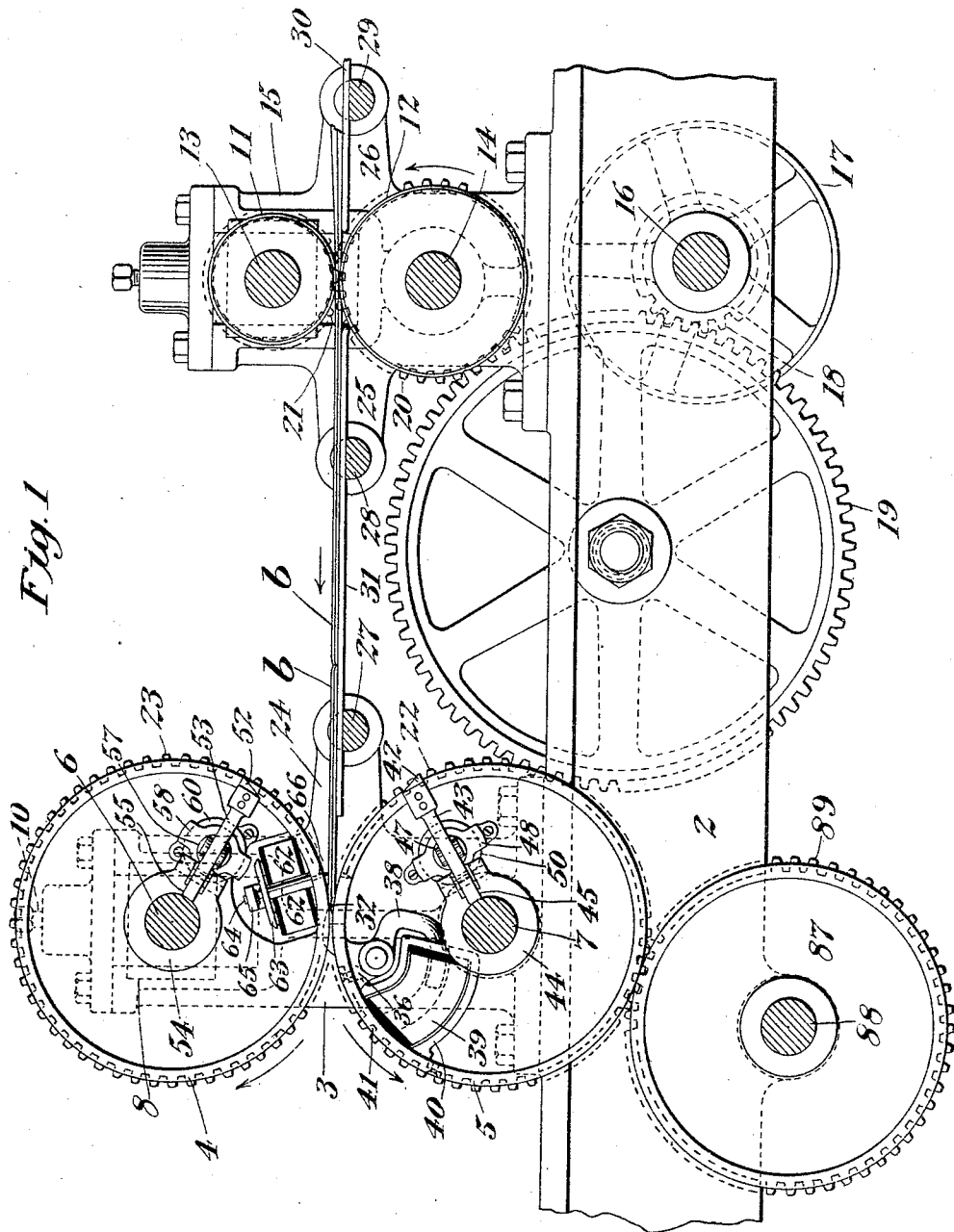


C. D. KING.
 DIAMOND FOLD FORMING MECHANISM FOR PAPER BAG MACHINES.
 APPLICATION FILED NOV. 22, 1904.

940,534.

Patented Nov. 16, 1909.

6 SHEETS—SHEET 1.



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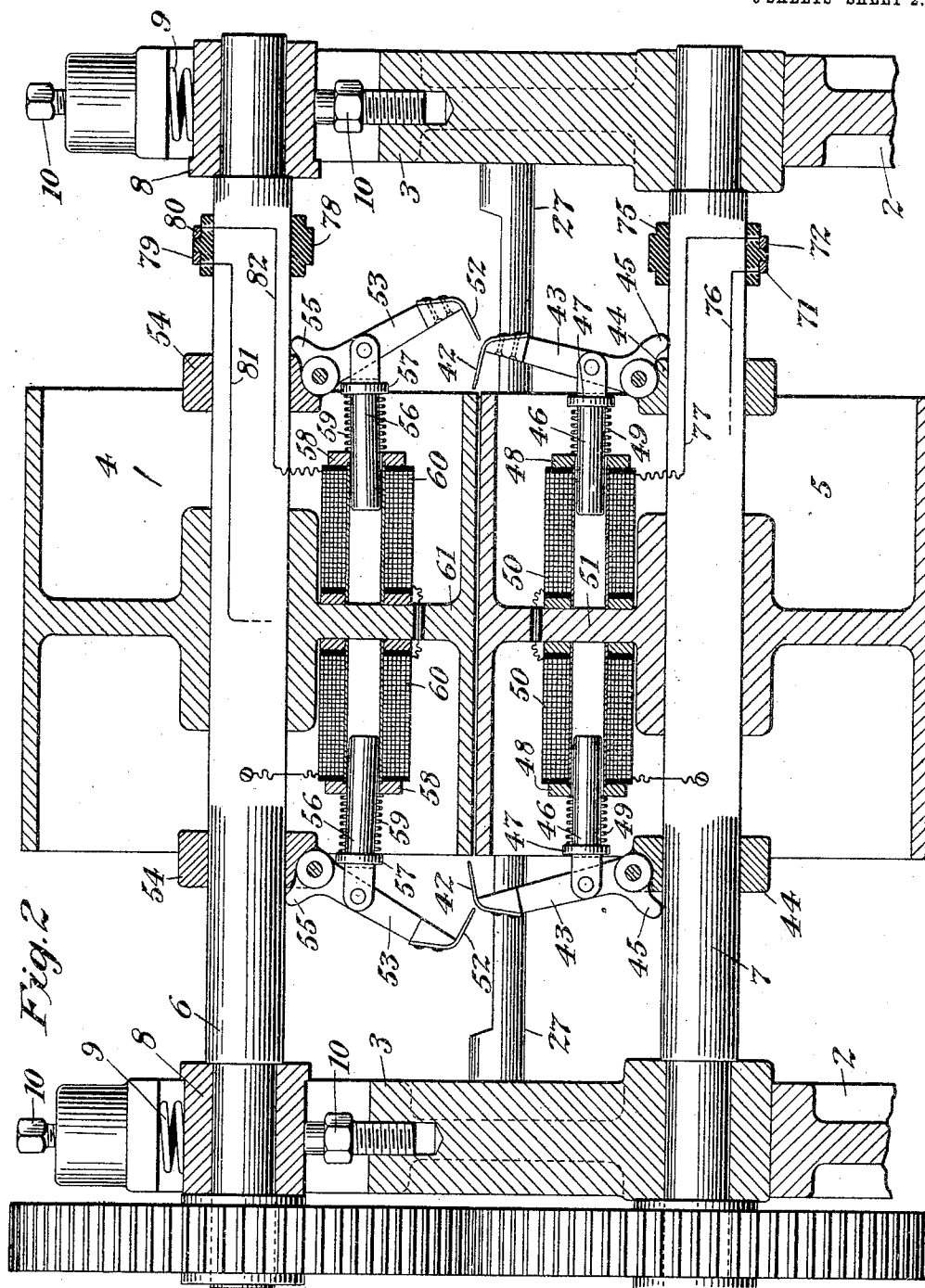


