Nov. 29, 1949 A. SHAPIRO ET AL 2,489,507

PAPER CUP MACHINE

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Fig. 7

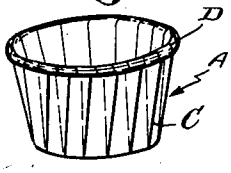


Fig. 1

Fig. 8

Fig. 9

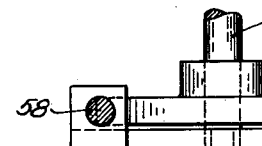


Fig. 6

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Fig. 2

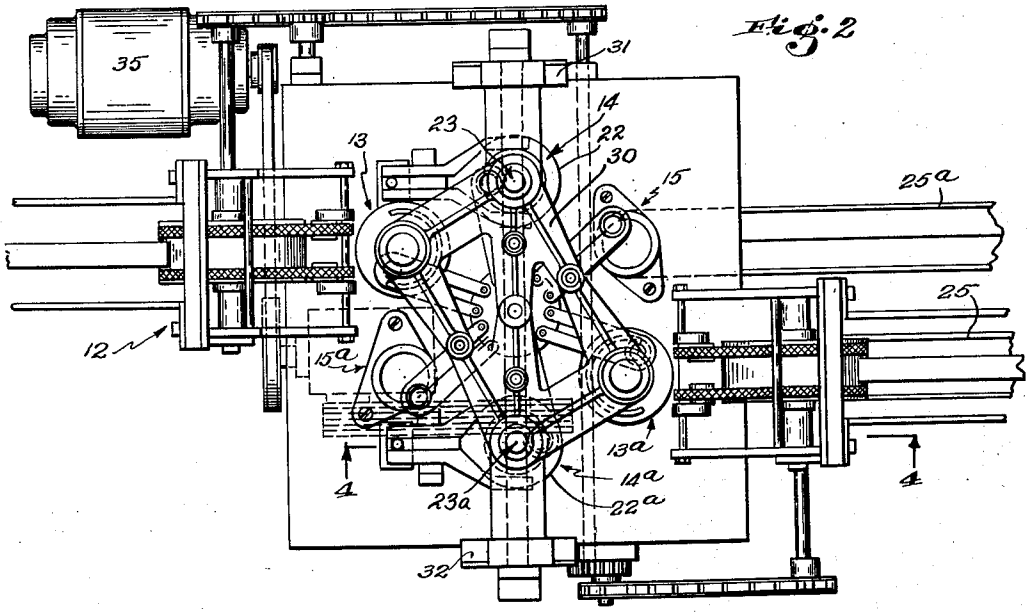
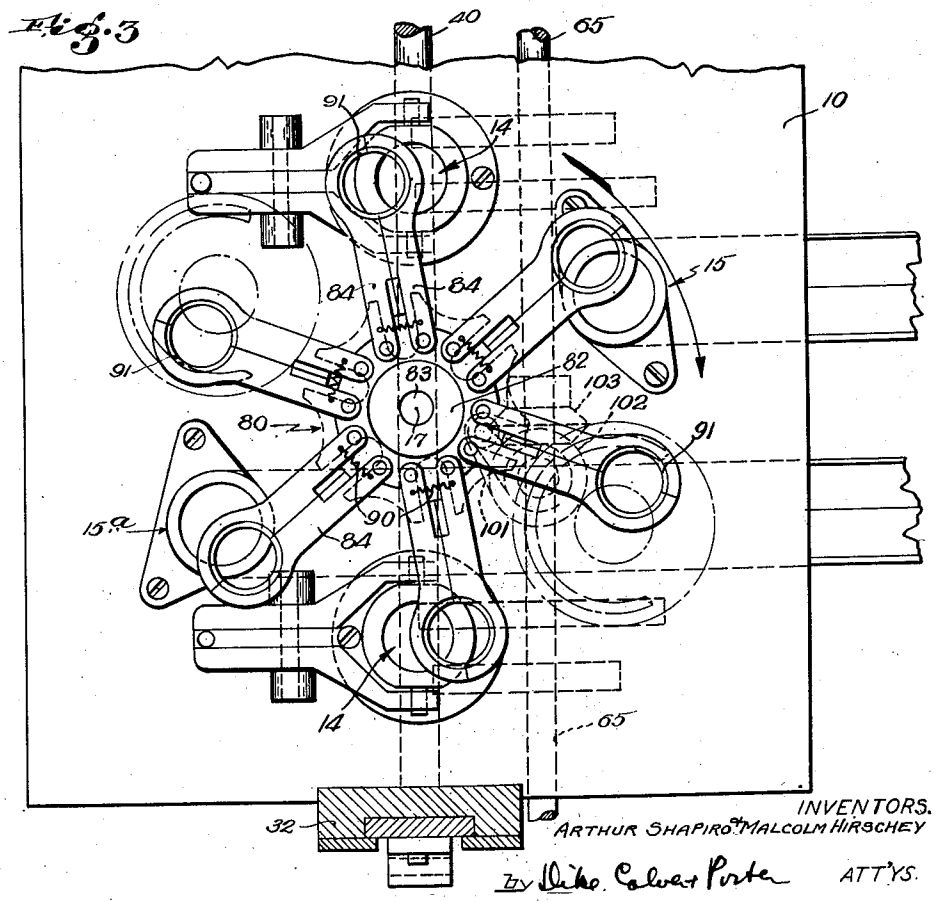


