Feb. 3, 1970 J. H. FORSHIER ET AL 3,493,126

PALLET LOADER

Filed July 22, 1968 6 Sheets-Sheet 1

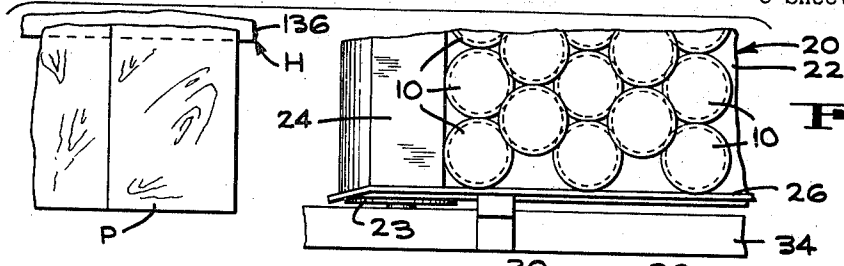


FIG_1

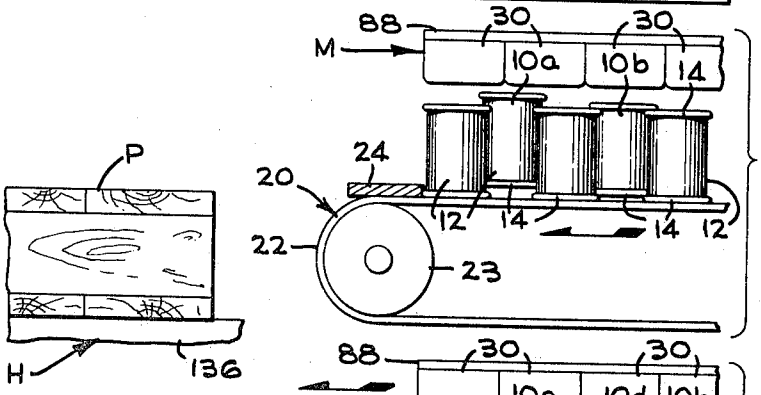


FIG_2

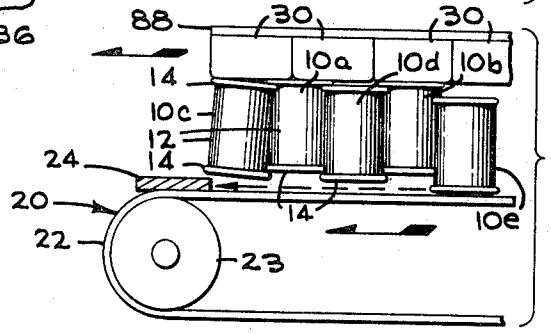


FIG_3

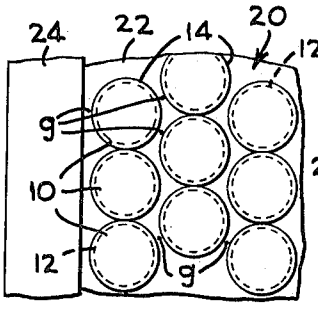


FIG_4A

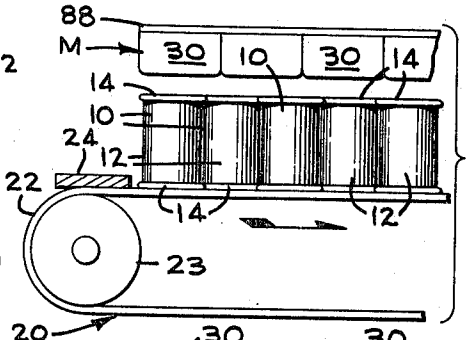


FIG_4

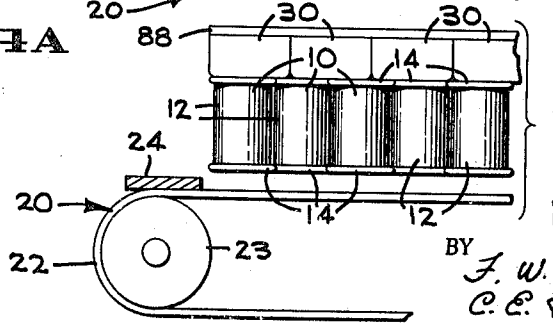


FIG_5

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PALLET LOADER

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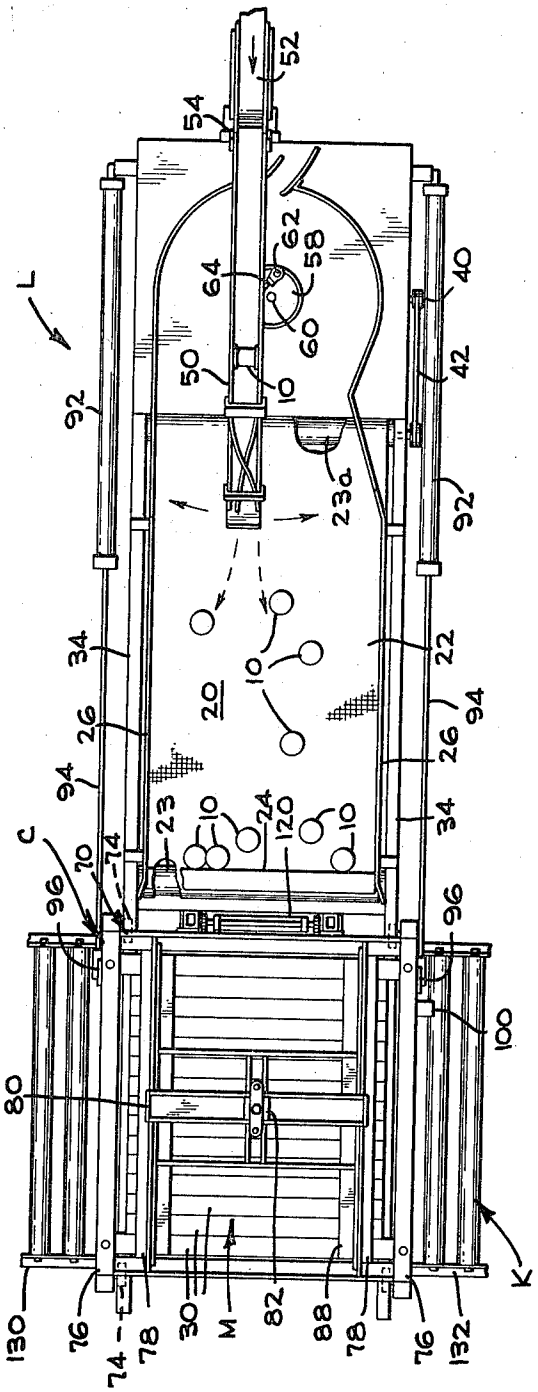


