Sept. 22, 1964 A. L. EHE 3,149,545

APPARATUS FOR MAKING MULTIPLE COMPARTMENT PAPER TRAYS

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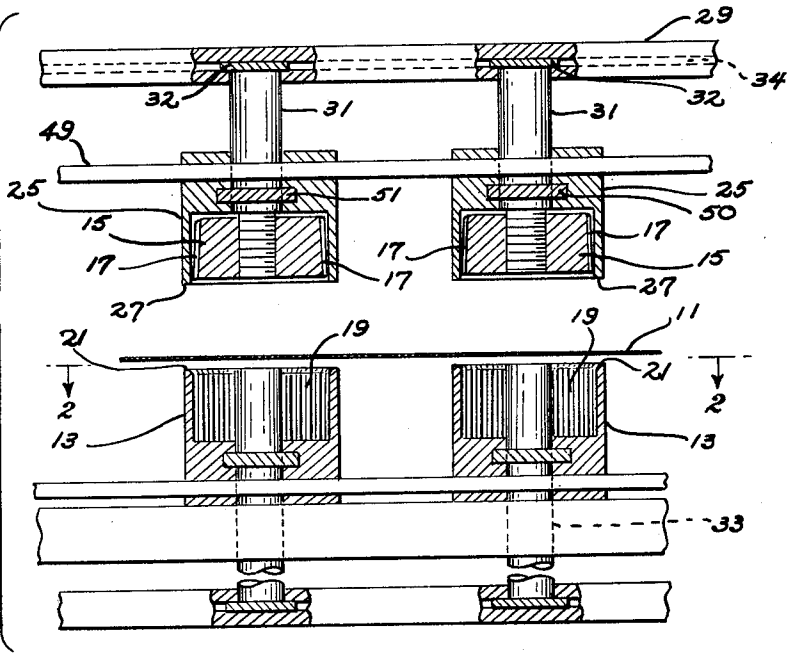
Fig. 1



