C. W. MORDEN.

MACHINE FOR FOLDING A CONTINUOUS STRIP OF MATERIAL.

APPLICATION FILED AUG. 27, 1914.

1,182,296.

Patented May 9, 1916.

6 SHEETS—SHEET 1.

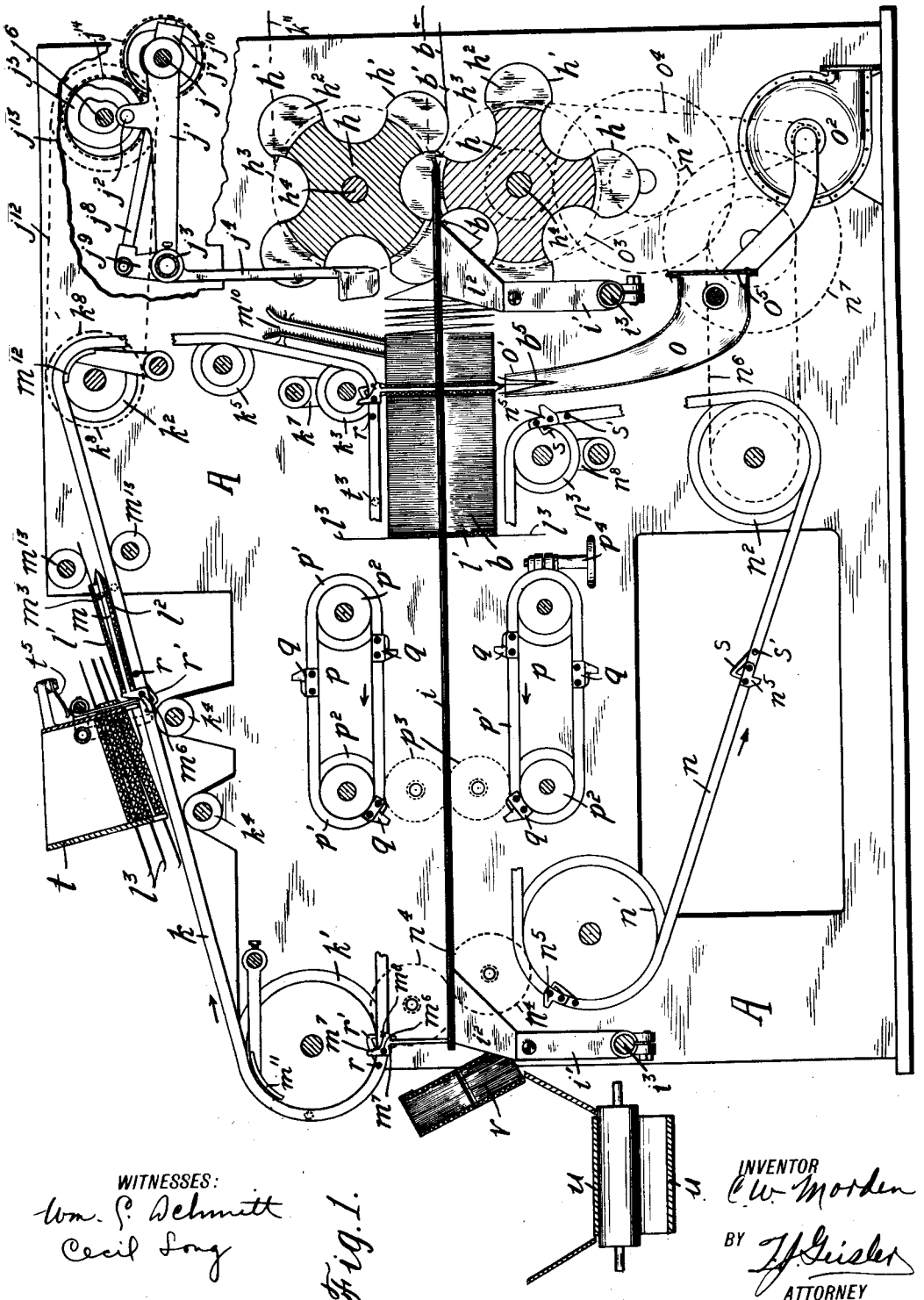

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Fig. 1.