FIG_6

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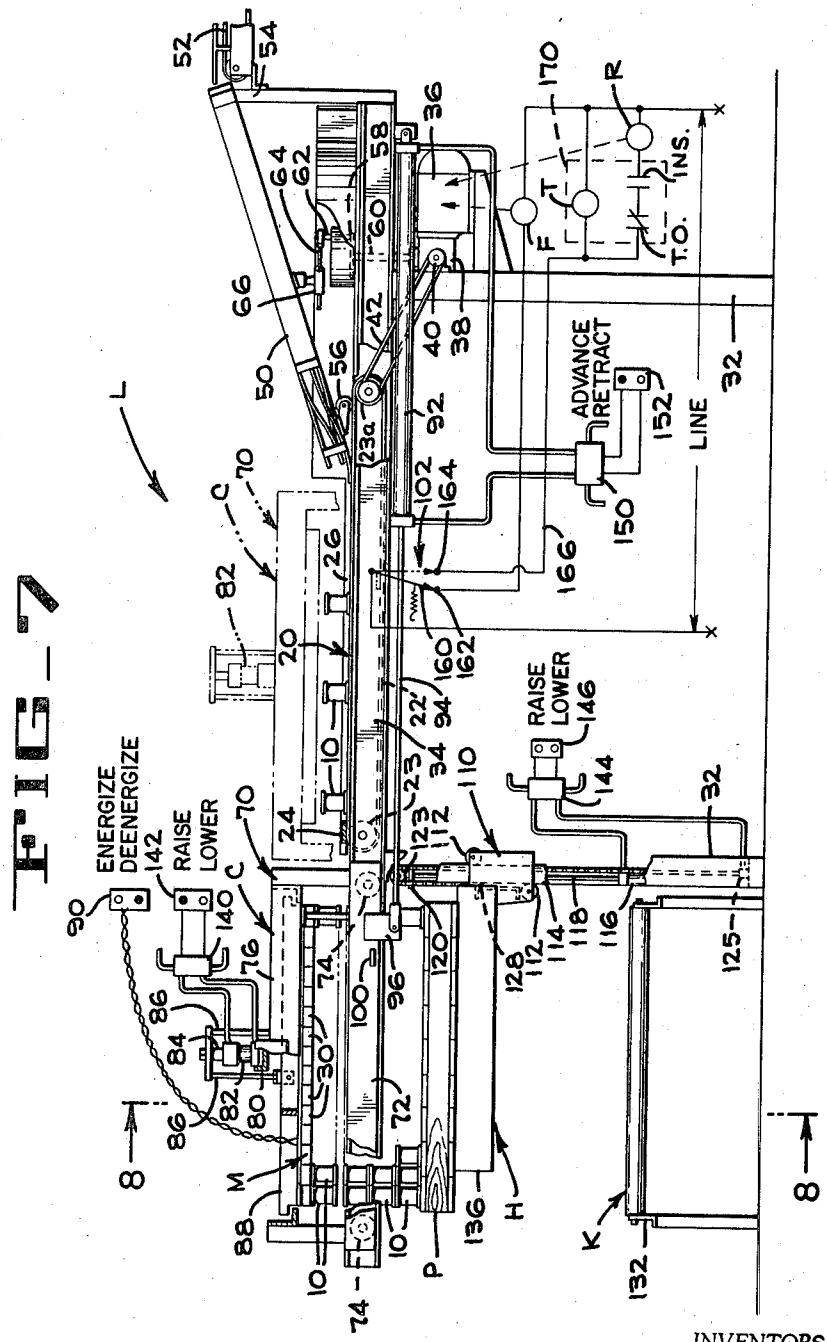
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PALLET LOADER

