March 24, 1942.  D. W. MOLINS ET AL  2,277,408  WRAPPING, PARCELLING, OR BOXING MACHINE
Filed Oct. 19, 1940  5 Sheets-Sheet 3

Inventor
D. W. Molins
A. Atkinson

Fig. 2B.
This invention is for improvements in or relating to wrapping, parceling or boxing machines, that is, machines for enclosing a number of articles in an outer case or box either by wrapping or folding a box blank around the articles to form an outer case or box or by inserting the articles into a preformed box. For convenience, where hereinafter the term "boxing" is used it shall be taken to include either of these methods and a group of articles ready for boxing will be termed a "batch."

It is an object of the present invention to provide in such a machine an arrangement whereby the separate articles may be visually inspected prior to the enclosure within the outer case or box, and also an arrangement whereby devices for detecting whether a batch is complete prior to insertion into a box may be employed and, in a specific case, an arrangement whereby articles may be inverted so that they lie in the finished box in the desired order, e.g., to expose a label or mark when the lid of the box is opened.

In a particular instance, which will be described and illustrated later by way of example, the articles consist of cigarette packets of rectangular block shape and the source of supply from the boxing operation is the stacker or delivery device of a machine in which the packets are individually wrapped. The stacker is of the kind where a vertical column of packets is formed by feeding packets to the base of the column, the packets for boxing being removed from the top of the stacker. The packets are superimposed in the stacker with the broad faces of neighbouring packets in contact with one another and it is desired to remove them in pairs from the top of the stacker.

According to the invention there is provided in or for a wrapping, parceling, or boxing machine, means for feeding articles (e.g., packets) towards the wrapping, parceling or boxing machine in separate paths which later converge and overlap so as to assemble the articles into superimposed or substantially superimposed relationship.

The invention also provides in or for a wrapping, parceling, or boxing machine, means for feeding articles (e.g., packets) towards the wrapping, parceling or boxing machine in separate paths which are over a part at least of said paths side by side and at different levels and which later converge and overlap so as to assemble the articles into superimposed or substantially superimposed relationship.

Further, according to the present invention there is provided in or for a wrapping, parceling, or boxing machine, means for removing a plurality of superimposed articles (e.g., pairs) from a column, means for relatively displacing the articles so removed so that they lie side by side (e.g., for visual inspection) and a transfer device whereby the articles are moved towards the wrapping, parceling or boxing device and re-assembled during or after transit into superimposed or substantially superimposed relationship.

Further, the invention comprises the subject matter of the kind set forth in any of the three preceding paragraphs, wherein means is provided to move the articles when in superimposed relationship into contact with wrapping material (e.g., a box blank) and wherein means is operative to move the articles and wrapping material through folding mechanism adapted at least partly to fold the wrapping material about the collated articles.

Further, the invention comprises a device of the kind set forth in any of the four preceding paragraphs, wherein means is provided whereby the articles are turned over or inverted during transit along the paths to expose the reverse face for further inspection or to ensure that the articles are boxed with a particular face uppermost when the box is opened.

The invention also comprises means for detecting whether a batch assembled ready for boxing is complete, said detecting means being arranged, for example, to prevent the boxing operation from taking place if the batch is incomplete.

One way of carrying the invention into effect embodying a machine of the kind wherein a box blank is folded about the articles will be described with reference to the accompanying drawings in which-

Figure 1 is a front elevation of a machine constructed according to the invention.

Figures 2A and 2B are views drawn to a larger scale and together constitute the front elevation shown in Figure 1.

Figures 3 and 4 are plan views of Figures 2A and 2B respectively.

Figure 5 is a section of Figure 3 on line 5—5.

Figure 6 is a fragmentary view in the direction of arrow A Figure 2A.

Figure 7 is a perspective of a partly folded box blank.

The views are broken away at places to expose hidden parts and parts are omitted from some of the views particularly Figure 1, but the construction will be easily understood if the views are considered together.