Fig. 2

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6 SHEETS—SHEET 3.

Fig. 11

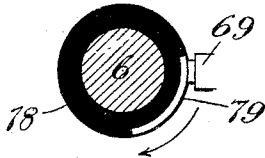


Fig. 12

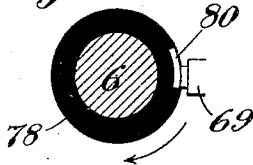


Fig. 3

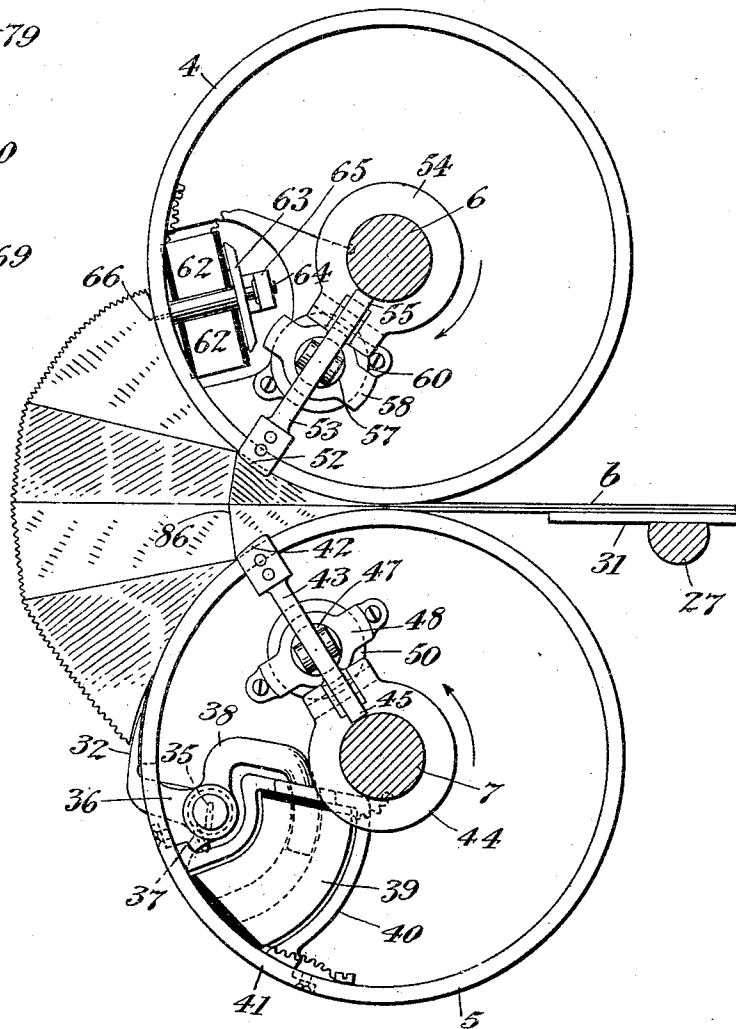


Fig. 10

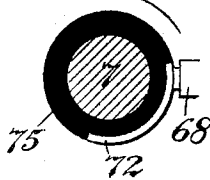
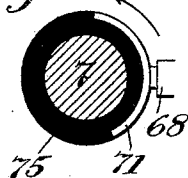


Fig. 9



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6 SHEETS—SHEET 4.

Fig. 15

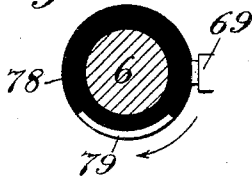


Fig. 16

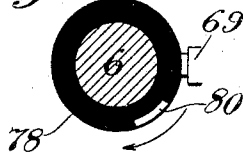


Fig. 14

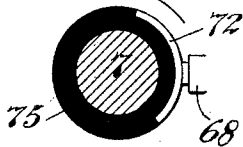


Fig. 13

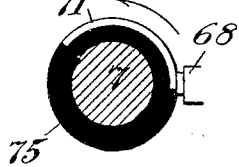
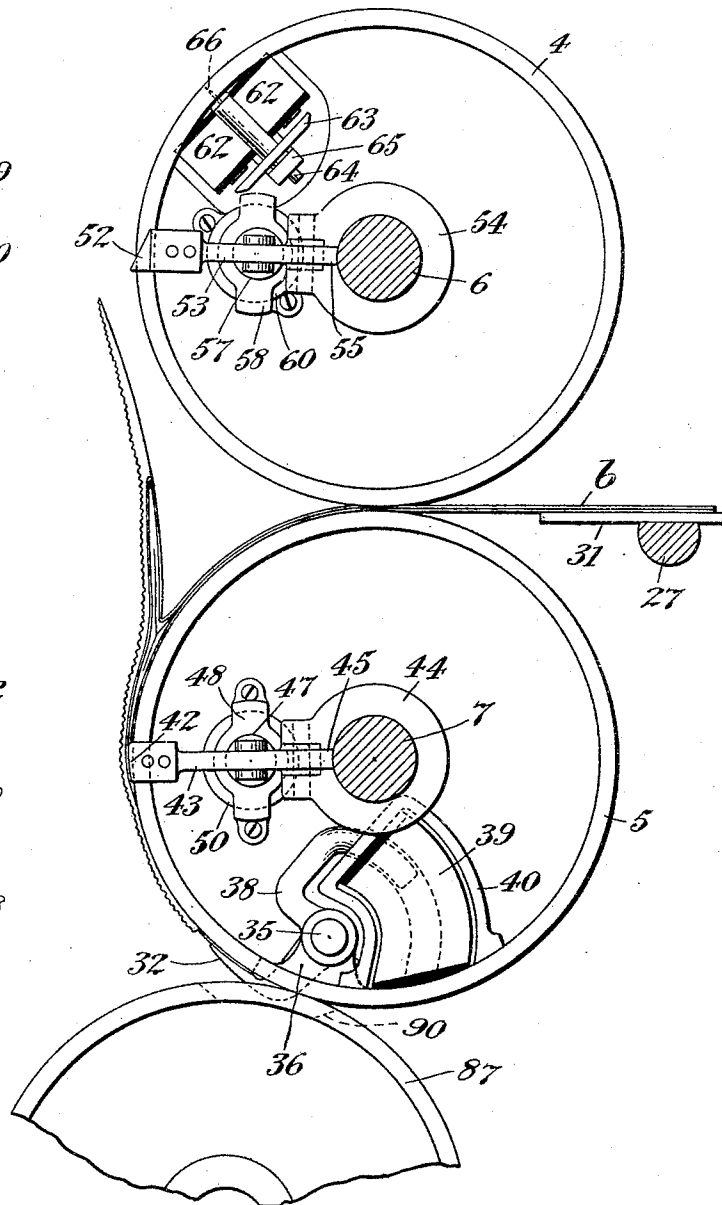


Fig. 4



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 6 SHEETS—SHEET 5.