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FIG-7



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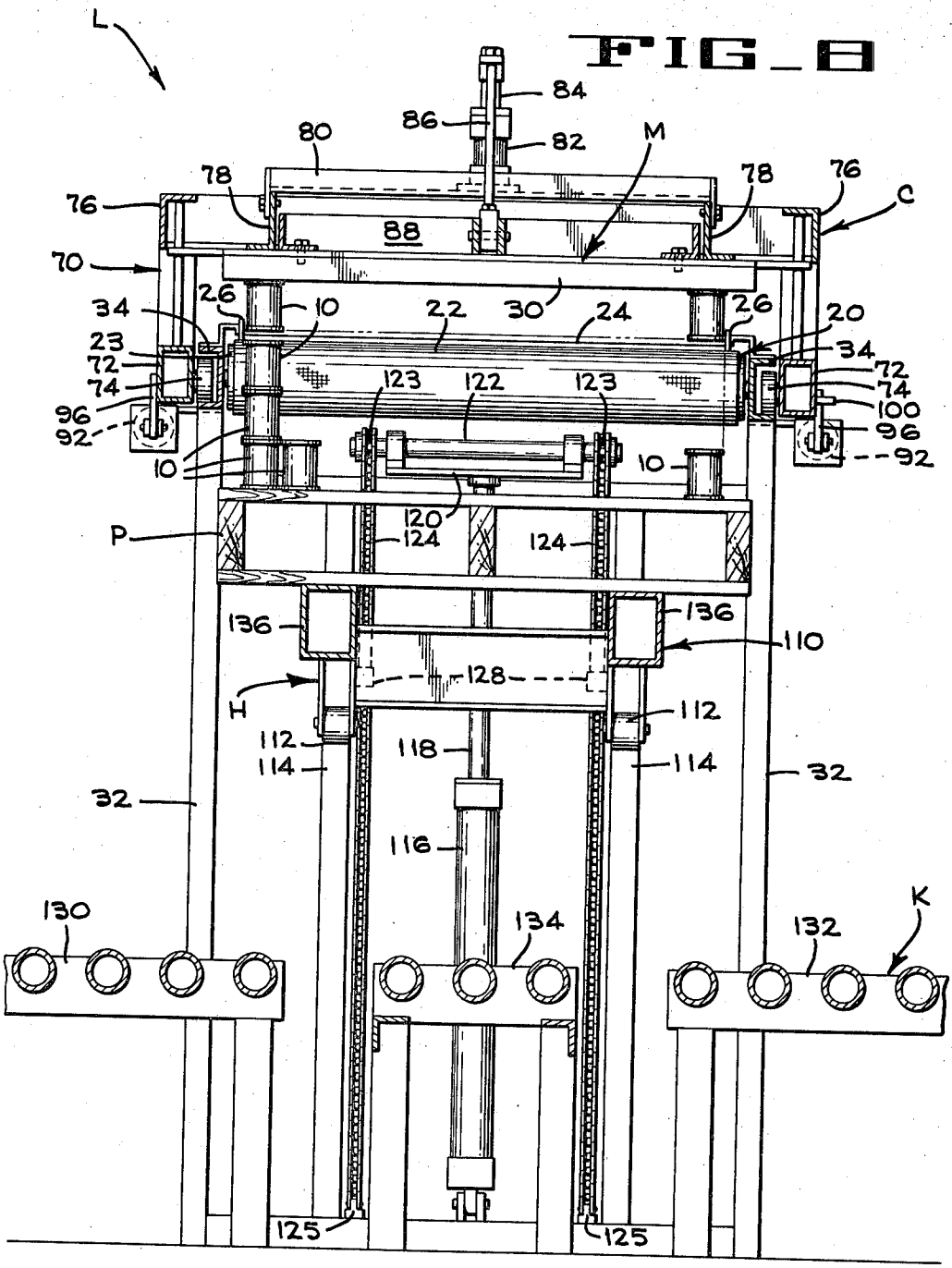
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PALLET LOADER