Referring to the drawings, pairs of superim-
posed packets are removed from the top of a column in a vertical stacker of a machine where the packets are individually wrapped and in which they lie with the broad faces of neighboring packets in contact. The packets are removed in pairs by a reciprocating pusher which moves a pair of packets horizontally over a plate and delivers said pair to a stationary position in the path of another reciprocating pusher movable at right angles to the first mentioned pusher. This second pusher moves the upper packet of the pair horizontally on to a plate which is positioned at a higher level than the first mentioned plate and has its upper surface substantially level with the bottom surface of the upper packet. When the upper packet comes to rest on the upper plate it is lying in the path of a third pusher which is so disposed that it moves parallel to the first pusher but at a higher level. During these movements the packets are located by guides shown in Figure 4 but omitted from Figure 2 for clarity. The two plates on to which the packets are delivered extend away from the stacker and may continue to do so for some distance so that subsequent movements of the pushers feed further packets on to the plates, and in so doing the packets already on the plates are moved along them by the movements of the first and third pushers. In this way two parallel horizontal rows of packets may be formed with one row at a higher level than the other. In the construction shown, however, endless belt conveyors 8 and 9 are inserted in place of an intermediary portion of each of the plates, previously referred to, so that in this case, the packets first move on to a plate and are then carried by a belt and subsequently delivered by the belt to a further portion of the plate described below. In either construction the packets are moved along in separate paths at different levels. During transit along the paths the packets may be visually inspected by the machine attendant who can remove any defective ones. Such removal does not affect the operation of a device of the kind first mentioned (i.e., where the packets are pushed along a fixed plate) because a row from which a packet is removed will remain stationary until further pusher movements have filled up the gap, after which the row moves on at each pusher stroke as before. In the case illustrated, where conveyor belts are employed, the belts urge fresh packets forward to fill the gaps and in both examples a detector device is employed to prevent the operation of the boxing mechanism if a packet is missing from a row.

At the end of the conveyor belts 8 and 9 the rows move into pairs of guides which are arranged above and below the broad faces of the packets at the respective levels. The first portions of the guide plates and respectively constitute in effect a continuation of the plates and respectively and in the case where belts are not employed the parts and respectively would consist of single horizontal plates. The guide plates are bent to describe large semi-circles or curves of this nature so that they form curved passages in the vertical plane and bring the packets from the conveyor belt levels to lower levels at which they move along substantially horizontally towards the boxing apparatus. The curved passages are so arranged that the rows of packets still preserve their respective relative levels at the lower position. To effect this, each semi-circular path is of the same length as the other and thus the two sets of guides cross at about the mid-distance between the upper and lower levels so that the upper guide at the top is also the upper guide when the lower level is reached. See Figure 1. This arrangement ensures that the total lengths of the rows of packets are equal and normally contain an equal number of packets.

It will be appreciated that by this movement each packet has been inverted so that the other broad face of each packet is now uppermost, which facilitates inspection but is further necessary because of the desired location of the closure flaps with respect to the packet itself are such that it is necessary to invert the packets as described to ensure that the correct surface is exposed in the finished box of packets when the lid is opened.

The packets emerging from the ends of the curved passages move on to travelling conveyor bands and disposed at the appropriate levels. The bands are substantially horizontal, but as viewed from above the bands converge towards one another until at a position near the boxing apparatus one band lies above or overlaps the other to a certain extent. This arrangement is achieved in the construction shown by disposing the upper band vertically beneath the band while the band is inclined with respect to the band as viewed in plan, see Figure 3. In this way the two rows of packets become once more partly superimposed but separated by the thickness of the upper belt plus a small amount of clearance and the thickness of the plate which supports the upper belt and prevents it from sagging under the weight of the packets. As above stated, the two rows of packets at the final position are only partly superimposed, that is, the upper row is not vertically above the lower row but is still displaced by a distance of say one-third of a packet length from the truly superimposed position. This enables a detecting device to engage the packets in both upper and lower rows as explained below.