Fig. 5

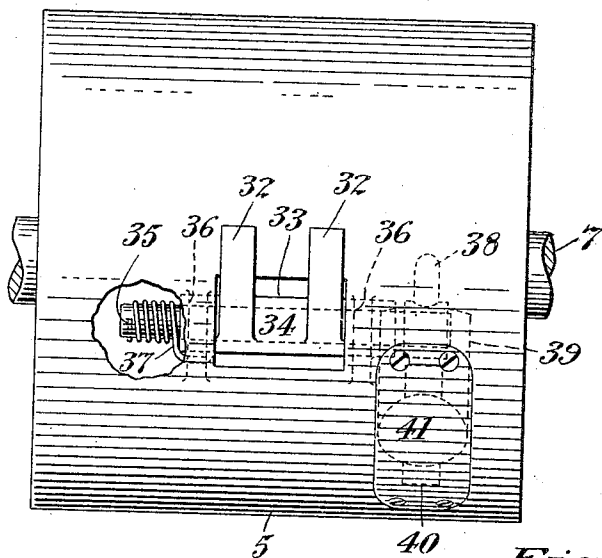


Fig. 7

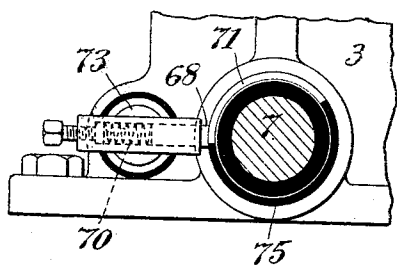


Fig. 6

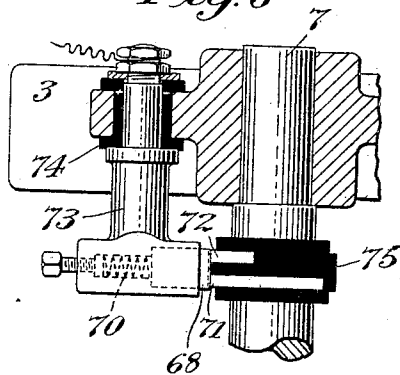
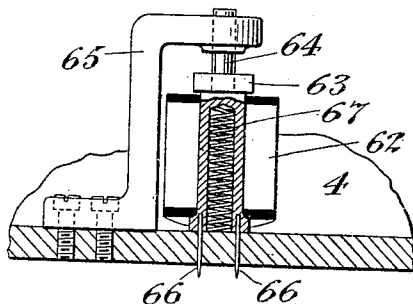


Fig. 8



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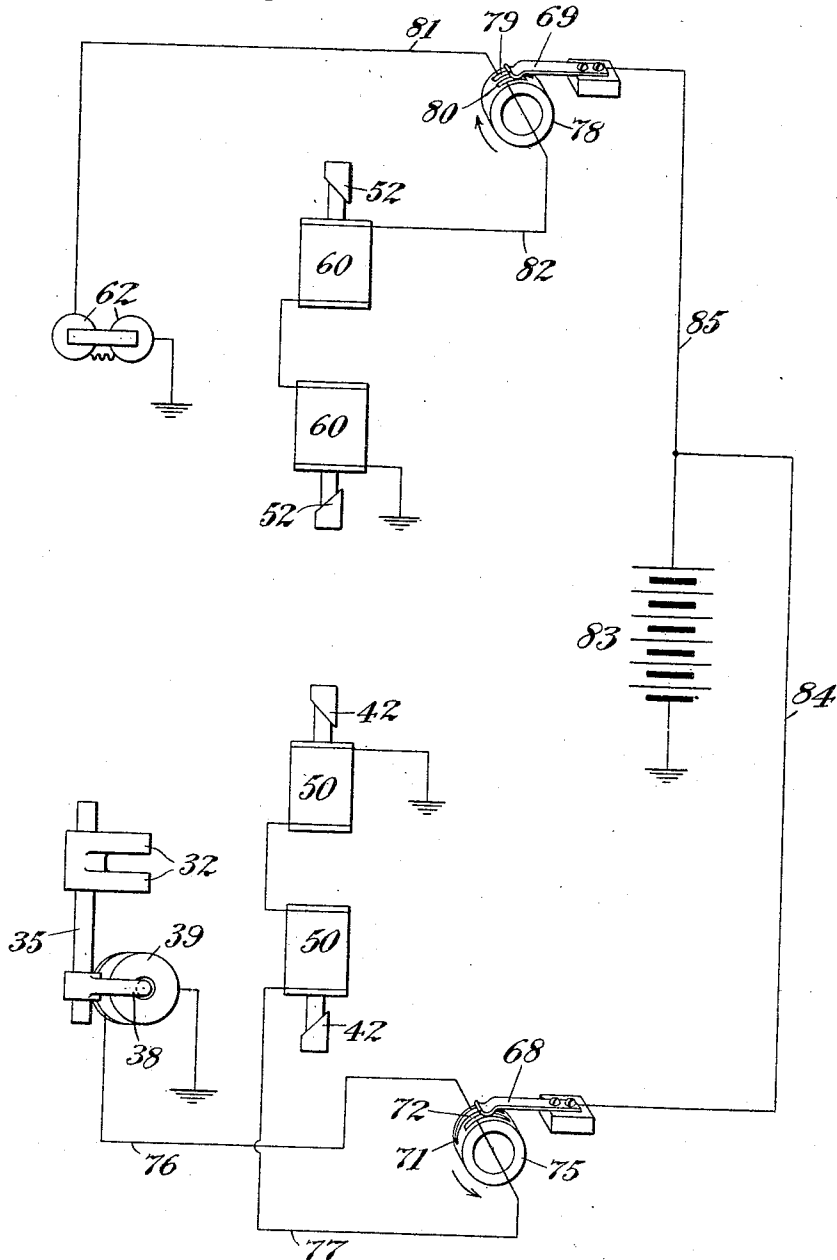
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6 SHEETS—SHEET 6.

Fig. 17



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DIAMOND-FOLD-FORMING MECHANISM FOR PAPER-BAG MACHINES.

940,534.