Filed July 22, 1968 6 Sheets-Sheet 4

FIG_8



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PALLET LOADER

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FIG_9

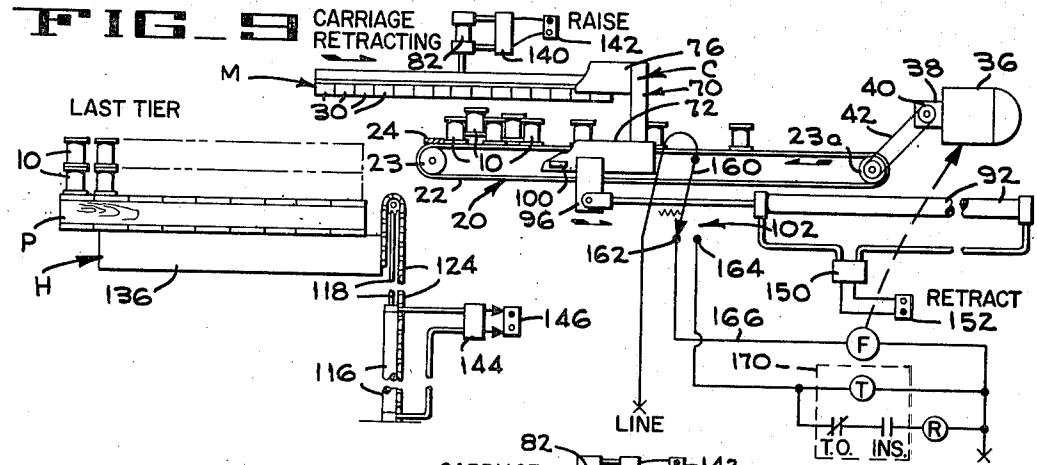


FIG_10

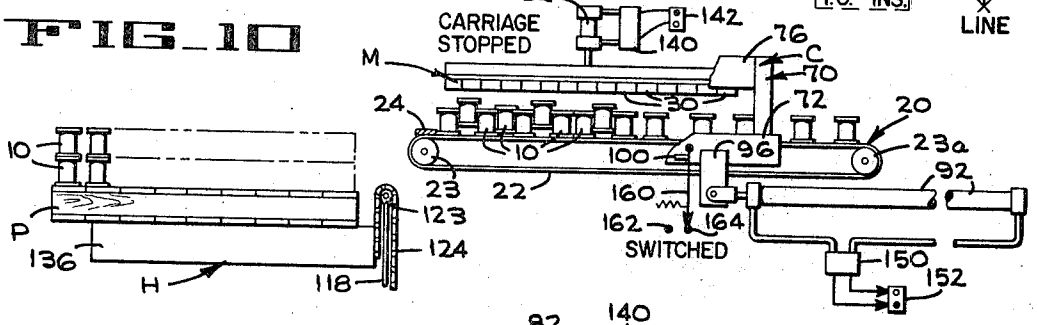


FIG_11

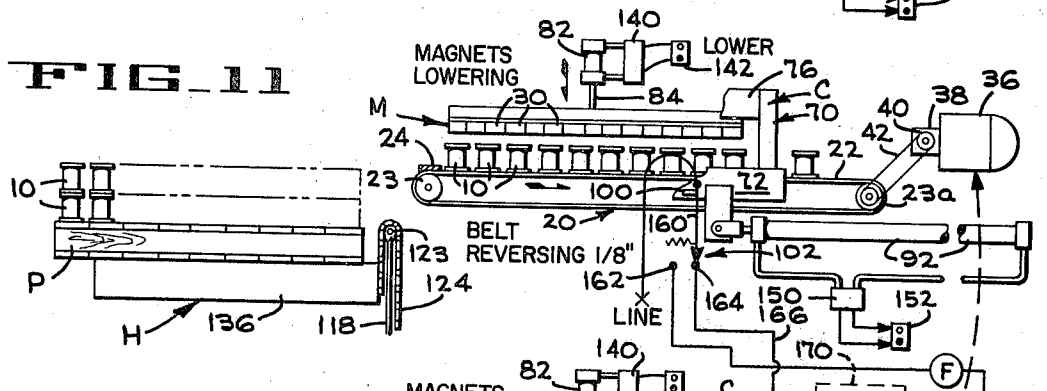
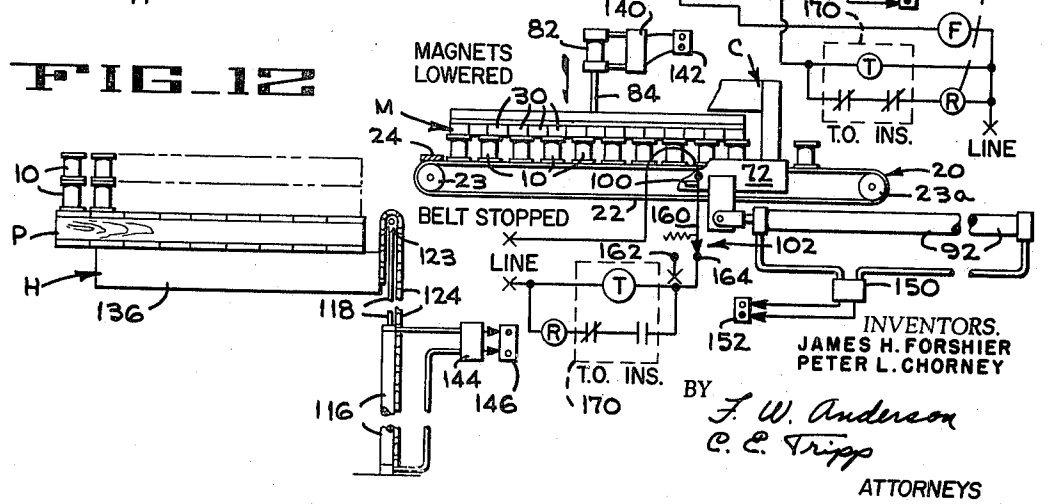


FIG_12



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PALLET LOADER

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FIG_13

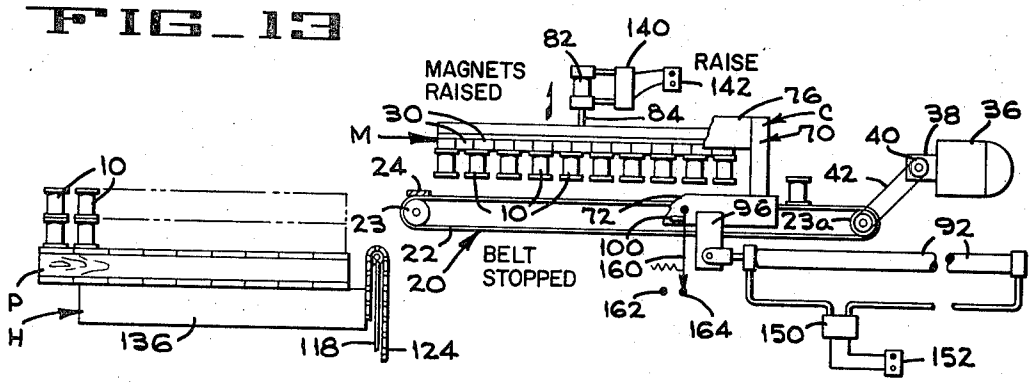


FIG_14

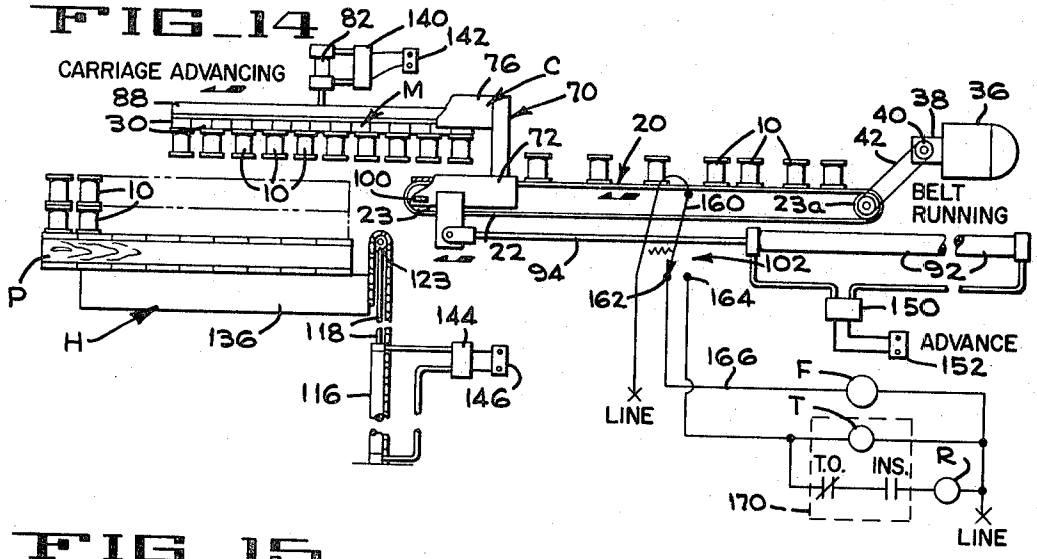
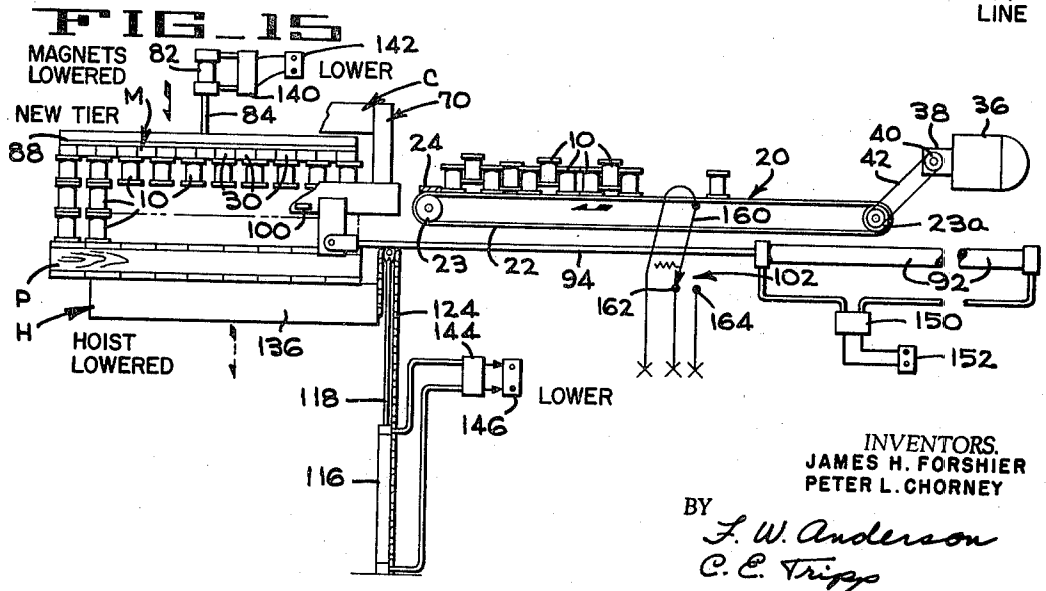


