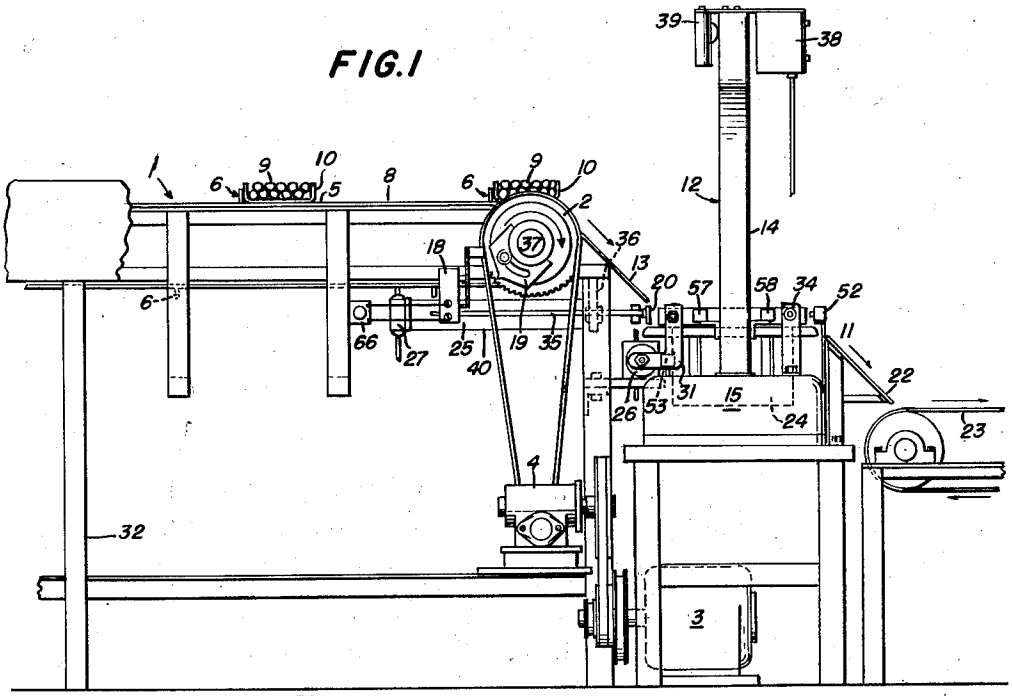
Aug. 26, 1958 W. F. FRIED, JR 2,849,116

AUTOMATIC WEIGHT SORTING APPARATUS

Filed April 18, 1957 2 Sheets-Sheet 1

FIG. 1



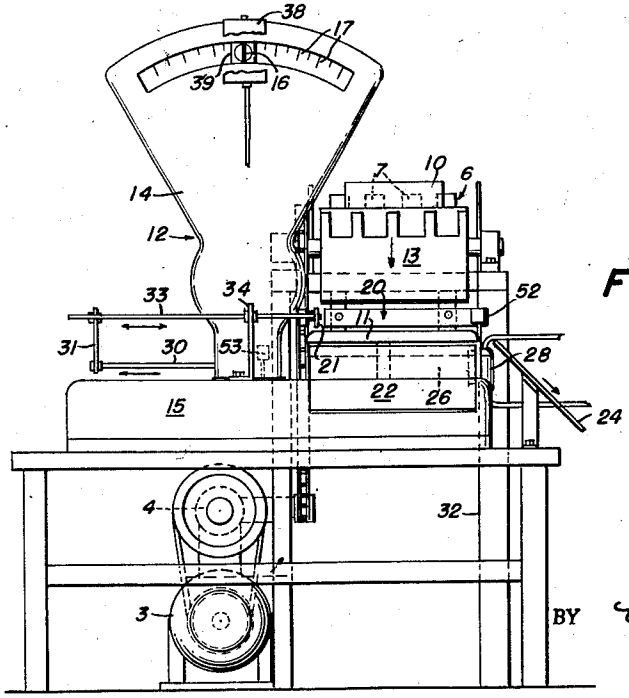


FIG. 2

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AUTOMATIC WEIGHT SORTING APPARATUS