Fig. 3



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Fig. 4

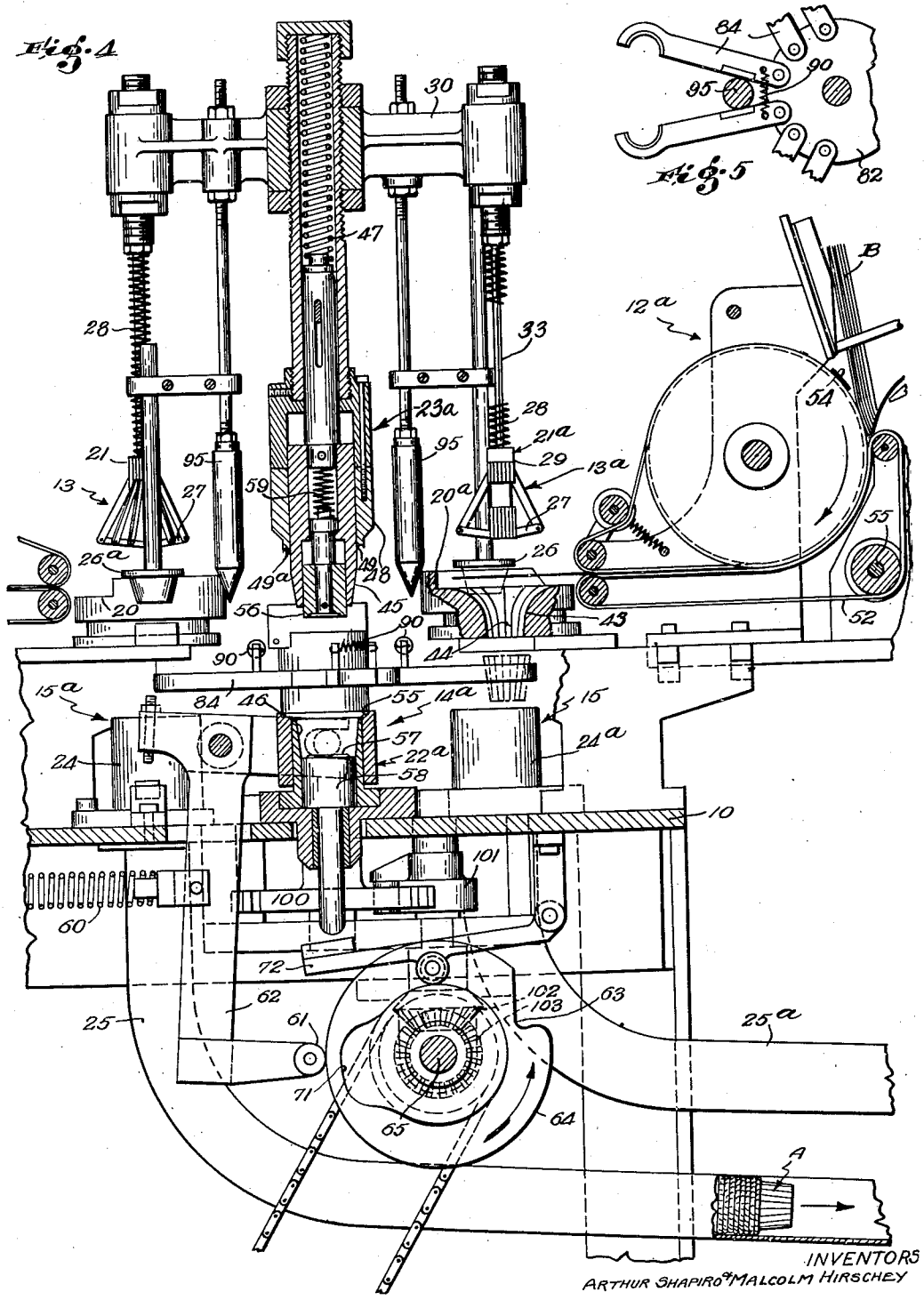


Fig. 5

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PAPER CUP MACHINE

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Application November 21, 1947, Serial No. 787,358