FIG_15



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United States Patent Office 3,493,126
Patented Feb. 3, 1970

3,493,126

PALLET LOADER

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Filed July 22, 1968, Ser. No. 746,568
Int. Cl. B65g 57/24, 57/04
U.S. Cl. 214—6 5 Claims

ABSTRACT OF THE DISCLOSURE

Tin cans are transferred from a normally running pattern forming conveyor to a pallet hoist by a magnetic head. Retraction of the head operates a conveyor reversing switch, momentarily reversing the conveyor to relieve pressures on the cans.

DESCRIPTION OF THE PRIOR ART

This invention represents an improvement in a pallet loader and unloader manufactured by the Canning Machinery Division of the FMC Corporation and identified as the Stackmatic Pallet Unloader. These machines, before incorporation of the improvement representing the present invention, represent the most pertinent prior art, and the present invention is shown in simplified diagrammatic form as an improvement thereon.

Briefly, the machine to which the present invention relates comprises a draper conveyor which advances cans towards a pattern forming plate that arrests the cans, so that as the conveyor slips under the cans, an array or pattern of cans is formed. A loading head comprising a carriage and a series of can pick-up magnets reciprocates from a position over the pattern of cans to a position over a pallet hoist which carries a pallet to be loaded with cans. When a pattern of cans has been formed under the loading head, the magnets are lowered to engage the upper ends of the cans and lift the pattern from the conveyor and clear of the pattern forming plate. The carriage mounting the magnetic head is then advanced over the pallet and the magnetic head is lowered again to deposit the cans on the pallet. The current for the magnetic head is turned on and off to pick up and deposit the cans.

Most cans handled by this apparatus have a cylindrical body portion and upper and lower rims or chimes. At the pattern plate, the conveyor or draper belt that brings the cans to the plate slips under the bottoms of the cans as the cans are arrested by the pattern plate or bar. The cans are distributed on the belts so they form a nested pattern and the frictional forces against the bottoms of the cans cause the chimes of some cans to climb up over the chimes of adjacent cans, thereby creating a vertically displaced pattern. When the magnetic head descends to pick up the cans the magnetic effects will be stronger on the vertically displaced cans than on those slightly below them, causing uneven application of lifting force to the pattern.

Also, some of the cans may become canted upon lifting of the pattern.

Furthermore, there is some resistance between the front forming plate and the adjacent cans as the pattern is lifted as well as between the row of cans on the upstream side of the pattern (arresting) bar and those remaining on the conveyor. These effects may cause erratic action; the canted cans may drop from the magnetic head or they may strike the pattern plate as the carriage is advanced thereover.

It is the purpose of the present invention to eliminate these difficulties in an apparatus of the type described.

Also noted is a United States Patent to Bainbridge 2,858,009 which shows a can palletizing machine that

employs a suction cup transfer head. This machine presents the same problems as the FMC machine referred to specifically above and can also be considered as representative of prior art.

SUMMARY OF THE INVENTION

In the apparatus of the present invention, the back pressure forces on the cans interrupted by the pattern forming or arresting plate is removed before the magnetic head lifts them away from the pattern forming conveyor. This is accomplished by momentarily reversing the conveyor until the cans can settle down firmly thereon, without interference between their chimes, whereupon the conveyor is stopped. For example, in a typical installation the conveyor need only be reversed to a distance of ⅛ inch before it is stopped. The conveyor remains stopped until the magnetic head picks up the cans and carries them over the end of the conveyor and the pattern bar to the pallet hoist for loading them on a pallet disposed on a hoist. As a result of this invention, the upper end of each can is firmly seated against and gripped by the magnetic heads. None of the cans are canted or inclined, the cans do not slide down during transfer and do not strike the pattern forming bar.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGURE 1 is a fragmentary plan showing a nested pattern of cans at the arresting plate.

FIGURE 2 is a side elevational diagram showing how back pressure causes the cans to form a vertically irregular pattern.

FIGURE 3 shows the effects of the irregular pattern when the cans are lifted by a magnetic head.

FIGURE 4 shows diagramatically how reversing the conveyor stabilizes the pattern.

FIGURE 4A is a diagrammatic plan showing the effect of conveyor reversal.

FIGURE 5 shows how the stabilized pattern of cans is lifted by the loading head.

FIGURE 6 is a simplified plan of a pallet loader embodying the invention.

FIGURE 7 is a side elevation of the loader.