Specification of Letters Patent.

Patented Nov. 16, 1909.

Application filed November 22, 1904. Serial No. 233,786.

To all whom it may concern:

Be it known that I, CHARLES D. KING, a citizen of the United States, and a resident of Brooklyn, in the county of Kings and State of New York, have invented certain new and useful Improvements in Diamond-Fold-Forming Mechanism for Paper-Bag Machines, of which the following is a specification.

10 This invention relates to diamond-fold forming mechanism for paper-bag machines, and its main object is to provide a mechanism of this type by means of which the diamond-folds of satchel-bottom paper-bags 15 may be formed with rapidity and precision.

The principal feature which distinguishes my improved diamond-fold-forming mechanism from all others with which I am familiar is the employment of automatic electric controlling means for governing the operation of suitable diamond-fold-forming mechanism, and particularly for governing the operation of diamond-fold-forming mechanism embodying one or more rotary forming-rolls adapted to make the diamond-fold of a satchel-bottom paper-bag by a rotary action. Attempts have been made to form this diamond-fold by rotary devices having a purely mechanical action, but such rotary mechanical diamond-fold-forming mechanisms have been unsuccessful because of the slow speed at which they have operated. The chief mechanisms of this type have employed cams for operating the various grippers, etc., of the diamond-fold-forming mechanisms, and the failure of such devices to operate with sufficient speed to render them commercially useful in the highly developed art of paper-bag making has been due to the fact that the principal timing element for controlling the throwing in and out of a gripper or similar device has been a cam having many degrees of angle and a gradual rise to the point at which the cam surface is effective for bringing such gripper or other device fully into action.

In this invention the delay which results from the use of cams and other mechanical controlling elements is entirely eliminated, as it is entirely practicable to operate the gripper or other device instantaneously by means of an electrical contact the length of which may be reduced to any desired minimum without affecting the controlling function of the contact.

In the mechanically-operated diamond-

fold forming mechanism to which I have referred a very great number of operating parts has been used, as compared with the number of parts employed in the present machine for accomplishing the same result, and it is well known that the delay in the operation of mechanism usually increases in correspondence with the increase in the number of operating parts.

The means which I employ for accomplishing these results and various other advantages which are attained by the use of my improved diamond-fold forming mechanism, will be hereinafter described, and the mechanism employed is illustrated in the accompanying drawings, in which—

Figure 1 is a longitudinal section of a portion of a paper-bag machine, the section being taken just inside one of the main frame-pieces of the machine and showing my improved diamond-fold forming mechanism embodied therein. Fig. 2 is a cross section of the same, partially in elevation, and illustrates the different positions in which the side-grippers of the upper and the lower forming-rolls normally lie. Fig. 3 is a detail illustrating in sectional side elevation the forming-rolls and coacting parts, with a bag-blank held in a position where it is about one-third open, in the operation of forming in the bottom thereof a diamond-fold. Fig. 4 is a similar view showing the positions of said parts on the completion of the diamond-fold. Fig. 5 is a detail illustrating in front elevation the forming-roll and its end-gripper. Figs. 6 and 7 are details illustrating respectively in sectional plan and in sectional elevation contact elements of the electrical controlling devices. Fig. 8 is a sectional detail illustrating the end-gripper of the upper forming-roll. Figs. 9 to 16 inclusive illustrate various positions of contact-strips and brushes corresponding to the positions of the forming-rolls and grippers adjacent to which they are placed. Fig. 17 is a diagrammatic view showing the electrical connections of the various controlling devices.

Similar characters designate like parts in all the figures of the drawings.

My improved diamond-fold forming mechanism may be applied to any type of paper-bag machine, but is shown herein in connection with a machine of the horizontal type. As the means for performing all of the other operations in the making of a

satchel-bottom paper-bag are well known, only so much of a paper-bag machine is illustrated as is necessary for showing the construction and mode of operation of the various devices of my improved diamond-fold-forming mechanism. In this construction said mechanism is carried by the side-frames, such as 2, of a paper-bag machine of the horizontal type. Suitable posts or pedestals, such as 3, bolted to the side-frames 2, may be employed for supporting the various elements of the diamond-fold-forming mechanism. As before stated, this mechanism is intended to form the diamond-fold of a satchel-bottom paper-bag by a rotary action, and in the preferred construction the mechanism will embody a pair of rotary coacting forming-rolls, such for example as those shown at 4 and 5, for making such fold. These forming-rolls are in this case secured to shafts, such as 6 and 7, mounted in journals carried by the posts or pedestals 3. The lower shaft 7 is in this construction journaled in fixed bearings in said posts, while the upper shaft 6 is preferably mounted in spring-pressed journal bearings, such as 8, having squared sides and mounted in a well-known manner in squared guide-openings near the upper ends of the posts 3, springs such as 9, being employed to hold the shaft 6 down but permitting it to rise slightly when it is necessary for the shaft to yield, and adjusting-screws 10 being also provided for varying the vertical position of said shaft.

In a manner similar to that just described, feed-rolls, such as 11 and 12, are carried by the shafts 13 and 14 mounted in bearings carried by a pair of pedestals or posts, such as 15, the shaft 14 being mounted in fixed bearings in said posts and the shaft 13 in spring-pressed journal bearings. The feed-rolls serve to feed into the pass between the forming-rolls 4 and 5, bag-blanks in the form of tubes the sides of which have been properly creased or tucked. These feed-rolls may operate in any suitable manner, and are driven in this case from a shaft 16 carrying a pulley 17 over which a belt (not shown) will pass, said shaft also having a spur pinion 18 which meshes with an intermediate spur-gear 19 of large diameter mounted on the side-frame 2 at the back of the machine and meshing in turn with a spur-gear 20 secured to the shaft 14 of the feed-roll 12, the gear 20 being in mesh with a similar spur gear 21 secured to the shaft 13 of the upper feed-roll. The intermediate 19 is in this construction also in mesh with a spur-gear 22 secured to the shaft 7 carrying the lower forming-roll, and the gear 22 is in turn in mesh with a similar gear 23 secured to the upper shaft 6 carrying the upper forming-roll. By means of this train of gearing connecting the feed-rolls and the

forming-rolls with one another and with the main driving-shaft 16, it will be seen that bag-blanks may be fed between the feed-rolls and through the forming-rolls at the same rate of speed. The posts or pedestals 3 and 15 are in this case formed with projecting arms or brackets, such as 24, 25 and 26, at the ends of which are bearings for the reception of supporting rods or shafts, such as 27, 28 and 29, which are cut away to form flat supporting surfaces for feed-plates, such as 30 and 31, over which the bag-blanks or tube-blanks, such as *b*, are fed, first between and beyond the feed-rolls and then into the pass between the forming-rolls, where the bottom ends of the bag-blanks will be operated upon by the mechanism now to be described for the purpose of forming the diamond-fold.