When the leading packet of each row moves into a predetermined position with respect to the parceling or boxing apparatus, it contacts a stop which is fixed to lie across each travelling band and arrest the packets, although each travelling band continues to move and slips beneath said leading packet. These bands travel faster than is necessary for normal feeding of the packets to close up any gaps caused by the removal of packets as rapidly as possible. It will be noted that the row of packets on the inclined band will tend to become arranged stepwise as the first packet of the row comes against the stop and slews a little as indicated in Figure 3. At this stage the detecting device comes into operation. The device comprises a number of feelers, fingers or like devices, indicated in Figure 2 by circles but shown in greater detail in Figures 1 and 5 and described later. Two feelers are provided for each packet in each row that should be in position adjacent to the parceling or boxing apparatus when the parceling operation is to commence. This is because if a packet has been removed by the inspector the remainder may not properly close up the ensuing gap by the time the feeling device starts to operate. If a displaced packet might lie beneath the feelers proper to two adjacent packets if only a single feeler per packet is employed. If, therefore, a box contains ten packets in two superimposed rows of five, the
detector will have the feelers in two banks of ten. When the detector mechanism moves the feelers into the one of the travelling bands brings a further packet along to fill the space caused by the deficiency. The particular device shown will be described later. The detector device is lifted vertically in timed relationship with the parceling apparatus so that permitted space in a row to be filled. If, however, the necessary number of packets are present the box apparatus may operate. Where it is desired to insert the packets into preformed boxes, a pusher may press the assembled batch of packets into the box through a mouthpiece in a manner similar to that described in United States specification No. 2,210,378 but if it is desired to fold a box blank around the box as in the construction shown the pusher may press the batch against a blank fed vertically downwards in the path of the pusher, after which the blank is folded and sealed in the same way as the package is folded in the known art of machine wrapping.

The general construction of the machine and driving arrangements will now be described in more detail. The lower part of the mechanism shown in Figure 2 comprises parts of a machine in which the packets are individually wrapped and for convenience certain portions of the present machine are attached to or driven from said individual wrapping machine. The individual wrapping machine comprises a frame 18 on which is mounted a vertical stacker comprising a pair of travelling bands 18. Finished wrapped packets are brought to the base of the stacker from the wrapping devices by a pusher piece 151 carried by an endless conveyor (not shown). When a finished packet has been positioned beneath the stacker it is raised upwards into the grip of the bands 18 by a reciprocating platform 20. The platform is guided by a slide 21 moving in a guide 22. The bands are intermittently moved in the direction of the arrows by a ratchet wheel driven by not shown) and move upwards as a fresh packet is fed between them. The platform is operated by a lever 23 pivoted at 24. The free end of the bell crank carries a roller 25 engaging a cam 26 and a spring 27 keeps the roller in operative engagement with the cam. The cam is fixed to a shaft 28 and driven in the direction of the arrow by another part of the wrapping machine. Another cam 29 on the same shaft operates the pusher 3 by a bell crank lever 30 pivoted at 31. The short arm of the lever carries a roller 32 engaging the cam, the return movement being by a spring 33 at the same arm. The long arm of the lever is connected by a link 34 to a pin 35 on a slide 36 moving in guides 37. The pusher 3 is fixed to the slide. By this arrangement the pusher 3 makes its strokes at the same time as the pusher 5 and therefore each succeeding stroke of the bell crank 30 will, in addition to delivering a fresh pair of packets from the stacker to the plate 4, move the lower packet of a preceding pair along the plate 4 while the pusher 7 moves the upper packet of said preceding pair along the plate 5. Thus two side by side rows of packets are moved along the rows, the row on the plate 6 being higher than that on plate 4.