Filed April 18, 1957 2 Sheets-Sheet 2

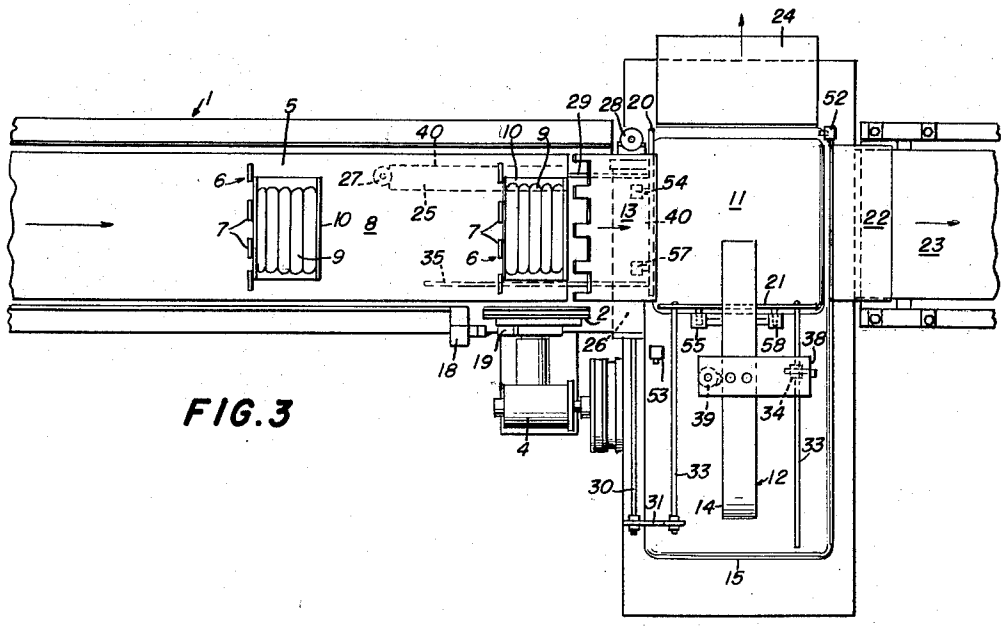


FIG. 3

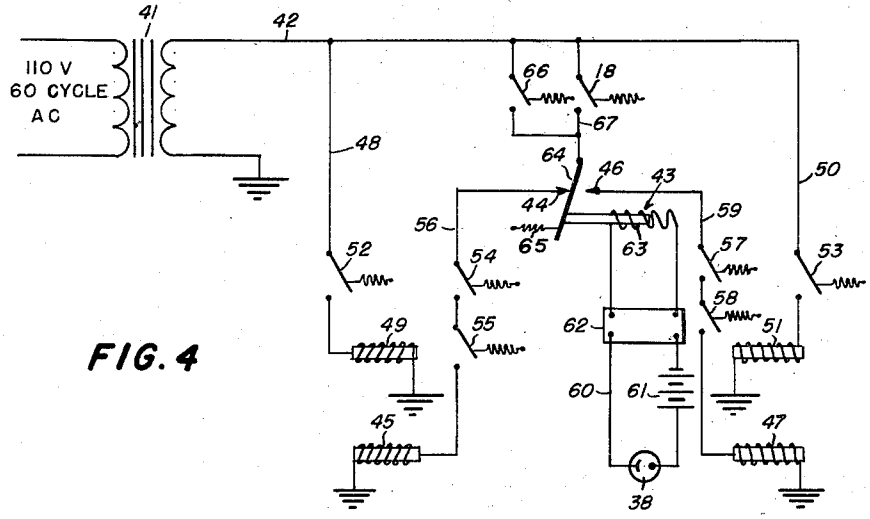


FIG. 4

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AUTOMATIC WEIGHT SORTING APPARATUS

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Application April 18, 1957, Serial No. 653,575

6 Claims. (Cl. 209—121)

This invention relates to apparatus for automatically sorting articles according to weight.