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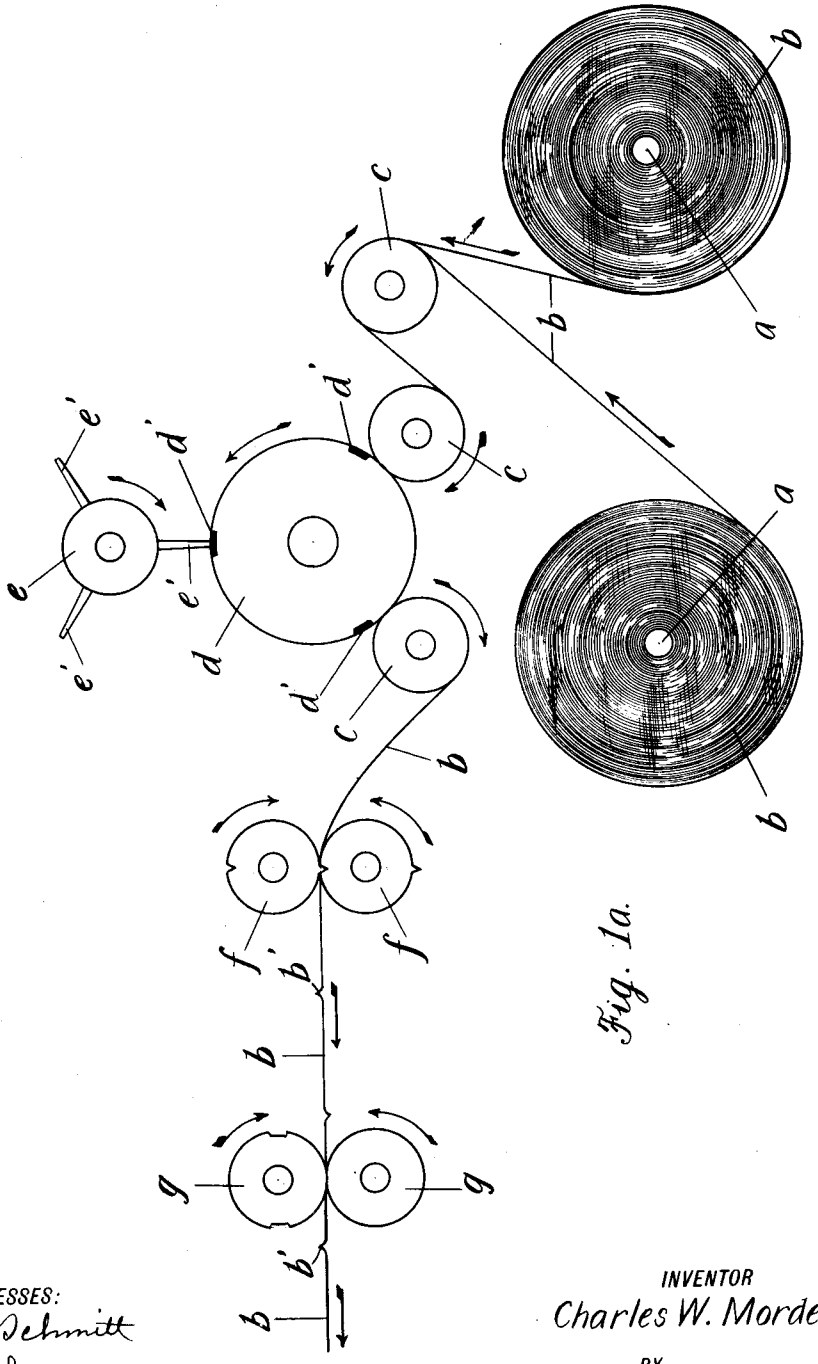

Fig. 1a.

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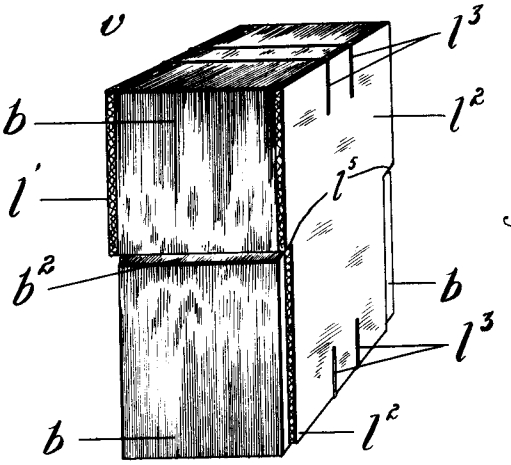

Fig. 2.

