H. M. HILL.

PAPER CUP MACHINE.

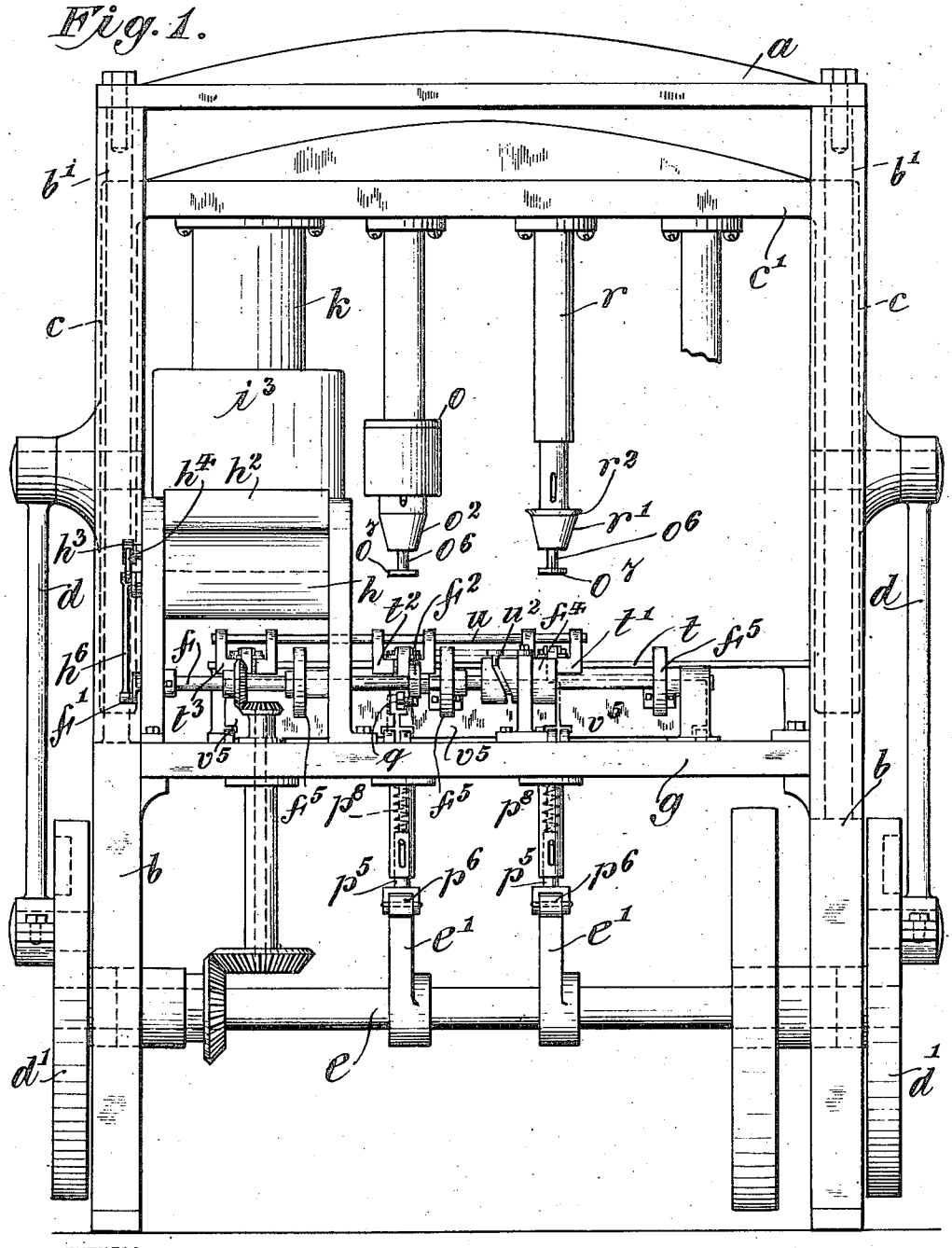
APPLICATION FILED JULY 11, 1916.

1,293,775.

Patented Feb. 11, 1919.

3 SHEETS—SHEET 1.

Fig. 1.



WITNESS

Geo. Smartz.