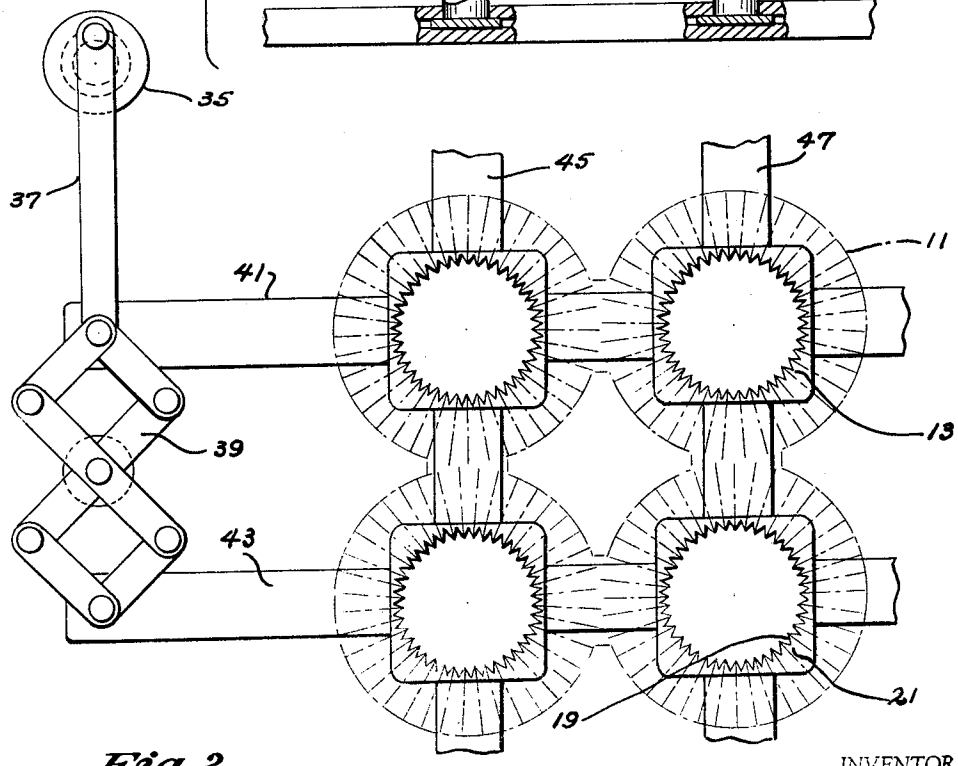


Fig. 2

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Fig. 3

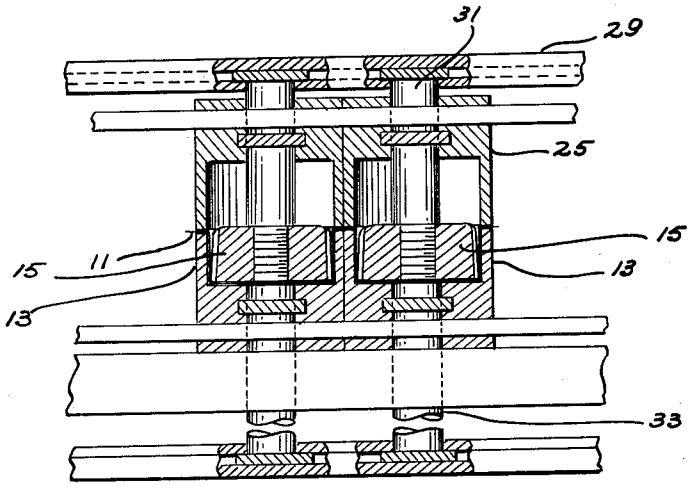
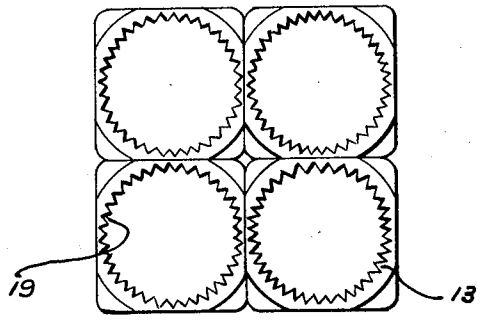


Fig. 4



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APPARATUS FOR MAKING MULTIPLE COMPARTMENT PAPER TRAYS

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9 Claims. (Cl. 93—60)

This invention relates to an apparatus for forming integral paper trays having a plurality or multiplicity of individual compartments, and also relates to a process for making such paper trays. More particularly, with respect to the apparatus, the invention is of a machine comprising a plurality of movable sets of relatively movable dies, so arranged as to move toward other die sets as the dies are brought together to form the trays, the movements together of the die sets being such that they compensate for the paper formed into cup walls, thereby preventing tearing of the non-stretching material during the forming operation.

In accordance with the invention, an apparatus for converting sheet paper into multiple fluted cup tray form comprises a plurality of sets of male and female forming dies of complementary fluted shapes, with a clearance therebetween for a plurality of sheets of paper material to be formed into cup shape when the dies are moved into complementary relationship, means for moving the dies relatively into such relationship and means for moving the sets of dies nearer to other such sets as the male and female dies are brought together, so that multiple cup trays are formable from substantially non-stretching paper sheet material without tearing of the paper. A process for making the described paper trays is also within the scope of the present invention.

The structure, operation, objects and advantages of the invention will be readily understood from the following description, taken together with the accompanying drawing, in which:

FIG. 1 is a side elevation of the apparatus in open position, before forming of the paper into cups, part of the apparatus being sectioned centrally along the dies;

FIG. 2 is a top plan of the apparatus along plane 2—2, illustrating the pattern and fold lines of the paper used to make the tray;

FIG. 3 is a partially sectioned side elevation of the invention after formation of the multiple cup tray and before ejection thereof, showing how the die sets have been moved together during the forming operation; and

FIG. 4 is a plan view illustrating the bringing together of the female dies at the completion of the forming operation.

Numeral 11 represents a plurality of flat sheets of thin non-stretching or substantially non-stretching material, such as paper, suitable for conversion into integral multiply compartmented trays by the apparatus and process of this invention. The number of sheets employed and their thickness depends on the material and the cup design or shape. With 20 to 50 pound glassine stock, the apparatus can form 20 to 100 sheets at a time. Under the paper is a plurality of forming dies 13, which may be referred to as female dies. Above the paper is a plurality of complementary male forming dies 15. Both male and female dies are fluted, the former externally at 17 and the latter internally at 19. The flutes fit each other, with sufficient clearance between them to allow for the thickness of the desired number of sheets to be formed into trays. In addition to being fluted at sides 17 and 19, the generally cylindrical dies 13 are also radially fluted at the top 21 thereof. The generally frustoconical dies 15, when moved downwardly, move the paper across the top 21 of the female dies and score it, making it easier to form the fluted cup walls between the dies. Shrouding dies 25 move downwardly to contact the paper atop the female dies 13. The shrouding dies are fluted at the bottoms 27 thereof to match and complement the flutes 21 on the female dies and better score the paper when it is moved between the dies. As will be apparent from the drawing, the shrouding dies move downwardly ahead of the male dies and are held or stopped by contact with the female dies, as the male dies continue downwardly and form the cups. Of course, the force with which the shrouding dies press against the lower dies will be such as to cause the scoring of the paper to be deep enough to facilitate fluting, but will not be so great as to seize the paper and cause it to be torn as the upper die forces it downward.