FIGURE 8 is an end view taken on line 8—8 of FIGURE 7.

FIGURES 9 to 15 are simplified operational diagrams of a pallet loader embodying the invention.

DESCRIPTION OF PREFERRED EMBODIMENT

The problem

FIGURES 1–3 illustrate the problems arising within the nested pattern of cans previously described. The cams **10** are advanced by a draper conveyor **20** underneath a reciprocating magnetic loading head M having can lifting electro-magnets **30**. It is a function of the loading head to lift a pattern of the cans from the conveyor and deposit them on a pallet P supported by a pallet hoist H. The conveyor **20** has a chain mesh draper belt **22** trained around a delivery pulley **23** and as seen in FIGURE 1 side guides 26 cooperate with a can arresting bar or pattern plate **24** for forming the nested pattern of cans.

As can be seen in FIGURE 2, as the belt **22** slips underneath the bottoms of the cans **10** (the forward row thereof having been arrested by the pattern plate **24**), back pressure forces are developed between the bar **24** and the cans as well as between the cans. This causes the chimes **14** above and below the cylindrical can bodies **12** to climb vertically relative to one another and thus disarray the cans somewhat in the vertical plane.

For example, as seen in FIGURE 2 can **10***a* has been wedged upwardly, as has can **10***b*.

In FIGURE 3, cans **10***a* and **10***b* are most readily gripped by the magnets **30** of the magnetic head M. Can

10*c* adjacent the arresting bar **24** is canted and might strike that bar. Cans **10***d* and **10***e* are not in direct contact with the magnet **30** and these may slide downwardly during transfer. This vertical lowering of some cans may cause them to strike the arresting bar **24** or cause them to be dislodged before they are deposited as a pattern or tier of cans on the pallet P by the magnetic head M.

FIGURE 4 shows conditions under the present invention corresponding to that of FIGURE 2, except that in accordance with the present invention, the conveyor belt **22** has been reversed momentarily to provide about ⅛ inch gap between adjacent portions of the cans, which were formerly in back-pressure force contact.

FIGURE 4A shows the gaps *g* referred to, it also being noted that the gaps are provided between the leading row of cans and the arresting bar **24**.

FIGURE 5 shows how the magnet **30** of the magnetic head M can, after the momentary reversal of the belt **20** has been stopped, lift the cans as a vertically planar pattern, with the upper ends of all cans firmly seated against the magnets **30**. Under these conditions, the cans are not canted and do not slide down, do not fall free of the magnets and do not strike the arresting plate **24** during transfer.

Description of the loader

FIGURES 6 to 8 show in simplified form a pallet loader embodying the present invention. The principle components of this loader have counter parts in the pallet loader-unloader manufactured by the FMC Corporation, as previously described. Except for the motor drive for the conveyor, the other elements are controlled hydraulically. Actually the machine as manufactured and sold has automatic switch and interlock devices so that it is self-sequencing. Generally speaking, the automatic sequencing features of the device (being known and conventional) are not critical to the present invention. Thus, in order to distinctly describe the invention in this case, the hydraulic cylinders, pumps, sequencing switches, solenoid valves, etc. are illustrated in their simplest diagrammatic form, and instead of showing an automatic control circuit for the operating cylinders, simple pushbuttons are indicated. In accordance with the present invention, the advantages of the mode of operation of the invention is obtainable regardless of whether the operating cylinders are automatically or manually operated, and hence the latter form of operation is described in the interest of clarity, as explained above.

The basic elements of the unloader L have bene previously described. They include an endless draper conveyor **20**, a magnetic pick-up head M, and which is actually mounted on a reciprocating carriage C. Associated with the loader is a pallet hoist H, which brings a pallet P into its loading position and which successively lowers it after each tier or pattern of cans has been deposited on the pallet, or on a tier of cans previously deposited thereon. For convenience a pallet conveyor K, which is of conventional design, is provided in the counterpart machine manufactured by the FMC Corporation. The pallet conveyor K runs along the delivery end of the machine beneath the hoist H, for supplying empty pallets to the hoist platform and for facilitating removal of loaded pallets therefrom.

As previously described, the conveyor **20** includes a draper belt **22**, which may be of link or chain-mesh construction and is trained around a delivery idler pulley **23**. The can arresting or pattern forming bar **24** is best seen in FIGURE 6, it being understood that an array of cans is accumulated underneath the magnetic head, for pick-up when that head is in its retracted position (shown in dotted broken lines in FIGURE 7). The conveyor belt **22** normally runs continuously and slips under the cans as they are arrested in pattern forming condition by the bar **24**.

The frame of the machine includes legs **32** which are connected by cross members at suitable points and which mount longitudinal carriage tracks **34**, which are illustrated in the form of channel members. The delivery idler pulley **23** for the conveyor belt has been previously described and is best seen in FIGURE 7. A rearward driving pulley **23***a* is also provided for the conveyor belt. The pulley **23***a* is normally driven by a motor **36**, so as to cause the conveyor belt to advance and deliver cans against the arrestor plate **24**. The motor drives a gear box **38** (FIGURE 7) which has a drive pulley **40** that drives the pulley **23***a* of the conveyor by chain and sprocket gearing **42**. The nature of the conveyor drive is not critical to the present invention so long as it can be quickly reversed to accomplish the previously mentioned purposes of the invention.

The motor **36** is reversible and actuated by the control mechanism forming part of the present invention as will be described presently.

Distributor

In the loading apparatus, means are provided to distribute cans onto the conveyor **20**. This mechanism is not critical to the present invention and such mechanisms are known to the art and are incorporated in the aforesaid FMC apparatus now on sale. Briefly, the mechanism will include a can delivery chute **50** which receives cans from a conveyor **52**, and which can be referred to a wig-wag chute. The chute **50** inclines downwardly for delivery of the cans received at its input conveyor **52** and the upper end of the chute is mounted for pivotal motion about a vertical axis on a bracket **54** (FIGURE 7). The lower end of the chute is supported on the conveyor belt by a caster **56**. The chute is oscillated by means of a rotary crank **58** driven by a shaft **60** (FIGURE 7) from the motor gear box **38**, previously described. The crank **60** has an upwardly projecting crank pin **62** that mounts a crank arm **64**. The crank arm slides in a pivoted bushing **66** depending from the chute. In this construction, which is known in the art, rotation of the eccentric **58** causes a wig-wag motion of the delivery end of the chute **50** for distributing the cams evenly along the conveyor belt **22**, as best seen in FIGURE 6.