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BY

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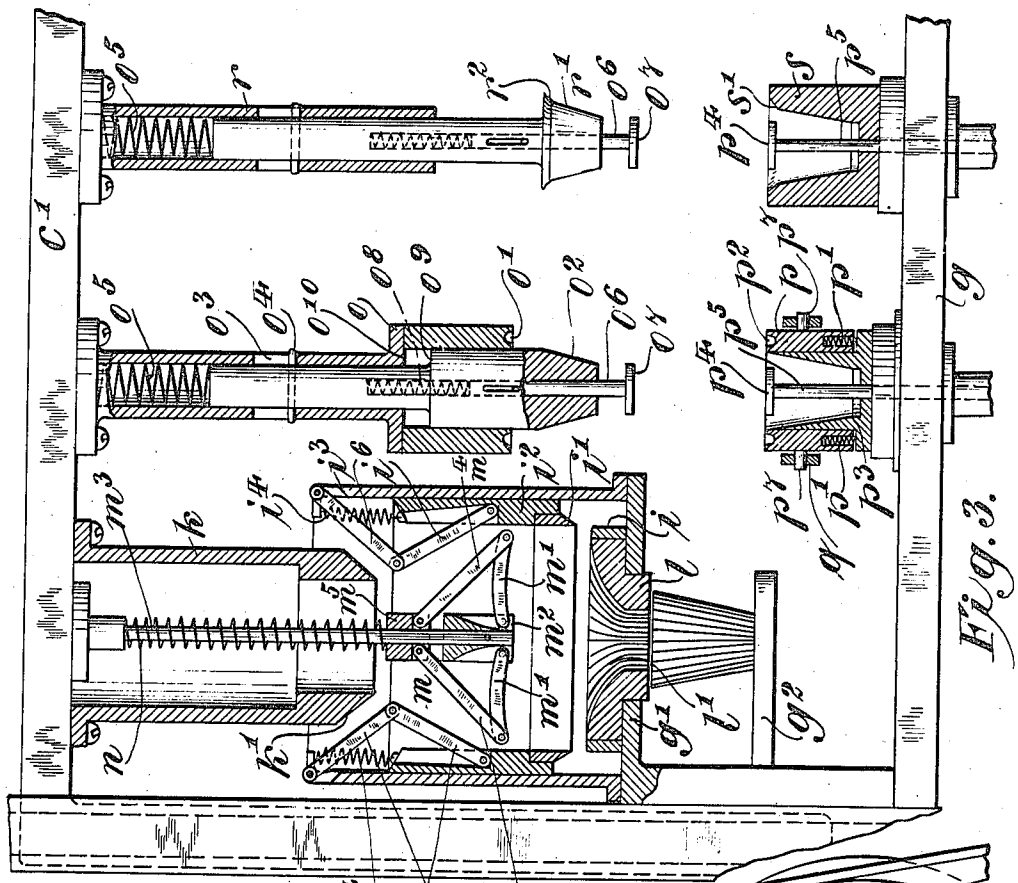


Fig. 3.

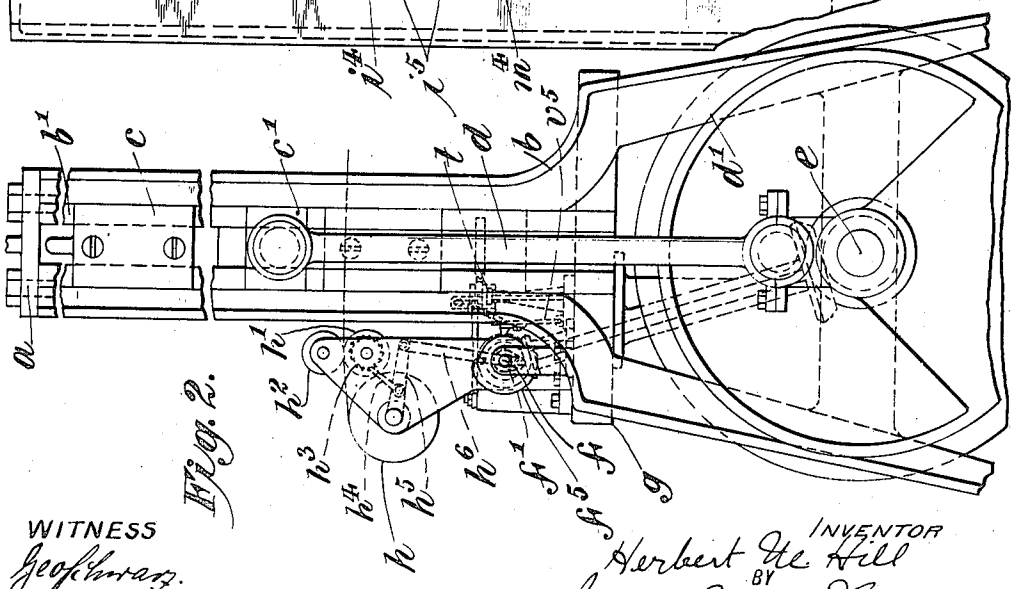


Fig. 2.

