

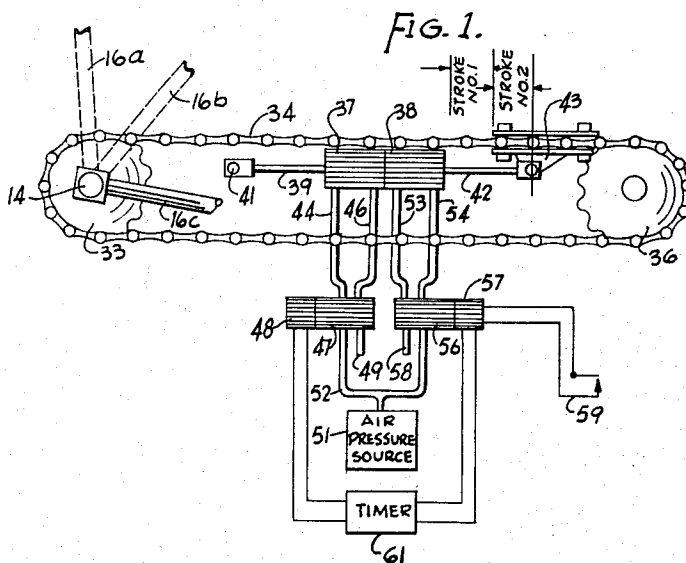
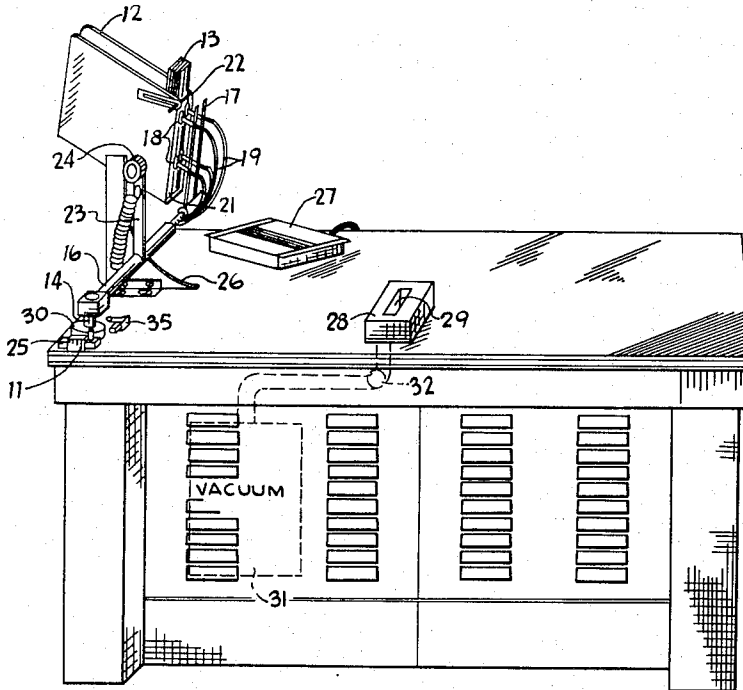
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PACKAGING APPARATUS

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PACKAGING APPARATUS

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ABSTRACT OF THE DISCLOSURE

Apparatus for transporting packaging material in card form in which a card magazine holding aligned cards presents these cards to a pick-up means on an arm connected to a shaft which pivots the arm along an arc to carry the card first to a heating station and then to a forming die, the arm moving freely back to pick up another card after the first card has been released from the forming die.

This invention relates to packaging apparatus for enclosing an article in a package that comprises a supporting card and a plastic member attached to the card and fitting snugly around the article. In particular the present invention relates to improved means for transporting the card from a card supply to a heater and then to a vacuum-forming die in which the plastic is formed to a proper configuration to receive the article.

In the packaging of small articles in a tight fitting plastic container attached to a card it is desirable to arrange the necessary apparatus in such a way that the transportation of the card can be most easily accommodated and the entire operation carried out with maximum efficiency and with smooth movement of the cards and their attached plastic members from station to station. The apparatus in which this is carried out may be conveniently arranged on an arc so that an arm can move from a stock of cards in a magazine to a heating means where it can remain for a sufficient time to heat up the plastic and then to a vacuum-forming die after which the arm can return for another card. The operator can sit or stand next to the die to place an article to be packaged in each plastic member as the plastic members are formed within the die. Thereafter the operator can fold the card over in a known way and remove the folded card with the enclosed article from the die to a further apparatus to accomplish automatic sealing of the package as has been known heretofore.