The principal elements of my improved diamond-fold-forming mechanism are the blank-holding means and the automatic electrical controlling means for governing the operation thereof. The blank-holding means will usually embody a plurality of blank-holding devices, and in the present construction there will be two sets of blank-holding means, each rotatable and one carried by one of the forming-rolls and the other by the other forming-roll. The blank-holding means carried by each forming-roll consists of both side-gripping and end-gripping means, there being preferably two side-gripping devices or clips carried by each forming-roll and one end-gripping device, which may be either a clip or any other suitable type of gripper. The end-gripping means carried by the lower forming-roll 5 is the first to be brought into action in this construction, and will therefore be first described. It embodies in this case a gripper which works in a space or opening in the rim of the roll 5, and preferably has a pair of gripping fingers 32 which pass through a large opening in the rim of said roll and are operative for clamping the lower forward end of the bag-blank to the periphery of said roll. The space between these fingers 32 is of sufficient width to permit the passage of a corresponding gripping element or end-gripper of the other forming-roll. These two fingers 32 project from a hub 34 which is secured to a shaft 35 journaled in bearings in a pair of lugs, such as 36, at the inner side of the rim of the roll 5, one end of this shaft being in this case secured to a coiled spring 37, the other end of which is fastened to a fixed point of the forming-roll, in this case to one of the lugs 36. This spring normally serves to hold the fingers 32 of this end-gripper away from the rim of said forming-roll. At the other end thereof the shaft 35 has secured thereto a rock-arm 38 bent to form a substantially U-shaped member. That side of said U- 130

shaped member which is not fastened directly to the shaft 35 constitutes in this case the core of a solenoid the body of which is designated by 39 and has a core space adapted to receive, and formed on an arc struck from the same center as, said outer member of the rock-arm 38, this center being the axis of the shaft 35.

In the normal position of the gripping fingers 32 it will be evident that the core of the solenoid will be drawn out of the body or coils 39. This solenoid is preferably of the iron-clad type and is mounted in a substantial U-shaped iron frame 40 secured to a section 41 of the rim of said forming-roll, this section 41 being in the form of a plate rigidly secured in a recess in the periphery of said forming-roll, as clearly shown in Figs. 1 and 5. Both of the forming-rolls should of course be made of anti-magnetic material, such as wood or anti-magnetic metal. The side-gripping means carried by the forming-roll 5 consist in this case of a pair of fingers or clips, such as 42, secured to levers, such as 43, which may be pivoted on collars 44 fastened to the shaft 7 at opposite ends of the roll 5, said levers having stop members such as 45, for locating the fingers 42 in their normal positions. The shaft 7 itself preferably limits the movements of the stops 45, and hence of the levers 43 and fingers 42 carried thereby. The fingers themselves are preferably constructed so as to exert a yielding pressure on the side edges of the bag-blanks presented thereto, they usually being made of resilient sheet metal.

For the purpose of operating the side-gripping means I prefer to employ solenoids the cores of which are connected to the levers 43. The cores of these solenoids are indicated herein at 46 and have stop-collars 47, between which and stops, such as 48, at the ends of the solenoids proper, coiled springs, such as 49, are placed, and are operative for normally forcing the cores 46 out to the positions shown in Fig. 2, and with them the side-gripping fingers 42.

The bodies of the solenoids are designated 50, these body portions or coils being secured to opposite sides of the rib or web 51 of the forming-roll 5. The coils of both of these solenoids are preferably connected in series, one terminal of one solenoid being grounded, as shown in Fig. 2, preferably on the shaft 7, while the corresponding terminal of the other solenoid is connected to an element of the automatic controlling means hereinafter to be described.

The side-gripping means carried by the upper forming-roll 4 may be substantially similar in construction and operation to that just described with respect to the forming-roll 5. In the construction illustrated, two side-grippers or fingers, preferably of resili-

ent sheet-metal, are shown at 52, and these are carried by levers 53 pivoted on collars 54 fast to the shaft 6 and having stop members 55 adapted to come in contact with the shaft 6 for the purpose of limiting one of the movements of said levers. The cores 56 of a pair of solenoids are also connected to said levers 53 in a manner similar to the cores 46, and have corresponding stop-collars 57, between which and stops 58 work coiled springs 59 which normally hold the cores 56 and the levers 53 in the positions shown.

It will be noticed that the stops 55 are so formed as to permit the levers 53 and the side-grippers 52 to have greater angular movements than the corresponding members carried by the forming-roll 5. This movement is sufficiently greater than that of the corresponding member on the roll 5 to permit the fingers 52 when in their normal position shown in Fig. 2, to clear the fingers 42, and the timing of the operations of these fingers is such as to prevent any interference between them at any other moment. The cores 56 will be energized by the coils 60 forming the body portions of the solenoids on the forming-roll 4, and its coils are also preferably connected in series at their inner ends, as in the case of the coils 50 on the roll 5, the connecting conductor being passed through an insulated opening in the rib or web 61. At their outer ends said coils 60 are connected respectively to the shaft 6 and to a contact element of the automatic electrical controlling means which coöperates with the roll 4.

The end-gripping means carried by the upper forming-roll 4 for the purpose of gripping the upper side of the forward end or bottom of each bag-blank, may also be of any suitable type. In this construction I have illustrated a gripper having a pair of pins adapted to move through openings in the rim of the forming-roll by which they are carried, for the purpose of perforating the upper ply of a bag-blank and thereby holding such ply. Here these pins are operated by an electromagnet, preferably of the duplex type, the coils of the magnet being indicated at 62 and their common armature at 63. This armature is here carried by a plunger 64 which works in a guide-opening in the bracket 65 secured to the inner side of the rim of the forming-roll 4 (see particularly Fig. 8), said plunger being also guided by a pair of pins 66 which work in openings passing entirely through said rim, these pins constituting grippers which hold the upper ply of a bag-blank by perforating it. The plunger is normally retracted and the pin 66 drawn into the rim of the roll 4 as by means of a coiled spring 67 which in this case works in a longitudinal bore in the plunger, as shown. In a manner similar to that before described one

terminal of this duplex magnet is grounded, as for example on the shaft 6, and the other is connected with a corresponding contact element of the automatic electrical controlling means.

From the foregoing description of the construction and organization of the various elements of each side-gripping or end-gripping means it will be seen that at least one of the two movements of each gripper is intended to be controlled electrically, and that the other movement, though shown as mechanically controlled, is also a practically instantaneous movement, and may, if desired, be effected by various other means. The movements which are electrically controlled are here illustrated as the working strokes of the respective grippers, and these are governed by automatic electric controlling means which will usually comprise contact-segments and brushes of well-known construction, the brushes being carried by some suitable fixed members and the contact-segments being rotatable preferably in synchronism with the respective forming-rolls whose grippers they govern.