The belts 8 and 9 are supported on pulleys 39 and 40 which are mounted respectively on a spindle 41 rotatably mounted in the frame 42 which supports the parts previously mentioned and on a stud 141 fixed to a support bracket 142. The pulleys are driven at the appropriate speeds by belts 43 engaging V pulleys fixed to the pulleys 39 and 40 and passing around small pulleys 44 fixed to a spindle 145. A larger V pulley 45 is also fixed to said spindle. A crossed belt 46 drives the V pulley 45 from a pulley 47 on the shaft 28.

The belts 8 and 9 are supported at the other end on freely rotatable pulleys 48 mounted on spindles 49 supported in brackets 50 extending from a support bar 51 which supports the curved guides. On reference to Figure 3 it will be seen that the guides 10—12 are obliquely disposed with respect to the guides 10—12 and thus the packets in the former are constrained to move in a path which converges with respect to that of the packets in the guides 10—12. Side plates 52 control the packets in the guides and ensure that they move in the desired path.

The conveyor bands 14 and 15 are mounted on a series of pulleys referred to later which are fixed to spindles rotatable in the side frames 53 and 54 of the machine. The frame 53 is straight while the frame 54 is inclined thereto, as viewed in plan. The band 14 is supported on a driving pulley 55 at one end of the frames and passes over an idler pulley 56 at the other end. The idler pulley is movable along slots in the frame and can be adjusted by screws 57 to tension the band. The band also passes over jockey pulleys 59 to enable it to clear the other band 15 which converges with respect to the band 14 and runs beneath it at one part of its run.

The band 15 is similarly arranged to run over a driving pulley 58 at one end and over an idler 60 at the other end and is also furnished with a tensioning device comprising a screw 61. The pulleys 59 and 60 are, however, inclined with respect to the frame 53 as shown in Figure 3, the bushes supporting the pulley spindles being bored and arranged obliquely for this purpose. The band 15 is also provided with a support plate 161 for the same purpose as the plate 16 provided in connection with the band 14. Each driving pulley 55 and 58 has fixed to its spindle a V pulley 562 over which passes a round belt 63 driven as described later.

The row of packets on the oblique or lower conveyor are kept in position thereon by the frame 54 which acts as a guide for the outer ends of the packets and an equivalent guide 64 is provided for the packets on the other conveyor.