It is essential that the movement of the cards from position to position be accomplished smoothly and yet precisely and it is also important that the operator have control of the mechanism so that in the event of any delay in removing a card and the enclosed article from the forming die, no new card will be brought in on top of the previous one. The operator can retain control best if the velocity of the arm is substantially constant and in order to achieve this it is proposed in accordance with the present invention to operate the arm by means of a belt or the like which in turn is driven not by a rotating driving means such as a motor but by pistons and cylinders. The pistons and cylinders can be placed adjacent to the belt so that the movement imparted is directly in line therewith. Any number of cylinder and piston means can be mechanically linked together to produce separate movements of the belt in the same direction to produce a corresponding number of separate movements of the arm to specific angular locations.

It is one of the objects of the present invention to provide a simplified packaging apparatus for transporting packaging cards from station to station at a substantially constant velocity. It is a further object to carry out the movement of such cards and the return move-

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ment of the transportation apparatus at substantially constant controllable velocities.

Further objects will become apparent from the following specification, together with the drawings in which:

FIG. 1 is a perspective view of a packaging apparatus constructed according to the invention; and

FIG. 2 shows the connection between the arm in FIG. 1 and the driving means.

The material handling and packaging apparatus in FIG. 1 comprises a supporting table or bench 11 having a card magazine 12 thereon in which a stock of cards 13 is placed substantially vertically. Extending from the upper surface of the table is a shaft 14 to which the arm 16 is attached to be pivoted by rotary motion of the shaft 14 and, in addition, to be rotatable about its own axis. At the other end of the arm 16 from the shaft 14 is a support structure 17 comprising a plurality of vacuum cups 18 connected to vacuum lines 19 that are in turn connected to the arm 16. The latter is hollow and has a vacuum-type connection through the shaft 14 to a controlled vacuum source (not shown). The magazine 12 has a stop 21 near the bottom to keep the cards 13 from falling out and the second stop 22 to keep the cards from falling forward. The latter stop is located below the upper edge of the cards but the suction force of the vacuum as applied by means of the suction cups 18 to the front surface of each of the cards in turn is sufficient to draw the forwardmost card to the stops 21 and 22.

The arm 16 has a second arm 23 attached to it and provided with a roller follower 24 at its outer end to engage a curved inclined surface, or cam, 26 which is attached to the supporting bench 11. The apparatus of the arm 23 is to cause the arm 16 to pivot as the latter swings back toward the position in which the vacuum cups 18 must be presented head-on against the cards 13.

A heating member 27 is located at a second station on the supporting bench 11. The heating member is connected to a suitable energy source such as an electrical outlet to provide a controlled amount of heating to the upper surface of the member to heat the plastic that forms the central part of each of the cards 13. The amount of heat required depends upon the time that the card remains in contact with the heating member and the quantity and configuration of plastic to be heated. The heating member 27 is located at substantially the same radial distance from the shaft 14 as the magazine so that as the arm 16 pivots about the shaft 14 a card 13 removed from the magazine 12 will automatically be brought into position over the heating member 27. Moreover, in carrying out this motion the roller 24 will roll down the cam surface 26 so that by the time the arm 16 reaches the proper position to place the card over the heating member 27, the card will then rotate a little more than 90°, sufficient to bring it to a horizontal plane and spaced, usually, slightly above the heating member to receive the heat therefrom.

After having been heated by the heating member the card is then moved by further pivotal movement of the arm 16 to a vacuum-forming die having a cavity 29 in its upper surface of the configuration to correspond to the article to be packaged. The vacuum-forming die is connected to a vacuum source 31 illustrated diagrammatically, and between the die and the source is a control 32 to control the evacuation of the cavity 29 when a card with its heated plastic member has been placed on top of the die 28. The die 28 is also located at the same radial distance from shaft 14 as the magazine 12 and the heating member 27, but the cavity 29 is even more precisely aligned than the heating member to receive the plastic member of the cards 13 so that the plastic can be deformed in the exact spot required to receive the

articles to be packaged. After the plastic has been properly deformed, the operator inserts the article into the depression in the plastic and folds the card 13 over along a center score line to enclose the article loosely after which the package is sent through a sealing apparatus such as is described in my Patent 3,075,330 to seal the two facing sections of the card 13 together and to shrink the plastic tightly about the enclosed article.

In order to place the card 13 properly on the surface of the die 28, it may be necessary to drop the arm 16 slightly as the card 13 reaches the die 28. This drop may be accomplished by means of an inclined cam surface 30 which engages a suitable stud or roller follower (not shown) on the shaft 14 to drop the shaft axially during the final rotary motion of that shaft required to bring the arm 16 over the die 28. The same follower may also be used to actuate switches 25 and 35 to connect the vacuum lines 19 to a vacuum source when the vacuum cups 18 are in position to receive a card 13 and to disconnect the vacuum lines when it is desired to drop the card on to the surface of the die 28. Alternative controls to achieve the same effect may also be placed elsewhere in the apparatus if it is more convenient.