The two fixed contact members of the electrical controlling means are designated respectively 68 and 69, and as both will preferably be of the same construction, a description of one will suffice for both. The contact element 68 is here represented as a brush normally pressed by a spring 70 into engagement with a pair of contact-segments 71 and 72 on the shaft 7, the spring being adjustable as to its tension, and the contact element or brush being mounted in a brush-carrier 73 which in turn is mounted in an insulating bushing 74 in the post or pedestal 3. The contacts or segments 71 and 72 against which the brush 68 is pressed are mounted on and insulated from the shaft 7, they being preferably secured to an insulating or fiber ring 75. These two contact-segments 71 and 72 are of different lengths, the former being connected by a conductor 76 with the solenoid 39, while the contact-segment 72 is connected by a conductor 77 with the adjacent solenoid 50. In a manner similar to that just described the shaft 6 is provided with an insulating or fiber ring 78 carrying a pair of contact-segments 79 and 80, the former of which is connected by means of a conductor 81 with the duplex magnet 62 of the upper forming-roll, and the latter of which is connected by means of a conductor 82 with the adjacent solenoid 60.

The relative positions and lengths of the different contact-strips 71, 72, 79 and 80 under all conditions, particularly their positions with respect to their brushes 68 and 69 near the beginning and at the end of the diamond-fold-forming operation, are clearly shown in detail in Figs. 9 to 16 inclusive adjacent the grippers which they control,

and will serve to make clear the timing of the operations.

The operation of my improved diamond-fold-forming mechanism as illustrated in the present application is as follows: Tucked tube-blanks are preferably first formed in any well-known manner and cut to the exact length required for making a paper-bag, and these are then fed, one after another, to the forming-rolls by the feed mechanism, the principal elements of which, as before stated, are feed-rolls 11 and 12. When the tube blank enters the space between the rolls 4 and 5 the end-gripping means of the lower forming-roll will first be brought into action and the fingers 32 will close down upon the lower ply of the tube-blank and grip it securely. This results from the fact that the brush 68 first comes into contact with the segment 71 and through this segment closes a circuit through the solenoid 39. The circuit thus closed may be traced on the diagram in Fig. 17, it being from a source of energy, such as the battery 83, through a conductor 84 to the brush 68, from which the course of the current is by way of contact-segment 71, conductor 76, solenoid 39, to ground, and back to battery 83. The end-gripping means of the upper forming-roll 4 will then be brought into action, the pins 66 being projected through the rim of the forming-roll 4 and through the upper ply of the tube-blank on the energization of the duplex magnet 62. The contact-segment 79 and the brush 69 control the circuit to this electromagnet, which circuit is as follows—from the battery 83 through conductor 85, brush 69, contact 79, conductor 81, magnet-coils 62, and ground back to the battery 83. The side-gripping means of the lower forming-roll 5 will then be brought into action and the resilient grippers 42 thereof will move into the tucks at opposite sides of the lower ply and will hold the edges of the lower ply of the bag firmly against the surface of the roll 5. These grippers 42 are operated by the cores 46 of the solenoids carried by the roll 5 when the coils 50 of such solenoids are energized, the energization of these coils being effected when the brush 68 and the segment 72 make contact with each other, at which time the circuit will be from the battery 83 through conductor 84, brush 68, contact-segment 72, conductor 77, the coils 50 connected in series, and through ground back to the battery. The side-gripping means carried by the upper roll 4 come into operation in this construction last of all and grip the side edges of the upper ply of the bag. The grippers 52 of the side-gripping means are operated by the cores 56 of the solenoids carried by the forming-roll 4 when the coils 60 of such solenoids are energized. The circuit through these coils is from the battery 83 through

conductor 85, brush 69, contact-segment 80, conductor 82, the coils 60 in series, and back by way of ground to the battery.

After a bag has been securely gripped and clamped to the forming-rolls it is opened out gradually as the rolls 4 and 5 rotate in unison, and this opening movement is continued until the bottom portion of the bag is pulled taut, the opposite side edges of the bottom pulled inward as a result of the tension on the central portions of the bottom edges of the upper and lower plies, and the ends of the bottom defined by fold lines 86 at opposite sides of the bag, that is, at opposite ends of the forming-rolls. The diamond-fold for forming the satchel-bottom of the bag will then be practically finished, and one after another the different gripping devices may be released from the blank. The first gripping means to be released will be the pins 66 of the end-gripper carried by the upper forming-roll 4, which will be drawn back by their spring 67 when their controlling segment 79 breaks the circuit through the battery 83 by riding off the brush 69. The side-grippers carried by the upper roll will next be released in a similar manner by the segment 80 riding off said brush. The end-grippers and side-grippers of the lower roll 5, however, will remain closed upon the lower ply of the blank for the purpose of transferring the same into position to be conveyed, as by means of a roll 87, to suitable creasing, pasting, flap-folding and pressing devices, which are not herein shown but which are well known in the art. The roll 87 is in this construction secured to a shaft 88 which carries a gear 89 in mesh with the gear 22 carried by the lower forming-roll 5, so that the two rolls 5 and 87 move at the same surface speed. At the point 90 the surface of the roll 87 is cut away as shown to permit the end-grippers 32 to pass freely.

The condition of the bottom of the bag-blank after the diamond-fold has been formed and the upper ply released is shown in Fig. 4, in which the end-grippers 32 are about ready to release the forward end of the blank as it enters the pass between the roll 5 and the roll 87, it being clear from Fig. 13 that the contact 71 is at such time about to ride off the brush 68. The side-grippers 42 of the lower roll, however, may hold the sides of the lower ply against the roll 5 until they are close to the pass between said rolls, when the segment 72 will ride off the brush 68 and break the circuit through the coils 50.

With a machine of this type it is possible to form the diamond-fold of satchel-bottom paper-bags by means of rotary rolls moving at the highest rate of speed necessary or ordinarily employed in forming and finishing paper-bags. All the parts are simple in

construction and they are few in number. Each movement, whether controlled by a spring or by electromagnetic action, is practically instantaneous, which is not the case with corresponding parts operated by cams or similar mechanical elements. Moreover, it will be obvious that in a machine of this type the parts operate quickly and silently, there being no cams or other parts to produce shocks.

What I claim is:

1. In a paper-bag machine, diamond-fold-forming mechanism having gripping and releasing movements and embodying a plurality of automatic controlling devices having different operating periods, and operative for instantaneously effecting each of said movements, each of said devices including an electrical device which controls one of such movements and which is brought fully into action suddenly as compared with the gradual action of a cam.

2. In a paper-bag machine, diamond-fold-forming mechanism having gripping and releasing movements and embodying a plurality of automatic controlling devices movable into action at different periods and also movable out of action at different periods and operative for instantaneously effecting each of said movements, each of said devices including an electrical device which controls one of such movements and which is brought fully into action suddenly as compared with the gradual action of a cam.

3. In a paper-bag machine, diamond-fold-forming mechanism embodying a plurality of blank-holding devices having gripping and releasing movements and also embodying a plurality of automatic controlling devices governing said blank-holding devices and having different operating periods, said controlling devices being operative for instantaneously effecting each of said movements of the blank-holding devices, and each of said controlling devices including an electrical device which controls one of said movements and which is brought fully into action suddenly as compared with the gradual action of a cam.