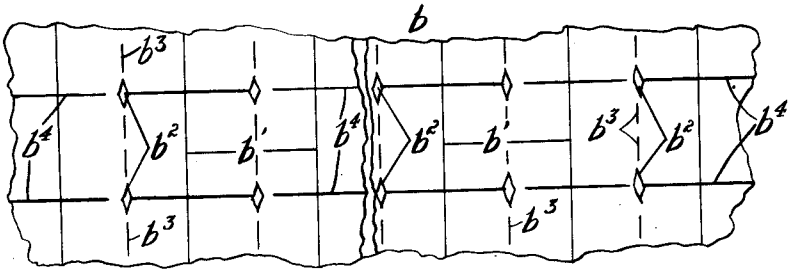

Fig. 3.

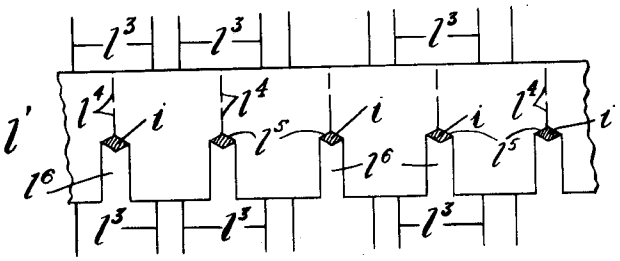

Fig. 4.

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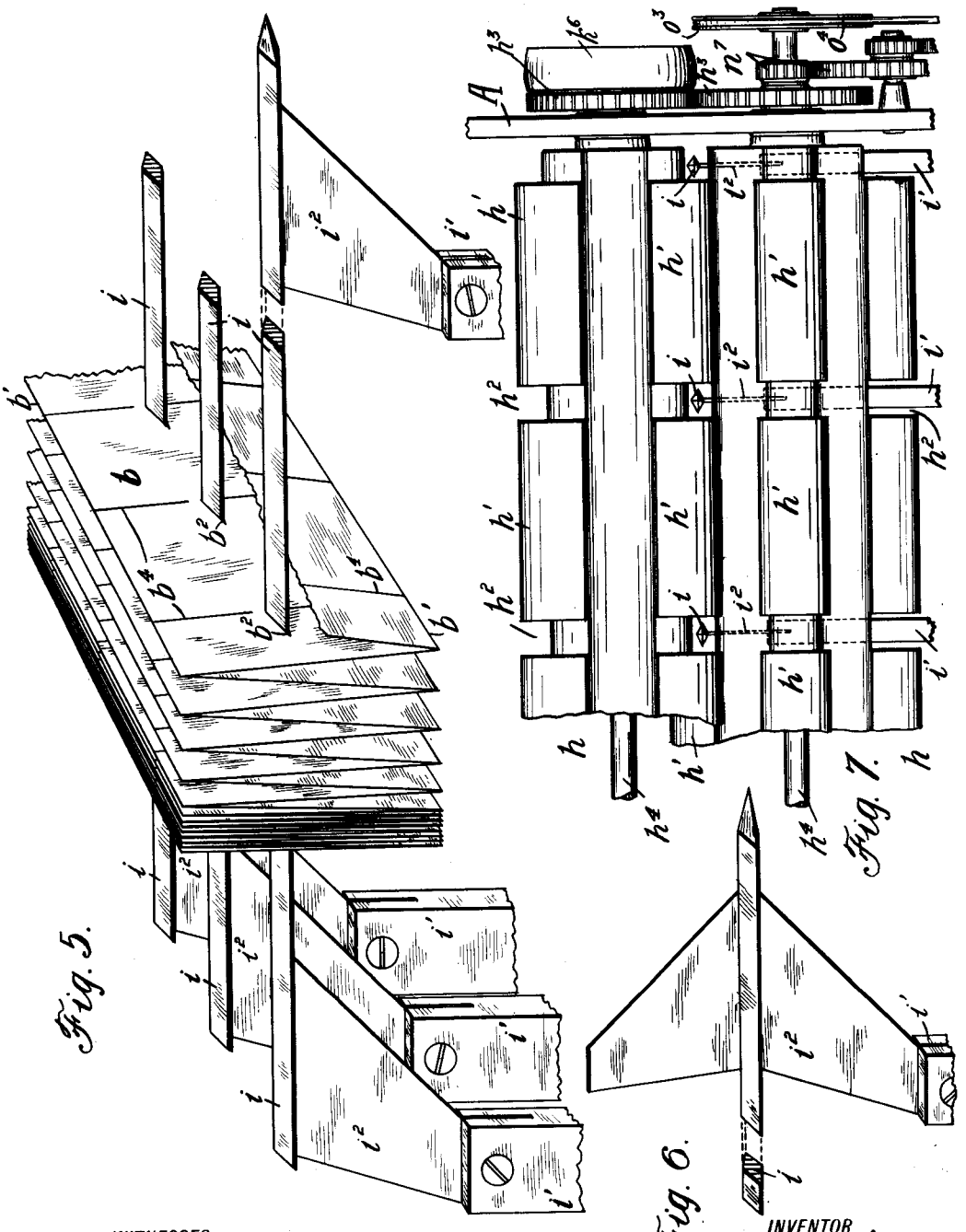