While it is essential in many industries to sort articles according to weight, the apparatus previously devised for automatic sorting, in general, has been too costly and complicated for use by relatively small packing plants. As a result, it is still the general practice among the smaller plants and particularly the local meat packers to sort by manual labor. However, with the widespread adoption by food stores of self-service meat departments, the demands on local meat packing facilities have so mushroomed as to create a crying need for apparatus which is both automatic and, cost- and maintenance-wise, within the reach of local packers. This need is especially acute in the packing of meat products such as wieners or frankfurters, which customarily are packed so many units to a package of a given minimum weight, to eliminate a major bottleneck, in at least the smaller packing plants, time-consuming manual weight sorting. It is to the elimination of this bottleneck that the present invention is directed.

The primary object of the invention is to provide an improved apparatus for automatically sorting articles by weight which is relatively inexpensive in both initial cost and maintenance.

Another object of the invention is to provide an improved apparatus for automatically sorting articles by weight, wherein articles are fed at spaced intervals by a moving conveyor to a sorting scale and, depending on whether their weight is within or outside predetermined limits, are discharged therefrom in one of two directions by means synchronized in operation with the feeding of the articles by the feed conveyor.

An additional object of the invention is to provide an improved apparatus for automatically sorting articles by weight, wherein an article deposited on the platform of a scale is discharged therefrom in one of two directions, depending on its weight, by one of a pair of pneumatically actuated pushers selectively responsive to the position of the pointer of the scale relative to the beam of a light-sensitive unit.

A further object of the invention is to provide, in improved apparatus for automatically sorting articles by weight, an electrical system for selectively operating one of a pair of angularly related, pneumatically actuated pushers, whereby a pusher, once set in operation, will complete its cycle of operation unaffected by any change in the condition of the electrical selecting medium and without interference from the other pusher.

Other objects and advantages of the invention will appear hereinafter in the detailed description, be particularly pointed out in the appended claims and be illustrated in the accompanying drawings, in which:

Figure 1 is a fragmentary side elevational view of a preferred embodiment of the weight sorting apparatus of the present invention;

Figure 2 is an end elevational view of the apparatus of Figure 1, taken from the discharge end with the discharge conveyor removed;

Figure 3 is a plan view of the apparatus of Figure 1; and

Figure 4 is a wiring diagram of the apparatus' electrical system.

Referring now in detail to the drawings, in which like reference characters designate like parts, the improved weight sorting apparatus of the present invention is particularly designed for sorting or separating units, articles or packages into two weight classifications, one of units within certain weight limits and the other of articles outside those limits and is especially suited for "accepting" or "rejecting," according to weight and prior to packing, units or packs containing the same number of like items or produtcs, such as wieners or frankfurters.

In its preferred form, the apparatus is comprised of an endless feed conveyor **1** having a drive pulley **2** which conveniently may be at the discharge end of the conveyor, the drive pulley **2** being driven by an electric motor or other drive means **3** to which it is drivably connected through suitable reduction gearing **4**. Extending transversely of the belt **5** of the feed conveyor **1** is a plurality of dividers or partitions **6** spaced uniformly longitudinally of the conveyor and each preferably formed of a plurality of transversely spaced fingers **7**. Divided longitudinally by the dividers **6** into a plurality of pockets or compartments **8** of substantially equal length, the feed conveyor **1** is designed to carry in each pocket a unit or pack **9** containing a given number of the items to be sorted. In the case of frankfurters, while the number will vary from plant to plant, a unit will usually contain on the order of ten items or elements and the elements of each unit preferably will be contained or held together during sorting by one of a plurality of clips or trays **10** of uniform weight and made of plastic or other suitable material.

As each unit reaches the discharge end of the feed conveyor **1**, it is discharged or deposited on a platform **11** of an automatic weighing scale **12**. Such discharge is conveniently accomplished in the illustrated embodiment by disposing the forward flight of the feed conveyor at a higher level than the platform **11** and providing between the conveyor and the platform an inclined slide **13** down which each unit slides to the platform as it leaves its pocket on the cenveyor. So as to engage the units as they start their downward movement, the upper end of the slide **13** preferably extends substantially to the conveyor and is slotted in correspondence with the transverse spacing of the fingers **7** of the dividers **6** so as to pass the latter.