Pick-up head

The carriage C, which mounts the magnetic pick-up head M, reciprocates from a can pick-up position over the conveyor belt (broken lines in FIGURE 7) to a position over a pallet P on the projectile hoist H (solid lines). The carriage has a framework **70** which includes lower side rails **72** that mount rollers **74**, best seen in FIGURE 8. These rollers slide in the channel tracks **34** forming part of the main frame and previously described. The carriage frame includes upper rails **76**, **78** the latter mounting a cross-beam **80** for supporting a hydraulic piston **82** that raises and lowers the magnetic head M. The piston rod **84** of the piston is connected to depending rods **86**, the lower ends of which support a framework **88** that mounts the electromagnets **30**. The manner in which the electromagnets **30** are mounted in their framework is well known in the material handling art and is not disclosed in detail. The electromagnets **30** can be energized and de-energized automatically or by manual operation of a switch **90**, illustrated schematically in FIGURE 7.

The carriage C is reciprocated between its retracted and advanced positions by a pair of hydraulic cylinders **92** having piston rods **94** that connect to carriage brackets **96**. The conveyor drive control of the present invention is automatically operated by a switch striker **100** mounted on the carriage which operates a single pole, double throw switch **102** when the carriage is in its retracted position shown in broken lines in FIGURE 7.

Pallet hoist

In order to receive the tiers of pattern cans, the pallet hoist H is provided and is disposed beneath the magnetic head M when the latter is in its advanced position. The details of this hoist are not critical to the present invention and hence the hoist is illustrated diagrammatically. The pallets P rest on a hoist carriage **110** which can be raised to receive the first tier cans and then sequentially lowered by one can height, after each tier of cans is deposited on the pallet, or on a previous tier of the cans.

The hoist carriage **110** is mounted on rollers **112** which slide on vertical tracks **114** forming a portion of the framework of the apparatus. The hoist carriage is raised and lowered by a frame mounted hydraulic cylinder **116**, having a piston rod **118** that supports a crosshead **120**. The crosshead mounts a sprocket shaft **122** (FIGURE 8) carrying sprockets **123** over which are trained lifting chains **124**. The chains themselves have one end anchored to the frame at **126** and the other to the hoist carriage at **128** (FIGURE 8). Thus raising or lowering the piston **118** and the crosshead **120**, raises or lowers the hoist carriage **110** by twice the piston travel.

As seen in FIGURE 8, the pallet hoist K has a pallet delivery section **130** and a loaded pallet take-away section **132**. An intermediate section **134** of the pallet conveyor is spaced from the delivery and take-away sections to accommodate the hoist carriage arms **136**, when the latter are lowered. Thus pallets can be advanced from the delivery section under the intermediate section with the carriage arms in their lowered positions, and lifting of the carriage arms by the hydraulic carrier **116** will raise the pallet and bring it up towards the magnetic head M for loading.

Controls

The hydraulic piston **82** for raising and lowering the magnetic head M is controlled by four-way solenoid valve **140** (FIGURE 7). This valve is connected to a source of hydraulic fluid in a conventional manner, the details of which are not critical to the invention. A manual control of the parts not critical to the invention is disclosed herein. Thus, the solenoid valve **140** for the magnet piston may be raised and lowered by a switch **142** that operates the valve.

The hoist cylinder **116** is controlled by a solenoid valve **144**, and a raise and lower switch **146** that is manually operated.

The hydraulic cylinders **92** that advance and retract the carriage C for the magnetic head are operated in parallel by conventional hydraulic techniques not shown in detail. The cylinders are simultaneously advanced or retracted by means of a solenoid valve **150** controlled by an advance and retract pushbutton **152** (FIGURE 7). The push button switch **90** for energizing and de-energizing the electromagnets **30** of the magnetic head M has previously been mentioned.

The control of the present invention, as previously outlined, automatically reverses the belt **22** of the conveyor **20** for a distance sufficient to create small gaps or clearances among the cans and at the pattern plate. This operation is controlled by a switch striker **100** on the carriage and the double throw switch **102**. The control switch **102** is a conventional micro-switch illustrated schematically in FIGURE 7 and mounted on a frame of the apparatus.

As seen in FIGURE 7, the arm **160** of the switch is connected to one side of the line. The arm is spring loaded to make a normally closed, forward contact **162**. This connects the forward motor starter contactor F to the other side of the line. Thus in the normal condition of the switch **102**, the forward motor contactor F is energized, and the motor is running, thereby causing the conveyor belt to advance cans towards the arrestor plate **24**.

A normally open contact **164** of the carriage controlled switch **102** connects the switch arm **160** to a reverse control line **166**. When this line is thus connected the electrical elements T of a pneumatic timer indicated generally at **170** is connected to the other side of the line and hence is energized. Energization of the timer element T closes a set of timing out T.O. contacts and opens a set of instantaneous contacts INS. in series with a reversing contactor R for the conveyor motor **36**, and connected across the line. The action of this circuit will be described presently in connection with the operational diagrams of FIGURES 9 to 15. The details of the timer **170** are not critical to the present invention and any electrically operated momentary timing units may be employed such as the Allen Bradley No. 849 ZAD 32 pneumatic timer.

Operation

The operation of the device has been explained generally, except for that of the control circuit. FIGURES 9 to 15 show sequential operational diagrams showing the relation of the operational control circuit with the mechanical elements of the loader embodying the present invention.