FIG. 2 shows the apparatus for pivoting the arm 16 in the present embodiment in which the arm must move to three different positions. This apparatus is mainly located under the upper surface of the bench 11 which has been broken away to make the mechanism visible. The arm 16 is required in the present apparatus to move to three different positions, or stations. The first position is the position at which the cards are picked up one after another and the arm in its position is shown in broken lines and is identified by reference numeral 16a. In the second position, to which the arm is moved to bring the card into proper relationship with the heating member 27, the arm is also indicated in broken lines and is identified by reference character 16b. The third position of the arm is reached when the card 13 is brought into place to be received by the die 28 (shown in FIG. 1). Part of the arm is shown in solid lines and identified by reference numeral 16c. Although the exact angular separations of the three positions is not to be considered a limitation on the present invention, it happens that the angle between the position of the arm through which the arm moves between the first and second positions is about 45° while the angle between the second and third positions is about 53°. Even greater angles can be accommodated, and the arm 16 is not limited to positions over the bench 11.

The power to move the arm is supplied to the shaft 14 through a pulley 33 and a belt 34. The designation of the member 34 as a belt is to be considered generic since the member 34 may also be a chain or other similar flexible power-transmitting means. If the member 34 is a chain, the pulley 33 will then normally be a sprocket wheel rather than a pulley. Since it is essential that the arm be moved to precise locations, no slippage can be permitted between the member 34 and the member 33 and although the necessary fixed relationship may be obtained by means of a timing belt and a toothed pulley, it is preferable, because of the power required, to use a roller chain as the member 34 and a toothed sprocket 33, and these means will therefore be referred to hereinafter by such designations.

The chain 34 in the present embodiment is formed into a closed loop that fits around the sprocket 33 and an idler sprocket 36. Between the two sprockets are two pneumatically-operated cylinders 37 and 38, each of which has a piston that slides back and forth and is attached to a connecting rod. If the arm had to move to only two positions, only one cylinder would be required. On the other hand, more than two cylinders could be used to make it possible to move to additional positions, even beyond the limits of the bench 11. In addition, the angular velocity of the arm can be separately controlled between each pair of positions. The connecting rod 39 is

attached to the piston in the cylinder 37 and is in turn anchored to a stud or screw 41 that is affixed to the bench 11 so that the anchor is immovable relative to other parts of the structure such as the shaft 14, for example. The connecting rod 42 is attached to the piston in the other cylinder 38 and is in turn connected to a bracket 43 which is firmly joined to the chain 34 and at a point between the two sprockets 33 and 36. The cylinders 37 and 38 are directly mechanically connected to each other and they, together with their associated connecting rods 39 and 42, are capable of motion only along one path which is parallel to that portion of the chain 34 to which the bracket 43 is attached.

The positions of the pistons within the cylinders 37 and 38 are controlled by air pressure supplied, in the case of the piston 37, through a line 44 or a line 46 as controlled by a valve 47 operated by a solenoid 48. When air is supplied to one of the two lines 44 or 46, the other line is connected to an exhaust channel 49 to bleed off back pressure on the other side of the piston at a controlled rate. The high pressure air is supplied from a source 51 by way of a line 52.

Similarly, the position of the piston in the cylinder 38 is controlled by air from the source 51 supplied either to a line 53 or a line 54 as controlled by a valve 56, which in turn is governed by a solenoid 57. The valve 56 has an outlet pipe 58 through which air may be bled off at a controlled rate through either the line 54 or 53 when high pressure air is supplied to the other. The solenoid 57 has an additional switch 59 which may be connected to a foot treadle to be governed by the operator to reverse the valve 56 at certain times.