The scale **12** is of the indicating type with a column or upright **14** surmounting its base **15** to one side of the platform **11** and enclosing a pointer or indicating arm **16** oscillatable over a chart **17** to indicate the weight of a unit on the scale. Once one of the units is deposited on the platform **11**, an electrical system hereinafter to be described is initiated, started or triggered by engagement with a starting switch **18** of a timing lug or cam **19** conveniently carried by the roller or pulley supporting the discharge end of the feed conveyor, here the drive roller or pulley **2**. Depending on whether the weight of the particular unit on the platform is within or outside the limits for which the apparatus is set, the electrical system causes one or the other of a pair of pusher plates or pushers, disposed substantially normal to each other and termed, respectively, an accept plate **20** and a reject plate **21**, to sweep or reciprocate across the platform **11** in angularly related directions toward one or another of its open sides and displace the unit therefrom, the actuated plate then returning to normal or at-rest position at one side of the platform. Positioned, respectively, by the ac-

cept plate 20 and the reject plate 21, the accepted or within-weight units are ejected from one of the open sides of the platform 11 and the rejected or over- or under-weight units from another, as determined by the connection of the separate drive means of the two plates in the electrical system. The sides of the platform 11 from which the two classes of units are ejected, as well as the manner in which the units are handled subsequent to their ejection, are a matter of choice. In the illustrated embodiment, the accepted units are ejected from a side of the platform opposite the feed conveyor 1 onto a downwardly-inclined accept slide 22 by which they are delivered to a discharge conveyor 23 leading to a wrapping machine (not shown). The rejected units in turn are ejected from the side of the platform opposite the column 14 of the scale 12 and directed by a downwardly-inclined reject slide 24 onto a conveyor (not shown) or directly into a reject bin (not shown) for further handling to bring the weight of the unit within the accepted limits.

Required to sweep across the platform 11 and then return to normal position, the pusher plates 20 and 21 may be reciprocated by suitable electrically responsive actuating means and preferably are reciprocated by a pair of reversible fluid pressure motor means or motors, one 25 for the accept plate 20 and the other 26 for the reject plate 21, the direction of movement of the piston (not shown) of each motor being controlled by a solenoid or like electrically-actuated valve, designated as 27 and 28 for the accept motor 25 and reject motor 26, respectively. Depending on the clearance available, each of the pusher plates 20 and 21 may be carried directly by the piston or push rod 29 or 30 of the associated pneumatic or other fluid pressure motor means 25 and 26, as in the case of the accept plate 20 in the illustrated embodiment, or may be connected for movement with the piston by a connecting arm or link 31, as in the case of the reject plate 21, the motor means in either case conveniently being mounted on the supporting frame or stand 32 of the feed conveyor 1. Disposed above the level of its motor means 26, the reject plate 21 is directly connected to the ends of a pair of guide rods 33, the opposite end of one of which is connected directly to the connecting arm 31 carried by the end of the push rod 30 of the associated motor means 26 and the other of which slides in and is guided by a guide bracket 34 mounted on the base 15 of the scale 12. Attached directly to the end of its fluid pressure motor means 25, the accept plate 20 is guided so as to maintain it level with respect to the scale platform 11 by a guide rod 35 spaced radially of the push rod 29 and sliding in or guided by a guide bracket 36, which in this case is mounted on the frame 32 of the feed conveyor.

As mentioned earlier, the actuation of one or the other of the pusher plates 20 and 21 is initiated or triggered, after one of the units 9 has been deposited on the scale platform 11 by engagement with the starting switch 18 of the timing lug 19 mounted on or carried by and extending radially of the axle of the drive roller or pulley 2 with the starting switch 18. The longitudinal spacing between the dividers 6 is substantially equal to the circumference of the drive roller 2 so that the timing lug 19 will make a full revolution and engage and close the starting switch 18 each time the conveyor belt 5 moves the distance of one pocket. As will be noted, the timing lug 19, through a bolt and slot connection 37, is angularly adjustable in position circumferentially of the drive roller 2 so as to enable the interval between the actuation of a pusher plate and the depositing of a unit on the scale platform to be varied or adjusted to best suit the time cycle to the type of units being sorted. The selection of the particular pusher plate to be actuated is dependent upon a light-responsive or sensitive photoelectric cell 38 which is mounted on one side of the upright 14 and the light source 39 for which is mounted on the other, the cell and its light source being so mounted along the path of movement of the pointer 16 that the beam of light to the cell will be interrupted or cut off when the pointer registers within the acceptable weight range or limits and will fall on the cell when the pointer moves outside those limits. Normally, the width of the pointer will control the acceptable limits. However, if the limits so provided are insufficient, they may be extended by attaching a masking disc or plate (not shown) of the required area to the pointer.