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3 SHEETS—SHEET 3.

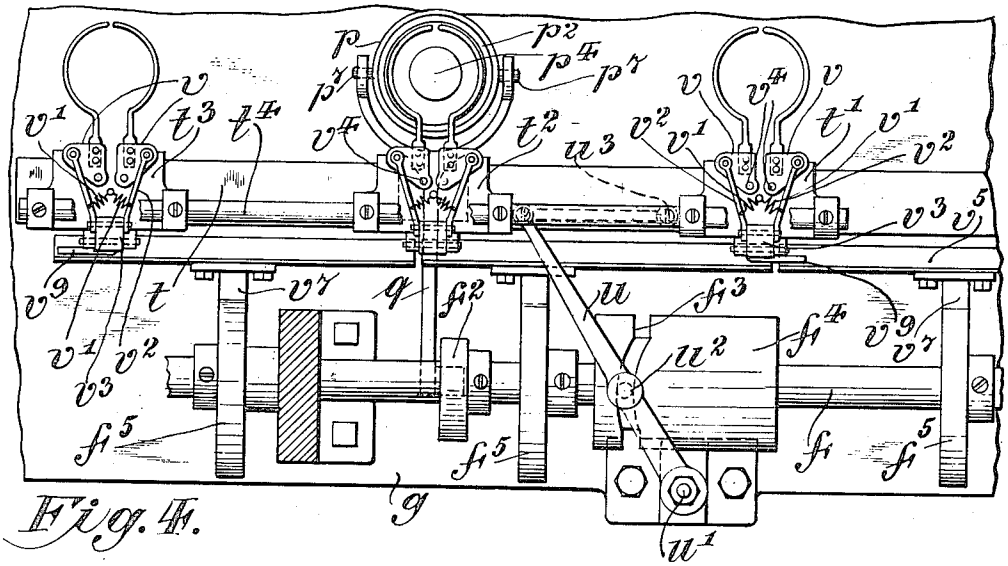


Fig. 4.

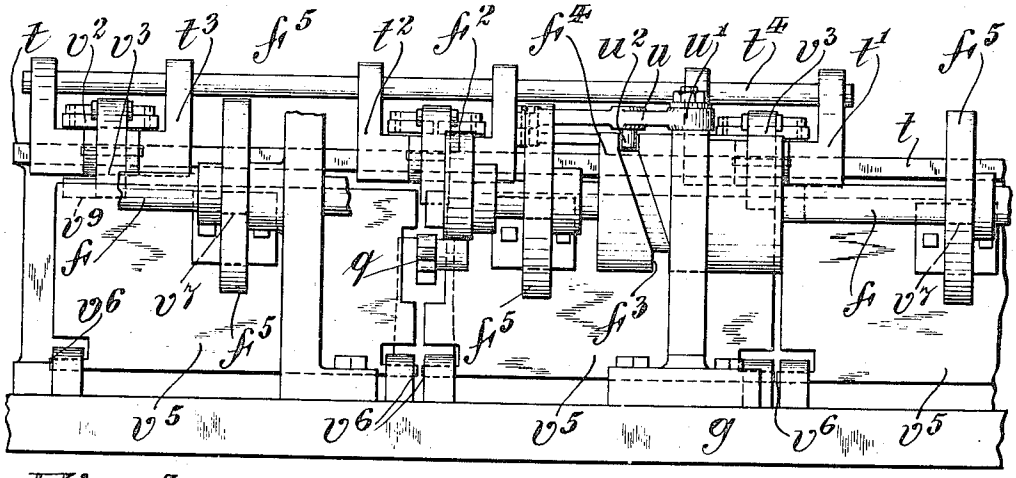


Fig. 5.

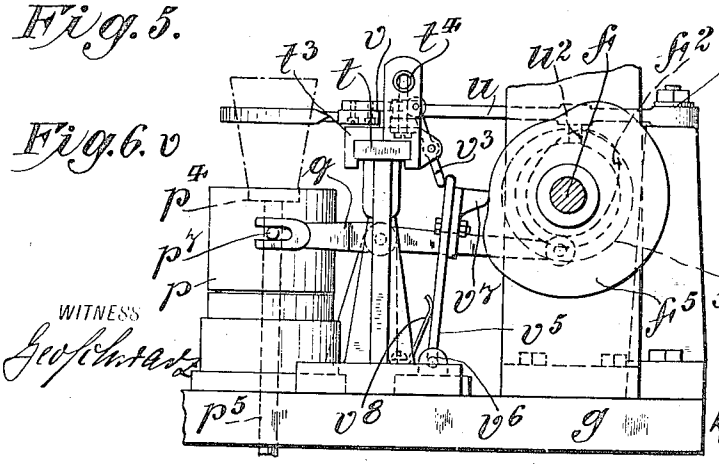


Fig. 6.