In making multiple cup trays from single sheets of paper, it has been observed that the paper tends to gather or tear as it is forced into cup forms. Thus, before the present invention it was not considered possible to produce automatically or on a practical commercial scale, multiple compartment trays which had been formed from a single sheet of paper. The present invention has overcome this difficulty, by virtue of the novel construction of the apparatus, which moves the die sets closer together as the cups are formed, to compensate for the movement of the paper into the female forming dies. In this way it has been found that satisfactory cups may be made.

The construction of the means for moving the dies and die sets closer together during the forming operation will now be described in more detail. A prime mover, not illustrated, drives a drive plate 29 which forces shrouding dies 25 and male dies 15 downward by means of plungers 31. As is seen, the dies move simultaneously. The prime mover also moves ejectors 33 upward and returns the shrouding and male dies to original position after forming of the cup trays. As will be known to one of skill in the art, the movements of the various parts may be timed and controlled by cams or equivalent mechanical devices, in the usual manner.

The prime mover rotates cam 35, causing arm 37 to move in substantially reciprocating manner. With a suitable point of scissors-type linkage 39 held steady, movement of arm 37 will cause the female dies 13 to be moved closer together via drive bars 41 and 43. Drive bars 45 and 47 are similarly actuated and move the dies together in a direction at a right angle to that of bars 41 and 43. When making trays having more than the four cups illustrated, which are only representative of the trays that may be made with the apparatus and according to the process of the invention, additional drive bars may be added to an extended scissors drive linkage. In addition to the drive bars on the female dies, corresponding drive bars move the male and shrouding dies. Thus, drive bars 49 and 51 and 50 move the male and shrouding dies in synchronism with the movements of the complementary dies. The distances of movements of the drive plate 29 and drive bars 41, 43, 45, 47, 49, 50 and 51 are regulated so that the paper may be formed in dies 13 by dies 15 without objectionable tearing or gathering thereof. This

movement of the dies sidewardly toward other dies or sets requires that plungers 31 and flanges 32 thereon should also pursue such a path and therefore channel 34 is so shaped.

After completing the pressing operation, the dies are in the positions illustrated in FIGS. 3 and 4. By thin wall construction at the points where the dies come together, they are made able to move close together, so that the cups formed in a paper tray may be immediately adjoining. The sides of the die members may be interfitted so that the dies may approach even closer together, allowing the production of cups that have their flutes interlocking at the upper edges of joinder, as distinguished from those in which the cups meet each other in a substantially straight edge.

After removal of the pressed sheets of cups from the female dies by simultaneous upward movement of the ejectors 33, the trays may be trimmed or cut so that the cups are round and fluted, the joinder to other cups only at parts of their circumferences. Alternatively, the sheets of paper may be trimmed to the pattern illustrated in FIG. 2 before cup formation. In still another apparatus, cutting means may be provided to sever the central sections to be removed, as the last step in the forming operation. Such means may be a part of the upper or lower die assembly. If the presence of the central section between cups is not unduly objectionable, it may be left in place. It will either dimple downward or peak upward, giving the tray a characteristic feature.

To assist the cups, strongly to maintain their fluted shapes, it is highly desirable to heat at least a part of the forming members, Preferably, a heating coil or other conventional heating means is provided for the female die, the male die or the ironing and scoring surfaces of the female and shrouding dies, 21 and 27, respectively. The positioning of the heating coil may be in any conventional location from which the die surfaces could be sufficiently heated. Such locations will be known to one of skill in the art and need not be described here at any greater length.

In the foregoing description of the process and apparatus of this invention, it has been mentioned that a plurality of sheets of paper may be formed into fluted cup trays at a time. Such an operation speeds production and the extra thicknesses of paper help to prevent tearing of the paper during the fluting process. If any paper should be torn, which might happen, due to imperfect setting of the means for bringing the die sets together as the dies close, the damage will usually be limited to the outer sheets of paper only.