The electrical system shown in Figure 4 is particularly designed for the preferred pneumatic motor means 25 and 26, the action of each of which is controlled by the solenoid-actuated valve 27 or 28, the latter, for the illustrated Bellows Company type of air motor, being readily mounted at one end of the air cylinder 40 of each motor. The valve of such an air motor shifts under air pressure on a momentary electrical impulse to one of its two solenoids, energizing of one advancing and of the other retracting the piston (not shown) of the motor. Although, as will be understood, the electrical system may be varied in its components as needed for the particular motor means employed to actuate the pusher plates, the switch arrangement of the system shown in Figure 4 is especially adapted for operation of the illustrated type of air motor.

The preferred solenoid-actuated valves 27 and 28 operating on relatively low voltage, the system, if to be connected to the usual 110 volt, 60 cycle, A. C. current supply, includes a stepdown transformer 41 to be ungrounded output lead 42 to which is connected the starter switch 18, preferably in the form of a single contact, spring-biased, normally open switch. Beyond and connected in series with the starter switch is a two-contact relay 43, one contact 44 of which leads to the advance solenoid 45 of the valve 27 of the accept plate motor 25, the other contact 46 leading to the retract solenoid 47 of the valve 28 of the reject plate motor 26. Connected to the output lead 42 in parallel with each other and the starting switch 18 is a pair of leads, one 48 to the retract solenoid 49 of the valve 27 of the accept plate motor 25 and the other 50 to the advance solenoid 51 of the valve 28 of the reject plate motor 26. In the lead 48 in series with the winding of the retract solenoid 49 of the accept motor valve 28 is a single contact, spring-biased, normally open switch 52 and a like switch 53 is interposed in the other lead 50. A pair of like switches 54 and 55 is connected in series in the lead 56 connecting the contact 44 of the relay 43 to the advance solenoid 45 for the accept plate motor 25 and a like pair, 57 and 58, are series-connected in the lead 59 between the contact 46 and the retract solenoid 47 for the reject plate motor 26.

The relay 43 is connected in a separate circuit 60, which includes the photoelectric cell 38, which obtains its power from a suitable power source 61. Current flowing through the circuit 60 when the photoelectric cell 38 is made conducting by the beam from the light source 39 falling on the cell, after amplification by the amplifier 62, energizes the solenoid 63 of the relay 43 pulling its switch arm 64 against the force of its spring 65 into contact with the contact 46 leading to the retract solenoid 47 for the reject plate 21. Conversely, when the photocell is made non-conducting by breaking or interruption of its light beam by the pointer 16, the switch arm 64 makes contact with the contact 44 to the advance solenoid 45 for the accept plate 20. The remaining component of the system is a manually operable switch 66 wired in parallel with the starting switch 18 and in series with the switch arm 64 of the relay 43.

The operation of the system is as follows. Responsive to and energized and deenergized on conductance and non-conductance, respectively, of the photocell 38, the relay 43, if the particular unit deposited on the scale platform 11 is under- or overweight, will connect the lead 59 to the retract solenoid 47 for the reject plate motor 26 to the normally open contact 67 of the starter switch 18. Consequently, on subsequent closing of the starter switch,

the retract solenoid **47** will be energized and the reject plate **21**, which in the illustrated embodiment is so arranged as to advance on the retract stroke of its motor **26**, will advance and eject the unit **9** from the platform **11** onto the reject slide **24**. While the reject plate is so advancing, the timing lug **19** will disengage the starter switch **18**, enabling the latter to open and breaking the circuit to the output lead **42** from the transformer **41**. However, the retract stroke of the reject motor **26** will continue, since dependent only for initiation on energization of its retract solenoid **47**. As the reject plate **21** reaches the end of its advance, the plate itself or a member carried by or movable with it, engages and closes the switch **53**, completing the circuit from the transformer **41** to and energizing the advance solenoid **51** of the reject motor **26**. Thereupon, the reject motor will reverse and retract the reject plate **21** to initial position at the side of the platform **11** occupied by the upright **14**.