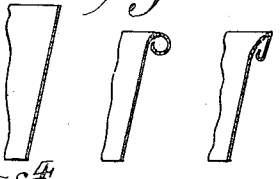


Fig. 7.

WITNESS

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UNITED STATES PATENT OFFICE.

HERBERT M. HILL, OF NEW YORK, N. Y.

PAPER-CUP MACHINE.

1,293,775. Specification of Letters Patent. Patented Feb. 11, 1919.

Application filed July 11, 1916. Serial No. 108,542.

To all whom it may concern:

Be it known that I, HERBERT M. HILL, a citizen of the United States, and a resident of the borough of Manhattan of the city of New York, in the State of New York, have invented certain new and useful Improvements in Paper-Cup Machines, of which the following is a specification, reference being had to the accompanying drawings, forming a part hereof.

In U. S. Patent No. 1,056,675, dated March 18, 1913, issued to Harriet Hill, there is shown and described a paper cup in which the upper edge portion of the body is bent upon itself and folded over and pressed on to one face of the body in such manner as to facilitate the packing of the cups and prevent the usual longitudinal plaits or flutes from unfolding. The principal object of this invention is to provide a machine by which cups of the character described may be formed automatically and quickly. A further object of the invention is to provide devices operable in unison with the forming devices for cutting the blanks for the cups from the stock. Still another object is to provide suitable carrying means for the cup whereby it may be transferred automatically from one die to another for the several pressing operations and finally be ejected from the machine in completed form. In accordance with the invention the paper stock is fed into the machine with a step by step movement and operation of the first forming die member by which the longitudinal plaits or flutes are made, is preceded by the cutting of a suitable blank from the stock by a cutter. After the cutting of the blank and the forming of the plaits by the action of the first die member, the cup is transferred automatically to a second die where its upper edge is bent or crimped or turned under so as to prevent the plaits or flutes from unfolding, and then the cup is carried on to a presser die, the action of which serves to flatten the folded upper edge and press it against the adjacent surface of the body of the cup. Finally, the carrier for the cup ejects it, in completed form, from the machine. There is illustrated in the accompanying drawings a machine by which the automatic operations as described may be successfully carried on in the manner contemplated by the invention, but it will appear clearly that the various mechanical devices for bringing about the operation and coöperation of the elements of the machine may be changed in form and arrangement without departing from the spirit of the invention. In the drawings—

Figure 1 is a view in elevation of a machine embodying the invention, the cross-head on which the several die members are carried being shown so as to retract the male members of the dies.

Fig. 2 is a view in side elevation of the machine shown in Fig. 1, indicating particularly the mechanism for operating the cross-head and the intermittent feed for the stock.

Fig. 3 is a fragmentary detail view on a somewhat larger scale and partly in front elevation and partly in section of the several dies for carrying on the successive operations in the manufacture of the cup.

Fig. 4 is a fragmentary view in detail showing in plan, a suitable carrier for transferring the cup from one die to another.

Fig. 5 is a detail view in side elevation of the actuating mechanism for the devices shown in Fig. 4.

Fig. 6 is a detail view in side elevation of special actuating means for one of the improved dies.

Fig. 7 is a view somewhat diagrammatic indicating the change of form of the upper edge of the cup effected by the improved machine.

The main frame *a* of the improved machine is formed with vertical end plates *b* in which are channels *b'* to receive the end bearing members *c* of a reciprocating cross-head *c'* to which a reciprocating motion is imparted by pitmen *d* connected thereto and to fly-wheel *d'* carried on the main drive shaft *e* for the cup forming devices to be hereinafter described. From the main drive shaft *e* rotative movement is imparted to a lay shaft *f* journaled in suitable bearings on a bed plate *g* supported by the end plates *b* of the main frame. Movement of all of the devices to be hereinafter described is initiated directly from the lay shaft *f* so that the time relation of all operations is adjustable and invariable after adjustment for the purpose of insuring the most effective coöperation.