4. In a paper-bag machine, diamond-fold-forming mechanism embodying blank-feeding means, a plurality of blank-holding devices each having gripping and releasing movements, and a plurality of automatic controlling devices governing said blank-holding devices and having different operating periods governed by said blank-feeding means and each operative for instantaneously effecting each of the movements of the blank-holding device to which it corresponds, and each of said devices including an electrical device which controls one of such movements and is brought fully into action suddenly as compared with the gradual action of a cam.

5. In a paper-bag machine, diamond-fold-forming mechanism embodying blank-feeding means and also embodying blank-holding end-gripping means having gripping and releasing movements, blank-holding side-gripping means also having gripping and releasing movements, automatic controlling means governing said end-gripping and side-gripping means and governed by said blank-feeding means and operative for instantaneously effecting each of such movements of each of such gripping means, said means including an electrical device which controls one of such movements of each gripping means and which is brought fully into action suddenly as compared with the gradual action of a cam.

6. In a paper-bag machine, diamond-fold-forming mechanism embodying blank-feeding means and also embodying blank-holding end-gripping means having gripping and releasing movements, blank-holding side-gripping means also having gripping and releasing movements, and a plurality of automatic controlling devices governing said end-gripping and side-gripping means and having different operating periods governed by said blank-feeding means and each operative for instantaneously effecting each of the movements of the gripping means to which it corresponds, and each of said devices including an electrical device which controls one of such movements of its gripping means and which is brought fully into action suddenly as compared with the gradual action of a cam.

7. In a paper-bag machine, diamond-fold-forming mechanism embodying blank-feeding means and also embodying blank-holding end gripping means, blank-holding side-gripping means, and a plurality of automatic electrical controlling devices including means controlled by the blank-feeding means for moving them into action at different periods and also for moving them out of action at different periods, said devices governing differential instantaneous gripping and releasing movements of said end-gripping and side-gripping means.

8. In a paper-bag machine, diamond-fold-forming mechanism embodying a forming-roll, blank-holding means carried by said forming-roll and having gripping and releasing movements, automatic electrical controlling means including means for moving it in synchronism with said forming-roll and governing said blank-holding means and operative for instantaneously effecting one of the movements of said blank-holding means, and means for instantaneously effecting the other movement of the blank-holding means.

9. In a paper-bag machine, diamond-fold-forming mechanism embodying a forming-roll, blank-holding means carried by said

forming-roll and having gripping and releasing movements, automatic electrical controlling means connected for rotation in synchronism with said forming-roll and governing said blank-holding means and operative for instantaneously effecting one of the movements of said blank-holding means, and means for instantaneously effecting the other movement of the blank-holding means.

10. In a paper-bag machine, diamond-fold-forming mechanism embodying a forming-roll, blank-holding means carried by said forming-roll and having gripping and releasing movements, automatic electrical controlling means carried by said forming-roll and governing said blank-holding means and operative for instantaneously effecting one of the movements of said blank-holding means, and means for instantaneously effecting the other movement of the blank-holding means.

11. In a paper-bag machine, diamond-fold-forming mechanism embodying a forming-roll, blank-holding means carried by said forming-roll and having gripping and releasing movements, a plurality of automatic electrical controlling devices connected for rotation in synchronism with said forming-roll and governing said blank-holding means and having different operating periods and operative for instantaneously effecting one of the movements of said blank-holding means, and means for instantaneously effecting the other movement of the blank-holding means.

12. In a paper-bag machine, diamond-fold-forming mechanism embodying a forming-roll, blank-holding means carried by said forming-roll and having gripping and releasing movements, a plurality of automatic electrical controlling devices connected for rotation in synchronism with said forming-roll and governing said blank-holding means and movable into action at different periods and also movable out of action at different periods and operative for instantaneously effecting one of the movements of said blank-holding means, and means for instantaneously effecting the other movement of the blank-holding means.

13. In a paper-bag machine, diamond-fold-forming mechanism embodying a forming-roll, a plurality of blank-holding devices carried by said forming-roll and each having gripping and releasing movements, a plurality of automatic electrical controlling devices connected for rotation in synchronism with said forming-roll and governing said blank-holding devices and having different operating periods and each operative for instantaneously effecting one of the movements of the blank-holding device to which it corresponds, and means for instantaneously effecting the other movement of each of said blank-holding devices.

14. In a paper-bag machine, diamond-fold-forming mechanism embodying a forming-roll, blank-holding end-gripping means carried by said forming-roll and having gripping and releasing movements, blank-holding side-gripping means also carried by said forming-roll and having gripping and releasing movements, automatic electric controlling means including means for moving them in synchronism with said forming-roll and for governing said end-gripping and side-gripping means and operative for instantaneously effecting one of the movements of each of such gripping means, and means for instantaneously effecting the other movement of each gripping means.

15. In a paper-bag machine, diamond-fold-forming mechanism embodying a forming-roll, blank-holding end-gripping means carried by said forming-roll and having gripping and releasing movements, blank-holding side-gripping means also carried by said forming-roll and having gripping and releasing movements, a plurality of automatic electrical controlling devices including means for moving them in synchronism with said forming-roll and governing said end-gripping and side-gripping means and having different operating periods and each operative for instantaneously effecting one of the movements of the gripping means to which it corresponds, and means for instantaneously effecting the other movement of each of said gripping means.

16. In a paper-bag machine, diamond-fold-forming mechanism embodying a forming-roll, blank-holding end-gripping means carried by said forming-roll and having gripping and releasing movements, blank-holding side-gripping means also carried by said forming-roll and having gripping and releasing movements, a plurality of automatic electrical controlling devices including means for moving them in synchronism with said forming-roll into action at different periods and out of action at different periods and also including means for governing said end-gripping and side-gripping means and each operative for instantaneously effecting one of the movements of the gripping means to which it corresponds, and means for instantaneously effecting the other movement of each of said gripping means.

17. In a paper-bag machine, diamond-fold-forming mechanism embodying a forming-roll, a plurality of blank-holding devices carried by said forming-roll and each having gripping and releasing movements, a plurality of automatic electrical controlling devices also carried by said forming-roll and governing said blank-holding devices and having different operating periods and each operative for instantaneously effecting one of the movements of the blank-holding

means to which it corresponds, and means for instantaneously effecting the other movement of each of such blank-holding devices.

18. In a paper-bag machine, diamond-fold-forming mechanism embodying a pair of oppositely-rotative coacting forming-rolls, blank-holding means carried by each of said forming-rolls, and automatic controlling means governing said blank-holding means and coöperative with said forming-rolls and operative for instantaneously effecting each of the movements of each of said blank-holding means, said means including electrical means which controls one of such movements of each blank-holding means and which is brought fully into action suddenly as compared with the gradual action of a cam.

19. In a paper-bag machine, diamond-fold-forming mechanism embodying a pair of oppositely-rotative coacting forming-rolls, blank-holding means carried by each of said forming-rolls and each having gripping and releasing movements, a pair of automatic electrical controlling means rotatable respectively in synchronism with said forming-rolls and governing said blank-holding means respectively and operative for instantaneously effecting one of the movements of each of said blank-holding means, and means for instantaneously effecting the other movement of each blank-holding means.