The accept plate **20** has a corresponding cycle, being actuated on closing of the starter switch **18** when the relay **43** is deenergized and its switch arm **64** in contact with the contact **44** by virtue of interruption of the beam to the photocell **38** by the pointer **16**. As in the case of the motor **26** of the reject plate **21**, that **25** of the accept plate **20** continues its advance stroke after the starter switch **18** has opened, in this case advancing the accept plate across the platform **11** to eject the within-weight-limit unit **9** down the accept slide **22** to the discharge conveyor **23**. At the end of the advance of the accept plate **20**, the switch **52** to the retract solenoid **49** for its motor **25** is engaged and momentarily closed, energizing the retract solenoid **49** and reversing the motor to retract the accept plate to its initial position.

The sorting mechanism continues to operate selectively in the above manner as the units **9** are deposited sequentially on the scale platform **11** by the feed conveyor **1**, accepting or rejecting each unit depending on whether the pointer **16** registers within or outside the acceptable weight limits. During such operation, completion of the cycle of either of the pusher plates **20** and **21**, once initiated, without interference from the other plate, is ensured by the switches **54, 55, 57** and **48**. One pair of these switches, one **54** in the lead **56** to the advance solenoid **45** of the accept plate motor **25** and the other **57** in the lead **59** to the retract solenoid **47** of the reject plate motor **26**, is positioned to be engaged and closed by the accept plate **20** when in its initial position and the other pair, consisting of the switches **55** and **58**, is engaged and closed by the reject plate **21** when in its initial position. As a result, when either of the pusher plates moves away from its initial position on the start of its cycle, the circuits from the starter switch **18** to the solenoids responsible for initiating the advance movements of both plates are broken and not again restored until the actuated plate has completed its cycle. Thus, the selective operation of a pusher plate, once initiated, will be unaffected by any shift in the position of the pointer **16** relative to the beam to the photocell **38** and cannot be interfered with by the other plate, the latter being held during that time in its at-rest position. So as to minimize the force required to close the several switches and, in the case of the switches **54, 55, 57** and **48**, to hold these switches closed in pairs when one or both of the pusher plates **20** and **21** are at rest, the several single contact switches employed in the system preferably are micro-switches, and the manually operated switch **66** may be of the same type. The switch **66** is provided to restart the cycle of the selected pusher plate should it become jammed for some reason after the initiation of its cycle.

From the above detailed description, it will be apparent that there has been provided an improved automatic weight sorting apparatus which is relatively simple and inexpensive in both its mechanical and electrical components and is practically trouble-free in operation. It should be understood that the described and disclosed embodiment is merely exemplary of the invention and that all modifications are intended to be included which do not depart from either the spirit of the invention or the scope of the appended claims.

Having described my invention, I claim:

1. Weight sorting apparatus comprising an automatic scale having a platform and a pointer, a feed conveyor divided longitudinally into a plurality of pockets of substantially equal length each for conveying one of the units to be sorted to said platform, a pair of reciprocable pusher means disposed substantially normal to each other and positioned to sweep across said platform and eject a unit therefrom in one of two directions, motor means for reciprocating each of said pusher means, photosensitive means responsive to the position of said pointer for selecting the pusher means to be actuated in accordance with whether the particular unit on the platform is within or outside acceptable weight limits, and means synchronized with said feed conveyor for initiating actuation of the selected pusher means on deposit of a unit on said platform.

2. Weight sorting apparatus comprising an automatic scale having a platform and a pointer, a feed conveyor divided longitudinally into a plurality of pockets of substantially equal length each for conveying one of the units to be sorted to said platform, a plurality of pusher means reciprocable in angularly related directions and normally positioned at sides of said platform, motor means connected to each of said pusher means for cyclically moving the connected pusher means from and to normal position across said platform and ejecting a unit on said platform therefrom in one of a plurality of directions depending on its weight, photosensitive means responsive to the position of said pointer for selecting the pusher means to be actuated in accordance with whether the particular unit on the platform is within or outside acceptable weight limits, and means synchronized with said feed conveyor for initiating actuation of the selected pusher means on deposit of a unit on said platform.