The cutting devices for the blanks out of which the cups are to be formed will first be described. On the bed plate *g* is supported a roll *h* of paper stock, as indicated, and the paper is led from this roll toward

the forming punches to be described, between suitable feed rollers h', h^2, to one of which, h', is imparted a step by step movement through engagement of a ratchet h^3 carried thereon by a pawl h^4 on a swinging arm h^5 to which the swinging movement is given by means of a rotating crank arm f' secured on the lay shaft f and connected with the arm h^5 through a suitable link h^6. The effect of movement of the swinging arm h^5 in one direction is to rotate the roller h' through the engagement of the pawl h^4 with the ratchet wheel h^3, while swinging movement of this arm in the opposite direction permits the pawl to ride loosely over the teeth on the wheel h^3 and assume a new position in readiness for the next rotation of the roller h'. During this idle movement of the roller h' the paper, of course, remains stationary and it is then that the cutting devices for the blank come into play. While the cutting devices are retracted, the paper is fed forward a sufficient distance to bring new stock below the cutting devices. From the rollers h', h^2 the paper is fed over an annular shearing block i which is carried on a fixed bracket g', and beneath a cooperating annular shearing blade i', in readiness for cutting. The upper knife member i' is carried on a reciprocating support i^2 mounted snugly within a cylindrical bearing member i^3 and normally held in such position as to retract the knife i', by means of spiral springs i^4. The bearing block i^2 with the knife i' may be depressed to cause the cutting of a blank by the coöperating knife members i, i', by novel devices comprising pivoted links i^5, i^6, one of which in each pair is pivoted to the cylinder bearing i^3 and the other of which is pivoted to the reciprocating block i^2, the interconnected ends of these links being normally forced inwardly from the reciprocating block i^2 by the action of the springs i^4. These ends rest in the path of a tubular plunger k secured to the reciprocating cross-head c' and the outer diameter of this plunger is such that when the cross-head is drawn down, the beveled end k' of the plunger forces the interconnected ends of the links i^5, i^6 outwardly, thereby straightening the several pairs of links and moving the block i^2 with the shearing member i' downwardly against the action of the springs i^4. The shearing action between the knife members i and i', as thus effected, serves to cut a circular blank from the stock and this blank is then operated on by the die member for pressing out the blank in cup-shape and with longitudinal plaits or flutes.

The die for operating on the blank comprises a female member l which rests directly on the bracket g' and within the fixed shearing member i. The die member l is open ended and has formed in its face a series of grooves l' against which the blank is pressed by the other die member indicated generally at m. This other die member comprises a series of radiating blades m' pivoted to a block m^2 which is fixed at the lower end of a rod m^3 which is secured to the cross-head c' and extends downward through the tube k. Each of the blades m' is pivoted at its outer end to a link m^4, the other end of which is pivoted to a block m^5 slidably disposed on the rod m^3 and forming a seat for a spiral spring n which encircles the rod. When the cross-head c' descends, the blades m' are carried downward with the rod m^3 against the face of the blank and on further downward movement each of these blades presses the blank into one of the grooves l' in the die member l thereby forming the flutes. The supporting block m^2 for the blades m' is cylindrical and presses against the central portion of the blank so as to carry it downward through the central opening in the die member l and form the bottom of the cup. As this block m^2 passes downward through the opening in the die member l and the blades m' are drawn along the upper face of the die member, the links m^4 are forced upwardly with respect to the die member against the pressure of the spring n. In this way a yielding pressure is placed upon the blank by the blades m'. Continued downward movement of the rod m^3 with the cross-head c' finally serves to bring about the complete shaping of the cup into the form indicated in Fig. 3 and its complete withdrawal from the die member l through the opening therein, and its deposit on a suitable bracket g^2 disposed to receive it. When the cross-head c' moves upward the blades m' ride along the face of the die member l and pressure of the spring n finally forces the blade members to the position indicated in Fig. 3 through the toggle action provided.