10 Claims. (Cl. 93—60)

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This invention relates to a machine for making paper containers and more particularly to such a machine in which several separate supplies of paper blanks are fed into the machine and several complete paper containers are simultaneously and continuously produced.

A paper cup or other similar container of the pleated variety is normally made from a round flat paper blank which is fed first into a forming or pleating die which gives it the cup shaped pleated form and then into a rimming or finishing die in which a rim having a generally round section is crimped around the cup's upper edge to hold the pleated form in place, give it added strength and a finished appearance. It is desirable to produce a number of such paper containers in one machine simultaneously by providing a multiple machine in which independent groups of dies work together on separate supplies of paper blanks and each of which groups is capable of producing finished products; and it is further desirable that all of the dies in such a machine be capable of performing steps in the formation of containers simultaneously so that each time a pair of finishing dies closes and opens, a finished container is produced by each pair of finishing dies in the machine, and that the production be continuous and rapid.

Heretofore attempts to make such multiple machines have resulted in cumbersome, complicated and very expensive machinery having so many moving parts that their maintenance and adjustment is extremely difficult. The problem has never been satisfactorily overcome and industry has largely had to fall back on the use of single production machines in which only one container is produced at a time.

Accordingly, the object of the invention is to produce several paper containers simultaneously and in rapid continuous steps on one machine and to provide such a machine having comparatively simple motions so that this can be done with less expense than heretofore.

The machine of the invention is arranged with a single transfer mechanism to convey all of the containers being formed in all of the dies, and all workpieces are simultaneously conveyed from one pair of dies to another and to the mechanisms which eject them from the machine in successive motions of the transfer mechanism. The dies are located at a fixed position on the machines and the workpieces are conveyed to and away from them. The successive operations performed by the dies in each group are continuous. That is, when a workpiece has been formed in a

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pair of pleating dies, a new workpiece is conveyed to the latter as the first is removed and conveyed to its succeeding operative position and presented to a pair of rimming dies, and as the first workpiece is being rimmed, the new workpiece is being formed. The operation of all dies is simultaneous. Since the dies do not operate at various changing positions relative to the machine, they are much simpler and less expensive. The resulting multiple production machine is lighter, smaller, less complicated and cheaper than the usual machines.

In general, the pairs of dies are arranged in spaced angular relation on the machine around an axis and the dies of each pair are moved relative to each other in a line parallel to the axis by a reciprocating cross head which is movable axially of the axis to oper and close the dies. The transfer mechanism comprises at least as many pairs of grippers as there are dies and rotates intermittently about the axis and the gripping members are radially disposed in the same spaced angular relation as the dies like the spokes of a wheel to receive the workpieces and convey them between successive operative positions.

The machine illustrated is a paper cup machine having two groups of dies on a common circle each of which performs all the steps of making two sets of paper cups simultaneously but it is to be understood that this invention is not limited to the example described. Any similar form of paper container such as paper dishes and the like may be made by the machine of the invention, and any number of separate groups of dies may be placed upon a common circle or upon concentric circles and all operated from one cross-head and all containers conveyed by a single intermittently rotating transfer mechanism. The particular machine disclosed is illustrative and not limiting.

In the drawings in which capital letters refer to the paper cup and its parts and numerals refer to the machine and its parts;

Fig. 1 is an elevational view of the machine of the invention;

Fig. 2 is a top plan view of Fig. 1;

Fig. 3 is an enlarged partial top plan view partly in section taken along the lines 3—3 of Fig. 1;

Fig. 4 is an enlarged partial elevational view partly in section taken along the lines 4—4 of Fig. 2;

Fig. 5 is a partial top plan view partly in section of a pair of grippers opened by a spreader;

Fig. 6 is a partial top plan view of a pair of cams for operating a lower rimming die;

Fig. 7 is a perspective view of a finished paper container made by the machine of the invention;

Fig. 8 is a top plan view of a paper container after it has passed through the pleating dies, and

Fig. 9 is an elevational view of Fig. 7.