3. Weight sorting apparatus comprising an automatic scale having a platform and a pointer, a feed conveyor divided longitudinally into a plurality of pockets of substantially equal length each for conveying one of the units to be sorted to said platform, a plurality of pusher means reciprocable in angularly related directions and normally positioned at sides of said platform, motor means connected to each of said pusher means for cyclically moving the connected pusher means from and to normal position across said platform and ejecting a unit on said platform therefrom in one of a plurality of directions depending on its weight, photosensitive means responsive to the position of said pointer for selecting the pusher means to be actuated in accordance with whether the particular unit on the platform is within or outside acceptable weight limits, and rotary means synchronized in movement with said conveyor for initiating actuation of the selected pusher means on deposit of a unit on said platform, said rotary means being angularly adjustable for varying the interval between deposit of each unit and initiation of said actuation.

4. Weight sorting apparatus comprising an automatic scale having a platform and a pointer, a feed conveyor divided longitudinally into a plurality of pockets of substantially equal length each for conveying one of the units to be sorted to said platform, a pair of reciprocable pusher means normally positioned at sides of said platform, said pusher means being disposed substantially normal to each other and adapted to sweep across said platform and eject a unit therefrom in one of two directions, electrically controlled motor means for reciprocating each of said pusher means, photosensitive means responsive to the position of said pointer for selecting the pusher means to be actuated in accordance with whether the particular unit on the platform is within or outside acceptable weight limits, means synchronized

with said feed conveyor for initiating actuation of the selected pusher means on deposit of a unit on said platform, and normally open switch means positioned to be closed by each of said pusher means at the end of its advance for reversing the associated electrically controlled motor means and retracting said pusher means to normal position.

5. Weight sorting apparatus comprising an automatic scale having a platform and a pointer, a feed conveyor divided longitudinally into a plurality of pockets of substantially equal length each for conveying one of the units to be sorted to said platform, a pair of reciprocable pusher means disposed substantially normal to each other and positioned to sweep across said platform and eject a unit therefrom in one of two directions, electrically controlled motor means for reciprocating each of said pusher means, photosensitive means responsive to the position of said pointer for selecting the pusher means to be actuated in accordance with whether the particular unit on the platform is within or outside acceptable weight limits, rotary means synchronized in movement with said feed conveyor, a normally open starter switch positioned to be engaged and closed by said rotary means as each unit is deposited on said platform for initiating advance of the selected pusher means, normally open switch means positioned to be closed by each of said pusher means at the end of its advance for reversing the associated motor means and retracting the selected pusher means to normal position, and switch means engaged and closed by each of said pusher means in the normal position thereof and opening on release therefrom for breaking the electrical circuits to both of said pusher means during the advance of one of said pusher means.

6. Weight sorting apparatus comprising an automatic scale having a platform and a weight-registering pointer, a feed conveyor divided longitudinally into a plurality of pockets of substantially equal length and disposed above said platform for delivering one of a plurality of units to be sorted from each of said pockets to said platform, a downwardly inclined slide at the discharge end of said feed conveyor for directing each of said units onto said platform, a discharge conveyor below the level and at a side of said platform opposite said feed conveyor for receiving units of acceptable weight discharged from said platform, a downwardly inclined slide for directing units from said platform onto said discharge conveyor, means at a side of said platform away from said feed and discharge conveyors for receiving units of unacceptable weight ejected from said platform, a pair of pusher plates each reciprocable toward and away from one of said discharge conveyors and receiving means and normally positioned at sides of said platform, a fluid pressure motor for reciprocating each of said pusher plates, a solenoid actuated valve connected to each of said motors for controlling the direction of movement thereby of the associated pusher plate, photosensitive means responsive to the position of said pointer for selecting the pusher plate to be actuated in accordance with whether a unit on said platform is within or outside acceptable weight limits, a normally open starter switch, an angularly adjustable timing lug mounted on a roller of said feed conveyor for closing said starter switch and initiating said selective actuation in timed relation to the arrival of each of said pockets at the discharge end of said conveyor, and switch means engaged and closed by each of said pusher plates in the normal position thereof and opening on release therefrom for breaking both circuits to both of said pusher plates during the advance of one of said pusher plates.

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