In FIGURE 9, the carriage is retracting due to manual operation of the retract button **152**, after the magnets have deposited the last tier of cans **10** on the pallet. The magnetic head M has been raised by means of the raise button **142** and the magnets **30** are de-energized by the button **90** (FIGURE 7). The arm **160** of the carriage operated switch **102** has sprung to contact **162**, and hence has connected the forward motor contactor F across the line. This causes the motor **36** (FIGURE 7) to drive the conveyor belt for advancing cans towards the pattern plate **24** as previously described. The switch contact **164** is open so that the timer element T is de-energized. Under these conditions, although the timer contacts T.O. are closed the instantaneous contacts INS. are open. The latter de-energizes the reverse motor contactors R across the line. Thus so long as the carriage operated switch **102** remains in the condition shown in FIGURE 9 the conveyor belt advances cans to form a pattern.

FIGURE 10 illustrates the conditions of the apparatus when the carriage has stopped at its retracted position. The means for stopping the carriage in its retracted and advanced positions is a conventional mechanical stop incorporated in the carriage piston **192**, or in the form of external stop elements, all in accordance with conventional hydraulic engineering practice. It will be noted in FIGURE 10 that the switch striker **100** on the carriage has shifted the switch arm **160** to break the forward contact **162** and close the reverse contact **164** for the conveyor motor.

In FIGURE 11 the magnets are lowering. This is done by operating the magnet lower switch **142**, when the carriage is advanced. The closing of the reverse switch contact **164** (FIG. 10) has energized the timing relay element T of the timer. The time out contacts T.O. of the timer remain closed, but energization of the timer element T does close the instantaneous contacts INS., thereby energizing the motor reverse contactor R across the line and reversing the conveyor motor **36**. The conveyor belt **22** is now reversed to relieve pattern pressures on the cans **10**.

FIGURE 12 shows the carriage still in its retracted position and with the magnets **30** having been lowered to engage the cans **10**. FIGURE 12 also shows the electrical conditions wherein the timer T has timed out. The timer times out in a fraction of a second, so that the conveyor belt **20** actually only reverses through about ⅛ inch of travel. After the time representing this reversed travel of the conveyor belt, the pneumatic timer element T opens the time out circuits T.O., thereby de-energizing the reverse motor contactor R. The forward motor contactor F (not shown in FIGURE 12) remains de-energized

as shown in FIGURE 11, because the contact **162** of the carriage switch **102** is held open by the switch striker **100** on the carriage.

In FIGURE 13 the magnet push button **142** has been operated to raise the magnets **30**, which are shown raised to lift the pattern of cans from the conveyor belt **22**. The belt remains stopped (after its reversal) because the carriage C is still retracted, and hence the switch striker **100** on the carriage holds the switch **102** in the position previously described.

In FIGURE 14 the carriage is advancing because the carriage advance push button **152** has been operated. The conveyor belt **122** is running because the switch striker **100** has been withdrawn from the arm **160** of the carriage operated switch **102**. This causes the switch arm to break the reverse contact **164**, de-energizing the timer element T. De-energization of the timer element T opens the instantaneous contacts INS, of the timer, thereby de-energizing the reverse motor contactor R, even though the T.O. contacts remain closed. The spring in the carriage switch **102** has caused switch arm **160** to make contact **162**, thereby placing the forward motor contactor F across the line and energizing the conveyor motor **36**.

In FIGURE 15 the magnets **30** have been lowered to deposit a new tier of cans **10** on the tier previously deposited on the pallet hoist. This is done by operating the magnet lowering push button **142**. The hoist can now be lowered by the height of one tier of cans by operating a hoist push button **146**.

The control for the conveyor motor **36** leaves that motor in its normal position for advancing the can conveyor belt **22**, whereby a pattern of cans is being formed at the can arrester bar **24**. The apparatus is now ready for de-energization of the magnet, raising thereof and retraction of the carriage as previously illustrated in FIGURE 9.

At the end of the pallet loading cycle, the hoist carriage is lowered to fit between the sections of conveyor K (FIGURE 8), the loaded pallet removed via section **132**, and an empty one introduced via section **130**.

Thus it can be seen that in accordance with the present invention, the introduction of a simple control circuit for the conveyor belt makes it possible to pick up cans from a pattern forming conveyor and deposit them as a tier on a pallet hoist or the like, without danger of losing the cans or having them knocked off during the transfer process.

Although the best mode contemplated for carrying out the present invention has been herein shown and described, it will be apparent that modification and variation may be made without departing from what is regarded to be the subject matter of the invention.

Having completed a detailed description of the invention so that those skilled in the art could practice the same, we claim:

1. Apparatus for forming patterns of cans or the like and then loading them, comprising a belt conveyor, means at the delivery end of said conveyor for arresting the cans advanced by the conveyor to form a pattern of cans, drive means for advancing and reversing said conveyor; a loading head comprising a carriage movable from a retracted, can pattern pick-up position over the delivery end of said conveyor to an advanced, loading position clear of the conveyor, and a can pattern pick-up head vertically movable on the carriage for lifting a pattern of cans from said conveyor when the carriage is retracted; and a control for said conveyor drive means; said control having means for causing said conveyor drive means to normally advance said conveyor, means for momentarily reversing said conveyor drive means when said carriage is retracted until pattern forming pressures on the cans are relieved, and means for again causing said conveyor drive means to advance the conveyor after said pick-up head has lifted the pattern of cans from said conveyor.

2. The loader of claim **1**, wherein said control includes a motor control switch and a switch striker element, one element being on the carriage for operating the switch to reverse the conveyor upon retraction of the carriage.

3. A pallet loader for tiers of cans comprising a reversible endless belt can advancing conveyor, an advancing and retracting magnetic can pick-up head, a pattern forming bar for arresting cans on said conveyor for pick-up, and means for momentarily reversing said conveyor prior to pick-up by said magnetic head.

4. The loader of claim **3**, wherein said means for momentarily reversing said conveyor includes means movable with said pick-up head and operable upon retraction of said can pick-up head to reverse the conveyor.

5. The loader of claim **4**, wherein said conveyor reversing means includes means for restoring the conveyor to can advancing operation upon advance of said pick-up head.

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