The operation of the cylinders and valves in FIG. 2 may be considered starting with the position shown in which pressure has been supplied via the lines 45 and 53 to the adjacent ends of the cylinders 37 and 38 to force the pistons toward the outer ends of these cylinders, thereby extending the connecting rods 39 and 42 to their maximum extent and placing the bracket 43 as far to the left as it will go with respect to the anchor 41. The bracket 43 moves the chain 34 in such a direction as to rotate the arm 16 to the position 16c which corresponds to the position of the vacuum-forming die. The next step, which is controlled by a timer 61, causes both of the valves 47 and 56 to be reversed so as to connect the lines 46 and 53 to their respective outlets 49 and 58 and to apply pressure to the cylinders 37 and 38 by way of the lines 44 and 54 to bring both of the internal pistons toward each other. This draws both of the connecting rods 39 and 42 into the cylinders 37 and 38 as far as they will go. Since the connecting rod 39 is anchored to the stud 41, both of the cylinders 37 and 38 will move to the left by a distance equal to the stroke of the piston within the cylinder 37. This distance is Stroke No. 1 on the drawing and because of this motion of the cylinders, the air lines connected thereto must be flexible. In addition, the retraction of the connecting rod 42 into the cylinder 38 moves the bracket 43 an additional distance to the left indicated as the distance of Stroke No. 2 and the total effect will be that the chain 34 will be moved in the proper direction and to the proper extent to rotate the sprocket 33 and hence the arm 16 to bring the arm into the position indicated by the reference numeral 16a. This is the initial position for a new cycle of operation and places the arm in the proper location to receive a new card from the magazine 12 (FIG. 1).

Subsequently, under the control of the timer 61, the air supply is reversed to the cylinder 37 and high pressure is applied to the line 46 while the line 44 is connected to bleed off back pressure at a controlled rate. This causes the connecting rod 39 to extend from the cylinder 37, thereby moving both of the cylinders 37 and 38, as well as the bracket 43 and the chain 34 to the right by a distance equal to Stroke No. 1. At that point the arm stops in the position indicated 16b and remains in that

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position for a controlled interval of time to allow the card to be heated up on heating means 27 (FIG. 1).

After the controlled interval of time has expired, the timer 61 reverses the connections to the lines 53 and 54 and supplies high pressure to the line 53 thus driving the piston in the cylinder 38 to the right and causing the connecting rod 42 together with the bracket 43 and the chain 34 to move to the right by a distance equal to Stroke No. 2. This, in turn, rotates the sprocket 33 and the arm 16 to achieve a smooth motion of the arm to the position 16c. However, if the operator has been unable to clear the vacuum-forming die in time, he may actuate the switch 59 to override the timer 61 and reverse the valve 56 to apply high pressure to the line 54 and drive the piston within the cylinder 38 to the left. If pressure is maintained on the switch 59, the arm 16 will return to the position 16b to place the card over the heating member 27 to keep it at the proper temperature so that the plastic will not become too stiff to be formed when the card is finally moved to the forming die 28 (FIG. 1). After pressure is released on the switch 59, or in the normal case where there is no pressure applied to that switch, the arm swings to the position 16c to deposit the card on the die 28 and is then ready to start a new cycle of operation.

While the invention has been described in the terms of a particular embodiment it will be understood by those skilled in the art that modifications may be made without departing from the scope of the invention as determined by the following claims.

What is claimed is:

1. Packaging apparatus for enclosing an article in a container comprising a card and a plastic member fitting around an article, said apparatus comprising: a card magazine in which cards are aligned to be presented in order; a heating station to heat said plastic member; a vacuum die having a recess shaped to correspond to the article to be packaged; an arm; pickup means on said arm to grasp a card from said magazine; a shaft connected to said arm to pivot said arm; a pulley attached to said shaft to rotate therewith; a belt engaging said pulley; a first reciprocally operable cylinder and piston connected to said belt to move said belt lengthwise and thereby cause said pulley and said shaft to rotate; a second reciprocally operable cylinder and piston connected to said first cylinder and piston to move said first cylinder and piston in order to provide additional lengthwise movement of said belt so as

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to provide additional rotation of said pulley and said shaft; first control means to control relative movement between said first piston and cylinder to pivot said arm from a first position at said magazine, to pick up a card, to a second position at the heating means; and second control means to control said second piston and cylinder to provide additional movement to move said card from said heating means to a third position onto said vacuum die.

2. The packaging apparatus of claim 1 in which said card magazine is substantially upright and said heating means and said vacuum die are substantially horizontal.

3. The packaging apparatus of claim 2 in which said arm is rotatable about its axis, said apparatus comprising, in addition: an inclined surface adjacent to the path of movement of said arm; and a follower extending from said arm to engage said inclined surface and rotate said arm between said first and second positions.

4. The packaging apparatus of claim 1 in which said first and second cylinders are mechanically connected directly together and said second piston is fixedly connected with respect to said shaft and said second piston is connected to said belt.

5. The packaging apparatus of claim 1 in which said first and second control means are adjustable to control the speed of pivotal movement of said arm.

6. The packaging apparatus of claim 1 comprising, in addition: a manually operated control connected to said second control means to reverse the movement of said second piston to prevent said arm from moving into said third position.

7. The packaging apparatus of claim 6 in which said manually operated control causes said arm to return to said second position.

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