After the leading packets of the rows are arrested by the stop 17, two pushers 65 and 68 move transversely thereto and press a batch of packets towards a blank in the first stage of the boxing operation. The pusher 65 moves the top row of the batch while the pusher 68 moves the lower row. It will be observed that the rows are out
of line as viewed in plan, although the operative faces of the pushers are in line and they move together at the same speed. The packets, however, remain stationary on the bands until such time as a pusher face engages them and ultimately a complete batch moves towards the blank as one mass. The pushers are pivoted to a pin 67 which is attached to slides 68 slideable in guides 69 which are fixed to a table 70 attached to the frame 53. A link 71 is pivoted on the pin 67 and its free end is pivoted to a lever 72 which is in turn pivoted on a cross stay 73 bolted to support frame 74. An extension 75 of the lever carries a roller 76 which engages with a cam 77 normally in operative engagement with a driving shaft 78. A spring 79 effects the return movement of the lever. The shaft 70 has a bevel gear 80 on its end engaging another bevel gear 81 on a countershaft 82 which is rotatably supported in a bearing 83. The countershaft has a gear 84 fixed on it which engages with a smaller gear 85 fixed to a spindle 86 also journalled in the bracket 83. A V-pulley 87 is fixed to the other end of the spindle 86 and drives the belt 63 previously referred to. In this way the bands 14 and 15 are continuously driven and will feed packets towards the stop 17 as long as they are supplied by the individual wrapping machine. If, however, a packet is removed from either belt 8 or 9 during the inspection, an incomplete batch will be assembled at the boxing position at the time the pushers 65 and 66 are about to move forwards. To prevent such an incomplete batch from being boxed the detector device previously referred to is employed. The device comprises a plate 94 made of insulating material in which twenty metal pins 95 are slidably mounted. The pins are arranged in two groups of ten pins each as previously mentioned and as shown in Figure 5 the group of pins lying above the lower row of packets are longer than the others to compensate for the difference in levels. In Figure 5 an enlarged view of a pin is shown from which it may be seen that the pin slides in a metal bush 86 and when in its lowest position it can contact with a metal washer 91. The washer is earthed while the bush is connected to the battery or other source of electric power 92. The other side of the battery is connected to a brush 93 engaging a slip ring 94 insulated from but rotatable with the shaft 78. A lateral extension of the slip ring constitutes a segment which in combination with another brush 96 forms a make and break switch. The brush is connected to an electric magnet 96 having an armature 97 pivoted at 88 and normally pulled down by a spring 98. The plate 88 is fixed to rods 103 vertically slideable in bearings 101, Figure 5, and is raised by a cam 102 fixed to the shaft 70 and lowered by a spring 104. When the detector is lowered the pins 89 are normally lifted by contacting with the packets and the circuit cannot be completed although the make and break switch is "on" at the time. If, however, a packet is missing from a row one of the appropriate pins will not be lifted and thus the magnet is energized. The armature is attracted and a pin 104 at the end thereof moves into a groove 105 in a clutch member 106 splined to the shaft 70 and pressed into operative engagement with the other clutch member 107 forced in the boss of the pin by spring 108. Rotation of the shaft 70 causes the clutch to disengage and so the cam remains still until the next revolution of the shaft when, if the missing packet has been replaced by the feeding movement of a band 14 or 15, the detector will not cause the magnet to be energized and the clutch will engage again. The pushers will therefore press the batch forwards into engagement with the blank 109 which is fed vertically into the path of the batch. It will of course be understood that when the pushers 65 and 66 are prevented from moving a batch into engagement with a box blank, the blank feeding mechanism will also cease to operate. Mechanism for interrupting the blank feeding mechanism in such circumstances is well-known and any suitable known mechanism may be employed for this purpose. The blank is shown in position in Figure 1 and may be used to form panels and hidden parts being shown as chain lines while the edges of the visible parts are hatched. Figure 7 shows the blank partly folded about a batch and the general shape of the blank may be readily seen from this figure. As the pushers assemble the two rows of packets into a batch, it will be observed from Figure 5 that the upper rows relieve during the inspection, an incomplete batch will be assembled at the boxing position at the time the pushers 65 and 66 are about to move forwards. To prevent such an incomplete batch from being boxed the detector device previously referred to is employed. The device comprises a plate 94 made of insulating material in which twenty metal pins 95 are slidably mounted. The pins are arranged in two groups of ten pins each as previously mentioned and as shown in Figure 5 the group of pins lying above the lower row of packets are longer than the others to compensate for the difference in levels. In Figure 5 an enlarged view of a pin is shown from which it may be seen that the pin slides in a metal bush 86 and when in its lowest position it can contact with a metal washer 91. The washer is earthed while the bush is connected to the battery or other