20. In a paper-bag machine, diamond-fold-forming mechanism embodying a pair of oppositely-rotative coacting forming-rolls, blank-holding means carried by each of said forming-rolls and each having gripping and releasing movements, a pair of automatic electrical controlling means carried respectively by said forming-rolls and governing said blank-holding means respectively and each operative for instantaneously effecting one of the movements of its respective blank-holding means, and means for instantaneously effecting the other movement of such blank-holding means.

21. In a paper-bag machine, diamond-fold-forming mechanism embodying a pair of oppositely-rotative coacting forming-rolls, blank-holding means carried by each of said forming-rolls and each having gripping and releasing movements, two sets of automatic electrical controlling devices one of which sets is carried by one of said forming-rolls and includes means for governing one of said blank-holding means and the other of which sets is carried by the other of said rolls and includes means for governing the other of said blank-holding means, the devices of each set having different operating periods and each being operative for instantaneously effecting one of the movements of its respective blank-holding means,

and means for instantaneously effecting the other movement of each blank-holding means.

22. In a paper-bag machine, diamond-fold-forming mechanism embodying a pair of oppositely-rotative coating forming-rolls, two sets of blank-holding devices one of which sets is carried by one and the other set by the other of said forming-rolls and each of which devices has gripping and releasing movements, two sets of automatic electrical controlling devices one of which sets is carried by one of such forming-rolls and includes means for governing one set of blank-holding devices and the other of which sets is carried by the other of said rolls and includes means for governing the other set of blank-holding devices the automatic electrical controlling devices of each set having different operating periods and each being operative for instantaneously effecting one of the movements of its respective blank-holding device, and means for instantaneously effecting the other movement of each blank-holding device.

23. In a paper-bag machine, diamond-fold-forming mechanism embodying a pair of oppositely-rotative coating forming-rolls, a pair of blank-holding end-gripping means carried respectively by said forming-rolls and each having gripping and releasing movements, a pair of blank-holding side-gripping means also carried respectively by said forming-rolls and each having gripping and releasing movements, two sets of automatic electrical controlling devices one of which sets is carried by one of said forming-rolls and includes means for governing the blank-holding devices of one roll and the other of which sets is carried by the other of said rolls and includes means for governing the blank-holding devices of said other roll, the automatic electrical controlling devices of each set having different operating periods and each being operative for instantaneously effecting one of the movements of its respective gripping means, and means for instantaneously effecting the other movement of each gripping means.

24. In a paper-bag machine, diamond-fold-forming mechanism embodying a pair of oppositely-rotative coating forming-rolls, two sets of gripping devices one set carried by each of said rolls and each set consisting of an end-gripper and two side-grippers disposed at opposite sides of their respective forming-roll and each having gripping and releasing movements, automatic electrical controlling means carried by said rolls and including means for governing the end-gripper and the side-grippers of each forming-roll and each operative for instantaneously effecting one of the movements of each gripper, and means for in-

stantaneously effecting the other movement of each gripper.

25. In a paper-bag machine, diamond-fold-forming mechanism embodying a pair of oppositely-rotative coating forming-rolls, two sets of gripping devices one set carried by each of said rolls and each set consisting of an end-gripper and two side-grippers disposed at opposite sides of their respective forming-roll and each having gripping and releasing movements, automatic electrical controlling devices carried by said rolls, and having different operating periods, and embodying means for simultaneously and instantaneously operating the side-grippers of one roll and for separately and instantaneously operating the corresponding end-gripper, and means for instantaneously releasing each of said grippers.

26. In a paper-bag machine, diamond-fold-forming mechanism embodying a pair of oppositely-rotative coating forming-rolls, two sets of gripping devices one set carried by each of said rolls and each set consisting of an end-gripper and two side-grippers disposed at opposite sides of their respective forming-roll and each having gripping and releasing movements, automatic electrical controlling devices carried by said rolls, and having different operating periods, and embodying means for simultaneously and instantaneously operating the side-grippers of one roll and for separately and instantaneously operating the corresponding end-gripper and also operative for actuating in different timing the grippers of the other roll, and means for separately releasing each of said grippers.

27. In a paper-bag machine, diamond-fold-forming mechanism embodying a forming-roll, electrically-controlled blank-holding means carried by said forming-roll, a contact-segment movable in unison with said forming-roll, a contact device coöperative with said contact-segment, and a source of electric energy in circuit with said contacts and with said blank-holding means.

28. In a paper-bag machine, diamond-fold-forming mechanism embodying a forming-roll, a plurality of electrically-controlled blank-holding devices carried by said forming-roll, a plurality of contact-segments movable in unison with said forming-roll and located in different rotative positions, and means coöperative with said contact-segments, including a source of electric energy, for separately energizing said blank-holding devices.

29. In a paper-bag machine, diamond-fold-forming mechanism embodying a forming-roll, a pair of electrically-controlled side-grippers carried by said forming-roll and electrically connected in series, an electrically-controlled end-gripper also carried

by said forming-roll and electrically connected in parallel with said side-gripper, contact-segments movable in unison with said forming-roll and located in different
 5 rotative positions, and means coöperative with said contact-segments, including a source of electric energy, for simultaneously energizing said side-grippers and separately energizing said end-gripper.

10 30. In a paper-bag machine, diamond-fold-forming mechanism embodying a pair of oppositely-rotative coacting forming-rolls, electrically-controlled blank-holding means carried by each of said forming-rolls,
 15 contact-segments movable respectively in unison with said forming-rolls, and means coöperative with said contact-segments, including a source of electric energy, for energizing said blank-holding means.

20 31. In a paper-bag machine, diamond-fold-forming mechanism embodying a forming-roll, an electromagnet carried by said forming-roll, a gripper also carried by said forming-roll and controlled by the armature
 25 of said electromagnet, and means for energizing said magnet.

32. In a paper-bag machine, diamond-fold-forming mechanism embodying a form-

ing-roll, an electromagnet carried by said forming-roll and having a pivoted armature, 30 a gripper in fixed relation with said armature, and means for energizing said magnet.

33. In a paper-bag machine, diamond-fold-forming mechanism embodying a forming-roll, a solenoid carried by said forming-roll and having a pivoted core, a gripper in 35 fixed relation with said core, and means for energizing said solenoid.

34. In a paper-bag machine, diamond-fold-forming mechanism embodying a forming-roll the rim of which has a working 40 space for a gripper, an electromagnet carried by said forming-roll, a gripper also carried by said forming-roll and controlled by an armature of said electromagnet and movable 45 in said working space in the rim of said forming-roll, and means for energizing said magnet.

Signed at New York, in the county of New York and State of New York, this 19th 50 day of November, A. D. 1904.

CHARLES D. KING.

Witnesses:

EDGAR A. FELLOWS,
 C. S. CHAMPION.