After shaping the blank to the form shown in Fig. 3 in which the cup is of the desired shape and provided with longitudinal flutes it remains to fold or crimp or turn under the upper edge of this cup so as to prevent the flutes from unfolding. For this second stage in the manufacture of the cup another die is provided. Without describing at this time the devices by which the cup is carried from the supporting bracket g^2 to this second die, the structure and operation of the die will be gone into. This die comprises two cooperating sections, the upper one o of which is of tubular form and is carried on the cross-head c' and provided with an annular channel o' in its lower edge for the folding of the upper edge of the cup in a manner which will appear. The coöperating die member comprises a ring p which is supported yieldingly on springs p' and grooved along its upper edge, as at p^2, for coöpera-

tion with the corresponding groove o' in the other die member o. The ring p embraces snugly a fixed female die member p^3 which is of form and dimensions to receive the cup snugly and have the plaits therein pressed against its wall by a coöperating male member o^2 which is carried with the folding die section o. The male member o^2 is supported in the tubular die member o through a slot o^3 and coöperating stud o^4 and is slidable within the tubular section o against the action of a spring o^5. In the male member o^2 is supported slidably a rod o^6 on the lower end of which is fixed a gripping disk o^7 for engagement with the bottom of the cup when the male member o^2 is lowered into the cup by the downward travel of the cross-head c'. A coöperating gripping disk p^4 is carried on a plunger rod p^5 which passes up through the female member p^3 of the die and the position of this gripping disk p^4 within the female member p^3 is determined by a cam e' on the main driving shaft e on the periphery of which rests a roller p^6 carried on the lower end of the plunger rod p^5.

Before describing the operation of the dies for folding or crimping or turning under the upper edge of the cup reference is to be had to Fig. 6 for a description of certain improved features of the lower member of such folding die. As described above, the lower folding section comprises the ring p. The upper edge of this ring normally stands above the plane of the supporting bracket g^2 of the cup since the ring is constantly subjected to the action of the supporting springs p'. Accordingly, in transferring the cup from the bracket g^2 to the disk p^4, it is necessary to hold down the ring p against the action of the springs p'. The holding down of this ring p is effected by a rocker arm q, one end of which is formed as a fork to embrace the ring and engage laterally projecting pins p^7 thereon, while the other end is engaged operatively by a cam f^2 on the lay shaft f. The shape of this cam is such as to bring about rocking of the arm q and the holding down of the ring p after it has been depressed by the die member o at the time when the cup is to be transferred from its position on the supporting bracket g^2 to a position on the plunger disk p^4. But immediately after the cup has assumed this position the cam f^2 permits the springs p' to raise the ring for subsequent depression by the coöperating upper folding die o in the following manner:

Assuming that the cup is resting on the disk p^4, after its transfer by suitable carrying devices, to be described, the cross-head c' will travel downward and bring the gripping disk o^7 in engagement with the inner surface of the bottom of the cup thereby confining the cup yieldingly between the disks p^4 and o^7. Continued movement downward of the male member o^2 will permit the male member to move relatively to the supporting plunger o^6 for the gripping disk o^7 against the action of a spring o^8 which is interposed operatively between the supporting plunger o^6 and the male member. Eventually, the lower face of the male member o^2 will engage the gripping disk o^7 and further relative movement therebetween will be prevented. Continued downward movement of the tubular die section o will cause relative movement between this member and the male die o^2 against the action of the compression spring o^5. This movement will continue until an annular shoulder o^9 on the head of the punch o^2 engages a coöperating shoulder o^{10} formed on the inner surface of the tubular die o. During the downward movement of the gripping disk o^7 and the male member o^2, the supporting disk p^4 and its plunger p^5 are lowered, in unison therewith, by the coöperating action of the cam e' and a suitable spring p^8 which engages the plunger operatively. When the disk p^4 rests at the bottom of the female member p^3, the continued movement of the male member o^2 under the yielding pressure of the spring o^5 serves to press the plaits or flutes in the cup against the inner wall of the female member so as to give the plaits a permanent set. The upper edge of the cup extends above the upper edge of the ring die p and is engaged by the groove o' of the descending tubular die o in such wise that the edge will be turned outwardly and reversely bent upon itself to a point where the further downward movement of the edge of the die o will force the edge of the cup into the groove p^2 on the upper edge of the ring member p. The edge of the cup is deflected by the groove p^2 still further so that it is turned under and again reversely bent, assuming finally the form indicated in Fig. 7. Although the lower edge of the die o seats on the upper edge of the ring member p, the fold in the upper edge of the cup will be wholly confined in the registering grooves o, p^2. Continued downward movement of the die o will press the ring member p downwardly against the action of the springs p'. After the folding operation, described, the cross-head c' will rise thereby returning the parts of the upper die member o to the raised position indicated in Fig. 3 and the cup will be raised from its position within the female member p^3, at the same time, by upward movement of the supporting disk p^4 and its plunger p^5. The rocker arm q will then come into play to depress the ring p against the action of the springs p' in order that the automatic carrier, to be described, may carry the cup from the disk p^4 over to the next die where the final pressing is to be given to the fold about the upper edge. The male member of

