting means, and said movable guide means for controlling the movement of said stacking device.
5. The stacking device recited in claim 1 wherein said transfer device has a transfer head.
6. The stacking device recited in claim 5 wherein said transfer device has a transfer device frame, and a ram member reciprocable on said frame for carrying said transfer head.
7. The stacking device recited in claim 6 wherein said transfer device has transfer reciprocating means connected to said ram member.
8. The stacking device recited in claim 5 and having a movable transfer member on said transfer head, said transfer member being held against said transfer head during transfer of said longitudinal member and movable away from said transfer head during movement from said stacking position to said rest position.
9. The stacking device recited in claim 1 wherein said stack-supporting means has stop means for arresting the transfer movement of said longitudinal member onto said stack-supporting means.
10. The stacking device recited in claim 1 wherein said guide means has a guide means frame and a guide member oscillatable between a zero layer position to a preselected layer position.
11. The stacking device recited in claim 10 and having an elevating means connected to said guide member, said elevating means having a horizontal wedge member reciprocable along a path of movement and a vertical wedge member in engagement with said horizontal wedge member and said guide member, said vertical wedge member and said guide member being movable by said horizontal wedge member to said preselected layer position.
12. The stacking device recited in claim 11 wherein said vertical wedge member is linked to said guide means frame.
13. The stacking device recited in claim 11 wherein said vertical wedge member is reciprocable on said horizontal wedge member to produce an oscillating movement of said guide member.
14. The stacking device recited in claim 7 wherein said transfer reciprocating means has a first fluid drive means, a fluid supply means, a second fluid drive means, and flow divider means connected to said first fluid drive means, said second fluid drive means and said fluid supply means.
15. The stacking device recited in claim 14 and having valve means between said fluid supply means and said flow divider

- means and movable between a transfer position, a blocking position and a retracting position.
16. The stacking device recited in claim 11 and having elevating drive means connected to one wedge means of said horizontal wedge means and said vertical wedge means.
17. The stacking device recited in claim 6 and having transfer guide means on said transfer device frame for guiding the movement of said transfer head.
18. The stacking device recited in claim 1 wherein said elevating means is a fluid cylinder.
19. The stacking device recited in claim 1 wherein said elevating means is a rack and pinion.
20. The stacking device recited in claim 4 wherein said control means has a first valve means connected to said transfer means for controlling the reciprocal movement of said transfer means.
21. The stacking device recited in claim 20 wherein said control means has a first switch means connected to said first valve means for controlling said first valve means, and a first cam means on one of said elevating means and a stacking device frame, said first switch means being on the other of said elevating means and said stacking device frame.
22. The stacking device recited in claim 4 wherein said control means has a second valve means connected to said movable guide means for controlling the movement of said movable guide means.
23. The stacking device recited in claim 22 wherein said control means has a second switch means connected to said second valve means for controlling said second valve means and a second cam means on one of said elevating means and a stacking device frame, said second switch means being on the other of said elevating means and said stacking device frame.
24. The stacking device recited in claim 23 wherein said control means has a contact means adjacent said stack supporting means and connected to said second switch means, said contact means being energizable by said longitudinal member on said stack supporting means to cause energization of said second switch means.
25. The stacking device recited in claim 24 wherein said contact means is a plate member.
26. The stacking device recited in claim 24 wherein said contact means is a resilient member.
27. The stacking device recited in claim 24 wherein said contact means has a positioning device.
28. The stacking device recited in claim 20 wherein said control means has a first stop means adjacent said predetermined path of movement of said longitudinal member and connected to said first valve means, said first stop means being operable by said longitudinal member to energize said first valve means.
29. The stacking device recited in claim 22 having pressure switch means connected to said second valve means and said second switch means for opening said second switch means.
30. The stacking device recited in claim 20 wherein said control means has a first operating means connected to said first valve means.
31. The stacking device recited in claim 22 wherein said control means has a second operating means connected to said second valve means.
32. The stacking device recited in claim 22 wherein said second means is manually operated.
33. The stacking device recited in claim 20 wherein said first valve means is manually operated.

* * * * *

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,643,818 Dated February 22, 1972

Inventor(s) Francis Gallucci

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 1, line 37, cancel "b" ; line 67, before "longitudinal", insert -- stacked -- . Column 3, line 1, change "19" to -- 10 -- ; line 40, cancel "(FIGS.", first occurrence; line 63, "28" should read -- 38 -- . Column 5, line 49, "126", first occurrence, should read -- 125 -- . Column 7, line 1, "strip" should read -- trip -- . Column 8, line 3, "T'" should read -- T5' -- ; line 62, before "In combination:", insert -- 2. -- .

Signed and sealed this 2nd day of January 1973.

(SEAL)

Attest:

EDWARD M. FLETCHER, JR.
Attesting Officer

ROBERT GOTTSCHALK
Commissioner of Patents