A finished pleated paper cup A is shown in the drawings (Fig. 7) having pleats C and a rim D and the same cup A is shown (Figs. 8 and 9) after it has been given its general form and pleated but before the rim D has been formed to strengthen and hold it together.

A machine for producing two of these paper cups simultaneously is mounted upon a table 10. Since two paper cups are produced in each operative cycle of the machine, the parts which form the cups are in duplicate and description herein which covers one of duplicate parts covers both. In general they are a pair of paper blank supplying or feeding mechanisms 12 and 12*a*, a pair of forming or pleating dies 13 and 13*a*, a pair of rimming or finishing dies 14 and 14*a* and a pair of cup ejectors 15 and 15*a* for ejecting paper cups A from the machine. All of the above mentioned dies and cup ejectors are mounted in a circle about a vertical axis 17 (viewing the machine in plan, Figs. 2 and 3) at equally spaced angular distances. The form of the dies is well known in the art.

The pleating dies shown 13 and 13*a* (Fig. 4) are of the "umbrella type" comprising female dies 20 and 20*a* fixedly mounted upon the table 10 and male dies 21 and 21*a* which because of their yielding ribs 27 have the appearance of the structure of an umbrella. The ribs 27 of a male die 21*a* are radially disposed and held yieldingly spread by a spring 28, a sliding collar 29 and interconnecting rods 33 (Fig. 4). A female die 20*a* has a flaring trumpet shaped aperture 43 and radially disposed fixed ribs 44 which are longitudinal of the inside of the aperture and with which the ribs 27 of the male die 21*a* yieldingly cooperate to pleat a cup A as it is driven down through and out of the bottom of the aperture 43.

The rimming dies 14 and 14*a* comprise female dies 22 and 22*a* also mounted on the table 10 and male dies 23 and 23*a* above them. A male rimming die 23*a* (Fig. 4) comprises a tapering element 45 which mates with a female tapering element 46 in the female die 22*a*, and yields against a spring 47 to flatten the pleats C and hold the cup A in its final form; a rimming element 48 which has a hollowed circular rimming surface 49 and an outside knife edge 49*a* cooperating with a rounded circular upper surface 55 on the female die 22*a* for forming the rim D; and a stripping element 56 having a dished out bottom annular surface 56*a* which cooperates with the corresponding upper surface 57 of a stripper 58 in the female die 22*a* for forming the bottom E of the cup A and which is urged downwardly by a spring 59 to strip the cup A from the male die 23*a* when the dies open. A female rimming die 22*a* is pivotally mounted on the table 10 and actuated to rise quickly to meet the male die 23*a* to rim a cup A by a strong compression spring 60 which urges it upwardly when a cam follower 61 on a lower arm 62 of the female die 22*a* drops into a depression 63 in a cam 64 which is fast on a cam shaft 65 driven from a main shaft 40. When the rimming dies 14*a* open, the cup A is stripped upwardly from the female die 22*a* by the stripper 58 which is actuated by a cam 71 on the camshaft 65 (Figs. 4 and 6).

The ejectors 15 and 15*a* comprise guides 24 and 24*a* attached to the table 10 and which lead into conduits 25 and 25*a*, and plungers 26 and 26*a* for pushing the finished cups A out of the machine through the conduits.

A cross head 30 operates all of the dies and the ejectors. The male pleating dies 21 and 21*a*, male rimming dies 23 and 23*a* and the ejector plungers 26 and 26*a* are attached to the cross head 30 which reciprocates vertically in a pair of gibs 31 and 32 and opens and closes all of the dies and operates the ejectors simultaneously. The cross head 30 is conveniently driven by an electric motor 35 through a reduction gear box 36, drive sprocket 37, chain 38, and a sprocket 39 fast on the main shaft 40 which rotates a crank 41 connected to the cross head 30 by a connecting rod 42. An operative cycle of the machine during which two complete paper cups A are produced constitutes one complete revolution of the main drive shaft 40 during which all of the dies and ejectors perform steps in the production of paper cups at the same time.

The work supplying mechanisms 12 and 12*a* for supplying round, flat paper blanks B to the pleating dies 13 and 13*a* are well known in the art and each may conveniently comprise a chute 50 for feeding a supply of blanks B by gravity into and between a pair of conveyor belts 51 and 52 which convey the blanks B successively to the pleating dies 13 and 13*a*. The belt 51 runs over a drum 53 which has attached on its circumference adjacent the belt a rubber thumb 54 which is adapted to pick off a paper blank B and start it between the conveyor belts 51 and 52 each time the drum 53 rotates. The belts 51 and 52 are conveniently arranged over idler pulleys 55 and with the drum 53 are driven from the main shaft 40. The feeding mechanisms 12 and 12*a* convey the blanks onto the female pleating dies 20 and 20*a* so that when the dies are closed the male dies 21 and 21*a* can push the blanks B down through the apertures 43 in the female dies 20 and 20*a*.