source of electric power 92. The other side of the battery is connected to a brush 93 engaging a slip ring 94 insulated from but rotatable with the shaft 78. A lateral extension of the slip ring constitutes a segment which in combination with another brush 96 forms a make and break switch. The brush is connected to an electric magnet 96 having an armature 97 pivoted at 88 and normally pulled down by a spring 98. The plate 88 is fixed to rods 103 vertically slideable in bearings 101, Figure 5, and is raised by a cam 102 fixed to the shaft 70 and lowered by a spring 104. When the detector is lowered the pins 89 are normally lifted by contacting with the packets and the circuit cannot be completed although the make and break switch is "on" at the time. If, however, a packet is missing from a row one of the appropriate pins will not be lifted and thus the magnet is energized. The armature is attracted and a pin 104 at the end thereof moves into a groove 105 in a clutch member 106 splined to the shaft 70 and pressed into operative engagement with the other clutch member 107 forced in the boss of the pin by spring 108. Rotation of the shaft 70 causes the clutch to disengage and so the cam remains still until the next revolution of the shaft when, if the missing packet has been replaced by the feeding movement of a band 14 or 15, the detector will not cause the magnet to be energized and the clutch will engage again. The pushers will therefore press the batch forwards into engagement with the blank 109 which is fed vertically into the path of the batch. It will of course be understood that when the pushers 65 and 66 are prevented from moving a batch into engagement with a box blank, the blank feeding mechanism will also cease to operate. Mechanism for interrupting the blank feeding mechanism in such circumstances is well-known and any suitable known mechanism may be employed for this purpose. The blank is shown in position in Figure 1, the crease lines and also hidden panels being shown as chain lines while the edges of the visible parts are hatched. Figure 7 shows the blank partly folded about a batch and the general shape of the blank may be readily seen from this figure. As the pushers assemble the two rows of packets into a batch, it will be observed from Figure 5 that the upper rows relieve during the inspection, an incomplete batch will be assembled at the boxing position at the time the pushers 65 and 66 are about to move forwards. To prevent such an incomplete batch from being boxed the detector device previously referred to is employed. The device comprises a plate 94 made of insulating material in which twenty metal pins 95 are slidably mounted. The pins are arranged in two groups of ten pins each as previously mentioned and as shown in Figure 5 the group of pins lying above the lower row of packets are longer than the others to compensate for the difference in levels. In Figure 5 an enlarged view of a pin is shown from which it may be seen that the pin slides in a metal bush 86 and when in its lowest position it can contact with a metal washer 91. The washer is earthed while the bush is connected to the battery or other source of electric power 92. The other side of the battery is connected to a brush 93 engaging a slip ring 94 insulated from but rotatable with the shaft 78. A lateral extension of the slip ring constitutes a segment which in combination with another brush 96 forms a make and break switch. The brush is connected to an electric magnet 96 having an armature 97 pivoted at 88 and normally pulled down by a spring 98. The plate 88 is fixed to rods 103 vertically slideable in bearings 101, Figure 5, and is raised by a cam 102 fixed to the shaft 70 and lowered by a spring 104. When the detector is lowered the pins 89 are normally lifted by contacting with the packets and the circuit cannot be completed although the make and break switch is "on" at the time. If, however, a packet is missing from a row one of the appropriate pins will not be lifted and thus the magnet is energized. The armature is attracted and a pin 104 at the end thereof moves into a groove 105 in a clutch member 106 splined to the shaft 70 and pressed into operative engagement with the other clutch member 107 forced in the boss of the pin by spring 108. Rotation of the shaft 70 causes the clutch to disengage and so the cam remains still until the next revolution of the shaft when, if the missing packet has been
overlapping conveyors to receive articles from said inspection-conveyors and to assemble the articles in superimposed relationship, means interposed between the inspection conveyors and the converging conveyors to rotate the articles through 180°, transfer means movable in a path transverse to the paths of said converging conveyors to move a batch of articles from the latter, and means to feed wrapping material into the path of the batch.

4. In a parceling machine, a pair of side by side inspection-conveyors, movable in parallel paths at different levels to receive articles from a source of supply, a pair of converging and overlapping conveyors disposed below said inspection conveyors to receive articles from the latter and to assemble the articles in superimposed relationship, curved guides between which the articles pass as they move from the inspection conveyors to the converging conveyors, said guides causing the articles to be rotated through 180°, transfer means movable in a path transverse to the paths of said converging conveyors to move a batch of articles from the latter, and detector means to engage the partially superimposed articles and connected with said transfer means to control the movement thereof.

DESMOND WALTER MOLINS.
ARTHUR BINGHAM.