this pressing die is very similar to the corresponding member in the folding die in that it comprises a tubular section r which is carried on the cross-head c' and receives slidably the presser member r', the lower portion of which is tapered to enter the cup. The female member s of the presser die is different from the female member of the folding die in that it comprises merely a fixed section of tapered form to receive the upper member r' and its upper edge is slightly flared, as at s', to act as a bearing surface against which the fold may be firmly pressed by a corresponding flaring surface r^2 on the punch r'. The cup to be pressed is received on a supporting disk p^4 of exactly the same character as that heretofore described, and the plunger rod p^5 thereof passes downward through the female die and is actuated by a suitable cam e' of the character before described. There is a cooperating gripper disk o^7 supported slidably in the male member r' of the punch and this gripper disk may be brought into yielding engagement with the bottom of the cup when the cross-head c' is lowered in the manner heretofore described. Downward movement of the punch r' with the cup is accompanied by corresponding movement of the gripping disk p^4 so that the cup is lowered into the female member s of the presser die. Continued downward movement of the male member r' serves to press the plaits of the cup against the inner wall of the female member s, under the influence of the spring o^5 and finally the flaring section r^2 of the male member engages the open fold of the upper edge of the cup and presses this fold flat and forces it against the adjacent surface of the body of the cup, as indicated in Fig. 7. A pressed fold of this character has a permanent set, which will prevent the plaits from unfolding and facilitate the packaging of the cups. After the pressing operation described the cross-head c' rises so as to withdraw the upper die members while the supporting disk p^4 rises in unison therewith so as to raise the cup on a level with the upper edge of the female die member s from whence it may be taken by the carrier and ejected from the machine.

The construction and method of operation of each of the cup forming devices having now been described, it remains to consider the illustrated carrier which has been found, in practice, to be suitable for the transfer of the cups automatically from one position to another and in proper time relation to the other elements of the machine. It will be evident that the details of construction of this carrier and that the specific devices for actuating it may be changed in many different ways and carriers of other forms but serving the same purpose may be substituted without requiring a reorganization of the machine. The form of carrier which has been elected to illustrate is shown most clearly in Figs. 4, 5 and 6. From these figures, it appears that there is supported on the bed plate g a longitudinally disposed track plate t on which are slidably mounted three conveyer carriages t', t^2 and t^3, adjustably interconnected by means of a rod t^4 so as to be slidable in unison. The carriages are slid along the track t by any suitable actuating mechanism indicated herein as a swinging arm u, pivoted, as at u', to a fixed part of the machine and provided intermediate its ends with a pin u^2 adapted to ride in a cam slot f^3 of a cam f^4 on the lay shaft f. The other end of the swinging arm u is loosely connected, as at u^3, to the rod t^4, so that swinging motion of the arm is converted into sliding movement of the rod with the conveyer carriages. Upon each of the carriages are pivotally mounted (at v^4) two cooperating jaws v of a form to embrace the cup snugly and these jaws are normally held closed by springs v' operatively connected to links v^2 which are pivotally engaged with the jaws and with rocker arms v^3, whereby a rocking movement of the rocker arm v^3 will serve to move the links v^2 rearwardly and swing the jaws outwardly about their pivot pins v^4 against the action of the restraining springs v'. The opening and closing movements of the jaws v are brought about at proper times automatically by swinging plates v^5 hinged along their lower edges, as at v^6. One plate is provided for each pair of jaws and the tail of each rocker arm v^3 bears against its plate at all times, as shown in Fig. 6, so that when the plate is rocked about its pivotal support v^6, the arm v^3 will be rocked so as to open the jaws v. A separate cam f^5 is provided for each plate v^5 and against the periphery of each such cam is pressed a nose v^7 on each plate, as by means of a suitable spring v^8. The lower end of the two of the rocker arms may have to be offset, as indicated at v^9, so that the arm will be engaged with its proper plate when the jaws are in their two extreme positions of travel.