When the pleated cups A have been ejected from the pleating dies 13 and 13*a* they are simultaneously transferred by a mechanism to be described to the rimming dies 14 and 14*a* as the cross head 30 rises and when the cross head comes down again they are given the form of the finished cup A shown in Fig. 6. Meanwhile a new blank has been fed to the pleating dies 13 and 13*a* so that when the two cups are being rimmed two more cups are being pleated. Then as all of the dies again open, the finished cups A are transferred to the ejectors 15 and 15*a*, and during a third operative cycle the finished cups are ejected from the machine while at the same time two more cups are being rimmed and a third pair of blanks are being pleated. Each time the main drive shaft 40 rotates, therefore, the three successive steps of pleating, rimming and ejection from the machine in the operation of producing paper cups are being performed on three pairs of work-pieces simultaneously.

In order to transfer the paper cups which are being formed from the pleating dies 13 and 13*a* to the rimming dies 14 and 14*a* and thence to the ejectors 15 and 15*a*, a transfer mechanism generally indicated at 80 and best seen in the plan views (Figs. 2 and 3) is provided which rotates intermittently in step by step progression about the axis 17 around which all of the dies and ejectors are mounted. The transfer mechanism 80 comprises a hub 82 on a vertical shaft 83 and a pair of radially disposed grippers 84 to

correspond to each pair of dies 13, 13a, 14 and 14a and each of the ejectors 15 and 15a. The grippers 84 are pivotally mounted on the hub 82 at the same spaced angular distance as the dies and ejectors, and they are normally held closed by springs 90. Each pair of grippers 84 has a hollow annular space 91 between them which is adapted to hold a paper cup A after it has passed through the pleating dies 13 and 13a. The transfer mechanism 80 is shown (Figs. 2 and 3) when the machine is at rest or in its starting position and the grippers 84 are slightly offset from the dies and ejectors. As soon as the machine is set in motion, the hub 82 is rotated slightly so that the annular spaces 91 of the grippers 84 are each positioned axially of the dies and ejectors so that they can receive cups A when they are stripped from the dies. The transfer mechanism 80 rotates one step when the cross head 30 rises to open the dies and moves the grippers 84 between the pleating and rimming dies and between the latter and the ejectors.

The grippers 84 are positioned under the pleating dies 13 and 13a operatively in closed position. When the cross head 30 is lowered the male dies 21 and 21a drive the work blanks B down through the female dies 20 and 20a and the cups A which have now been formed and pleated are continued downwardly into and received in the apertures 91 of the grippers 84 so that they may be transferred one step to an operative position between the male and female rimming dies 14 and 14a. As the rimming dies are closed, the male dies 23 and 23a drive the containers A down into the female dies 22 and 22a. Spreaders 95 are attached to the cross head 30 to enter between the grippers 84 and spread them as the rimming dies 14 and 14a are closed as best seen in Fig. 9 so that the grippers 84 release the containers and also clear the male rimming dies 23 and 23a. When the cross head 30 again rises to open the dies, the strippers 58 raise the cups A and present them to the grippers 84 which close and hold them as the spreaders 95 are withdrawn. The transfer mechanism 80 again rotates one step and with its next descent, the ejector plungers 26 and 26a push the completed containers 16 out of the grippers 84 which are simultaneously opened to release them by another similar pair of spreaders 95 attached to the cross head 30 and which operate in conjunction with the ejector plungers 26 and 26a. The transfer mechanism 80 is intermittently rotated in cooperation with the motion of the cross head 30 conveniently by a Geneva wheel 100 and arm 101 which are driven from the main shaft 40 through bevel gears 102 and 103 and the cam shaft 65.

It will thus be seen that the arrangement of the operative parts of the machine about the axis 17 and the use of a single transfer mechanism 80 can be expanded to provide as many independent groups of dies and ejectors as desired for forming simultaneously several paper cups. The dies and ejectors may be arranged on a single circle about an axis or dies served by one transfer mechanism may be arranged on several circles which are concentric to the axis of rotation of the transfer mechanism. Multiplicity of parts is eliminated by the use of the single transfer mechanism and the single cross head which may be used to open and close any number of dies and grippers so arranged.