As was mentioned previously, the paper between cups, except where they are joined together at the contacting upper edges thereof, is cut away before or after formation of the trays. In a preferred embodiment of the invention, cutting knives may be affixed to or associated wtih the dies, such as the shrouding dies 25, so as to cut away such excess paper as soon as the cups have been formed. Such cutting means will be held away from contact with the paper until the tray has been made, at which time it will be forced downwardly to perform its cutting function. If desired, means such as a blower or vacuum device, may be provided to remove any cuttings that might otherwise foul the dies.

In the preceding description, male dies 15 and female dies 13 have been referred to as forming dies whose respective external fluted sides 17 and 19 form the flutes in the paper cups of the trays. In some embodiments of the invention, there may be the only cup-forming surfaces. In other devices however, such as that illustrated in this application, the initial forming of the flutes of the cups is by the flutes of the upper fluted edge or top 21 of the forming die 13 and the lower edge or bottom of the shrouding die 25. The fluted sides 17 and 19 maintain and strengthen the initial fluting and prevent the flutes from being flattened or pleated between the dies.

It will be clear from this specification that a new and useful apparatus has been provided for the manufacture of new multiple compartmented paper trays and the like. The invention is not limited to the specific embodiment thereof illustrated but includes the apparatuses and processes of the appended claims, equivalents thereto and modifications thereof. As an example of such a modification, automatic feeding and withdrawing means may be provided for the paper sheets so that hand feeding is not necessary. Similiarly, adjusting means may be incorporated so that the various relative movements may be accurately adjusted for optimum operation. Also, such adjustment means may be capable of varying the machine set so that trays of different sizes may be produced, as may be desired.

What is claimed is:

1. Apparatus for converting sheet paper material to fluted multiple cup tray form which comprises a plurality of male forming dies, a plurality of female forming dies, both types of dies being of complementary fluted shapes with clearances therebetween for a plurality of sheets of paper material to be formed into cup shape when the dies are brought together into complementing relationship, means for moving the dies into such complementing relationship and means for moving sets of dies nearer to other sets of dies as the male and female dies of the sets are brought together, so that a multiple cup tray is formable from substantially non-stretching paper sheet material without tearing of the paper.

2. Apparatus for converting sheet paper into multiple fluted cup tray form comprising a plurality of sets of male and complementary female dies, both male and female dies having fluted complementary forming surfaces with clearance therebetween for a plurality of sheets of paper to be formed into cup shapes with fluted sides, means for relatively moving the male and female dies into and out of complementing relationship simultaneously in all die sets, the movement into complementing relationship forcing paper past the complementing forming surfaces of the dies and forming fluted cup sides, and means for moving the die sets together as the complementary forming dies are brought into forming relationship, the movement of the die sets together being sufficient to compensate for the movement of the paper past the forming surfaces of the dies when forming the fluted cup sides, so that a multiple fluted cup tray is formed from substantially non-stretchable paper without tearing or gathering of the paper.

3. Apparatus for converting sheet paper into multiple fluted cup tray form according to claim 2 in which the forming dies move vertically relative to one another and the die sets move together horizontally.

4. Apparatus for converting sheet paper into multiple fluted cup tray form according to claim 2 in which the means for moving the die sets together as the dies are moved into complementing relationship comprise a pair of multiple hinged scissor linkages, one of which is held to each of the male dies and the other of which is held to each of the female dies, a die set comprising a male and female die, the linkages being such as to move the male and female dies the same distances so that they are maintained in aligned die sets as the die sets move together.

5. Apparatus for converting sheet paper into multiple fluted cup tray form according ot claim 2 in which the female dies are of fluted cylindrical form and the male dies are of fluted frustoconical form, with the larger end thereof nearer to the female die and with the outer edge portions of the larger end also fluted to score the paper with flute lines as the dies are moved together relatively to form fluted sides of the paper cups.

6. Apparatus for converting sheet paper into multiple fluted cup tray form according to claim 2 in which ejectors move through the female dies after pressing of the paper into tray form to discharge the tray from the dies.

7. Apparatus for converting sheet paper into multiple

fluted cup tray form comprising the apparatus of claim 2 in which the female dies are complementary shaped where they abut when brought together so that they may be moved close together and the compartments made will be complementary fluted.

8. Apparatus according to claim 2 in which means are provided to score the paper sheets to fluted form as they are being drawn into the flutes between male and female dies and before they are fluted by such dies.

9. A process for converting sheet paper into multiple fluted cup tray form which comprises shaping the paper by forcing a multiplicity of sheets of paper at the same time past fluted forming dies while moving the forming dies in sets nearer to other sets of such dies to compensate for the movement of the paper past the forming dies to make the fluted cup sides, removing the multiplicity of fluted cup trays as a unit from contact with the dies and separating the trays.

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