In the operation of the improved carrier the three pairs of jaws will be slid to their extreme positions toward the left, as viewed in Fig. 4, so that that pair at the extreme left end will be opposite the cup on the bracket g^2. When the said pair of jaws reach this position they will have been opened fully by the pressure of the appropriate cam f^5 on the plate v^5. The cam f^5 will then move to such position as to permit the plate v^5 to rock freely and enable the closing springs v' of the gripper jaws to close the jaws about the cup. Rotation of the cam f^4 will then serve to swing the arm u and slide the sets of grippers toward the right, as viewed in Fig. 4, so as to bring the cup to its position

on the supporting disk p^4 of the folding die. Meanwhile, the intermediate set of jaws has taken that cup which has been folded by the folding die and transferred it to a position on the supporting disk p^4 of the presser die and the set of jaws at the right end of the carrier has removed the pressed cup from the supporting disk p^4 of the presser die and carried it to a position in readiness for ejection. When the cups have been moved to such positions, the several plates v^5 are rocked by their respective cams, so as to actuate the gripping jaws and release them from the cups, whereupon the carriage is again slid to the left with the jaws thus opened to a point where the jaws will be positioned in readiness for the gripping of other cups, as will be understood. And so the several grippers are reciprocated back and forth to replace finished cups by other cups to be acted on by the respective devices and to eject those cups which have finally been pressed into completed form.

As indicated hereinbefore, the invention is concerned essentially with the provision of a machine for automatically cutting suitable blanks from stock fed into a paper cup machine and the forming the cut blank into a fluted cup with an upper edge bent into such shape as to prevent the flutes from unfolding, all of these operations being intended to be carried on continuously and automatically in a single machine. Incidental to the invention there are several improved features of construction which have proven successful in practice, but it will be evident to the skilled mechanic that other devices than those shown may be constructed to carry out the intended functions in much the manner described herein and in proper coöperation with the other elements of the machine. Accordingly, the invention is not to be limited to the precise mechanical movements and devices illustrated, nor to any particular form or arrangement of such devices, but is to be extended to cover the subject matter as set out in the appended claims.

I claim as my invention:

1. In a paper cup machine, forming die members for the cup, independent die members to crimp the edge thereof including a female member formed with an annular section movable relatively to said female member, springs interposed between the female member and said annular section to support the section yieldingly in raised position, and devices independent of the die members and engaging the annular section to hold the same against the springs in lowered position when the cup is to be placed in the female member and operating to permit the annular section to be raised subsequently by the springs.

2. In a paper cup machine, forming die members, one of which is movable, for the cup, independent die members, one of which is movable, to crimp the edge thereof, including a female member formed with an annular section moving relatively to said female member, springs to support the annular section yieldingly in raised position, a cam-shaft, cams on the shaft and intermediate devices to operate the movable die members, an independent cam on said shaft, and independent devices engaging the annular section to hold the same against the spring in lowered position and operating to permit said section to be raised by the springs subsequently.

3. In a paper cup machine, in combination with the frame thereof, forming devices including a female die member mounted fixedly on the frame, a male die member adapted to enter the female member, cutting devices comprising a fixed member and a movable member both mounted on the frame in juxtaposition to the said female die member, a reciprocating cross-head on which the said male die member is carried, and devices carried with the cross-head to actuate the movable member of the cutting devices upon movement of said forming die members.

4. In a paper cup machine, means to support a supply of paper, cutting devices therefor including an annular shearing block mounted fixedly on the frame, a reciprocating annular knife member coöperating with said shearing block, toggle links secured pivotally to the reciprocating knife member, springs to hold the knife member in raised position, a bearing member for the reciprocating knife member mounted on the frame, a reciprocating cross-head and a plunger member carried by the cross-head to engage the toggle links operatively for actuation of the knife.

5. In a paper cup machine, forming die members including a fixed female die member having a series of grooves in its face carried in radial planes and a male die member formed of a series of curved radiating blades for direct coöperation with the respective grooves in the female die member, links pivoted to the outer ends of said blades and a spring in operative relation to said links to press the blades yieldingly in direct engagement with the curved face of the female die member upon movement of the male die member into engagement therewith.

6. In a paper cup machine, sets of devices for operating on the cup, a reciprocating carrier for transferring the cups successively from one of said sets of devices to another and including coöperating yielding grippers, each formed of two coöperating curved jaws, and swinging plates with respect to which the jaws are operatively disposed for actuation.

7. In a paper cup machine, sets of devices for operating on the cup, a reciprocating carrier for transferring the cups successively from one of said sets of devices to another and including a slidable carriage and grippers thereon, each gripper being formed of two coöperating curved jaws pivotally supported on the carriage, and devices to actuate the gripper jaws including a swinging plate for each set of grippers and along the face of which the actuating element of each set of grippers slides, whereby the jaws may be actuated at any predetermined time during the travel of the carriage, and means to swing each plate.

This specification signed this 7th day of July, 1916.

HERBERT M. HILL.