We claim:

1. A machine for making several paper containers simultaneously, comprising pairs of dies arranged around an axis, the dies of each pair being movable relatively to each other in a line parallel to the axis, work supplying mechanism supplying blanks to at least two pairs of dies, transfer mechanism comprising as many grippers as there are pairs of dies and rotatable about the said axis, spreaders to actuate the grippers and a cross head movable axially of said axis to open and close the dies, said spreaders being actuated by said cross head.

2. In a machine as set forth in claim 1, at least two ejectors actuated by said cross head and cooperating with said transfer mechanism which eject completed paper containers from the machine.

3. A machine for making several paper containers simultaneously, comprising pairs of dies arranged in spaced angular relation around an axis, the dies of each pair being movable relatively to each other in a line parallel to the axis, work supplying mechanism supplying blanks to at least two pairs of dies, transfer mechanism comprising at least as many grippers as there are pairs of dies and arranged in the same spaced angular relation as the dies and rotatable about the said axis, spreaders to actuate the grippers, and a cross head movable axially of said axis to open and close the dies, said spreaders being actuated by said cross head.

4. In a machine as set forth in claim 3, at least two ejectors actuated by said cross head and cooperating with said transfer mechanism which eject completed paper containers from the machine.

5. A machine for making several paper containers simultaneously comprising pairs of dies arranged in spaced angular relation around an axis, the dies of each pair being movable relatively to each other in a line parallel to the axis, work supplying mechanism supplying blanks to at least two pairs of dies, transfer mechanism comprising at least as many grippers as there are pairs of dies and arranged in the same spaced angular relation as the dies and rotatable about the said axis, a cross head movable axially of said axis to open and close the dies, spreaders to open the grippers when the dies are closed, said spreaders being actuated by said cross head, and strippers associated with said dies and cooperating with said grippers which remove the workpieces from the dies and present them to the grippers.

6. In a machine as set forth in claim 5, at least two ejectors actuated by said cross head and cooperating with said transfer mechanism which eject completed paper containers from the machine.

7. A machine for making several paper containers simultaneously, comprising pairs of dies arranged around an axis, the dies of each pair being movable relatively to each other in a line parallel to the axis, work supplying mechanism supplying blanks to at least two pairs of dies, intermittently driven transfer mechanism comprising as many grippers as there are pairs of dies, each gripper comprising a pair of arms each of which is pivotally mounted on a hub which is rotatable about the said axis, said arms being adapted and normally positioned together to grip a container between them, spreaders interposable between the arms of the grippers to open them when the dies are closed and a cross head movable axially of said axis to open and close the dies, said spreaders being actuated by said cross head.

8. A machine for making several paper con-

tainers simultaneously, comprising pairs of dies arranged in spaced angular relation around an axis, the dies of each pair being movable relatively to each other in a line parallel to the axis, work supplying mechanism supplying blanks to at least two pairs of dies, intermittently driven transfer mechanism comprising at least as many grippers as there are pairs of dies and arranged in the same spaced angular relation as the dies, each gripper comprising a pair of arms each of which is pivotally mounted on a hub which is rotatable about the said axis, said arms being adapted and normally positioned together to grip a container between them, spreaders interposable between the arms of the grippers to open them when the dies are closed, a cross head movable axially of said axis to open and close the dies, said spreaders being actuated by said cross head.

9. A machine for making several paper containers simultaneously comprising pairs of dies arranged in spaced angular relation around an axis, the dies of each pair being movable relatively to each other in a line parallel to the axis, work supplying mechanism supplying blanks to at least two pairs of dies, intermittently driven transfer mechanism comprising at least as many grippers as there are pairs of dies and arranged in the same spaced angular relation as the dies, each gripper comprising a pair of arms each of which is pivotally mounted on a hub which is rotatable about the said axis, said arms being adapted and normally positioned together to grip a container between them, a cross head movable axially of said axis to open and close the dies,

spreaders interposable between the arms of the grippers to open them when the dies are closed, said spreaders being attached to said cross head, and strippers associated with said dies and cooperating with said grippers which remove the containers from the dies and present them to the grippers.

10. In a machine for use in making several paper containers simultaneously, pairs of dies arranged around an axis in spaced angular relation, the dies of each pair being movable relatively to each other in a line parallel to the axis, transfer mechanism comprising as many grippers as there are pairs of dies and rotatable about the said axis and a cross head movable axially of said axis to open and close the dies and means connected to the cross head causing the grippers to clear the dies when the latter are closed.

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