Fig. 7.

Fig. 5.

Fig. 6.

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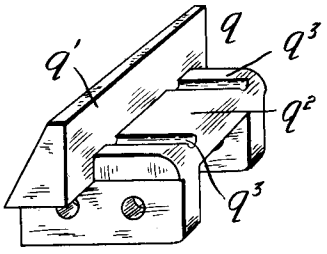


Fig. 8.

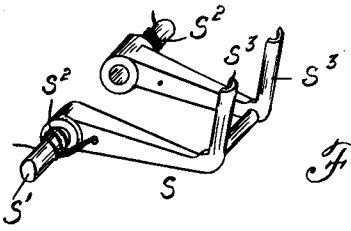
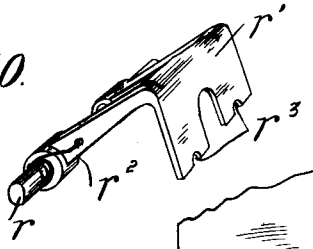


Fig. 9.

Fig. 10.



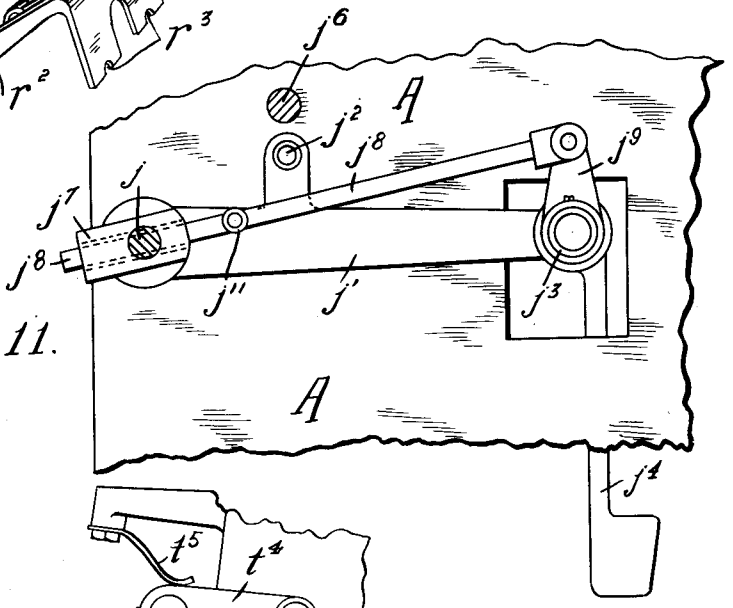


Fig. 11.

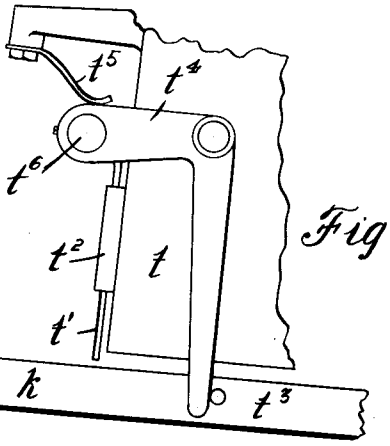


Fig. 12.

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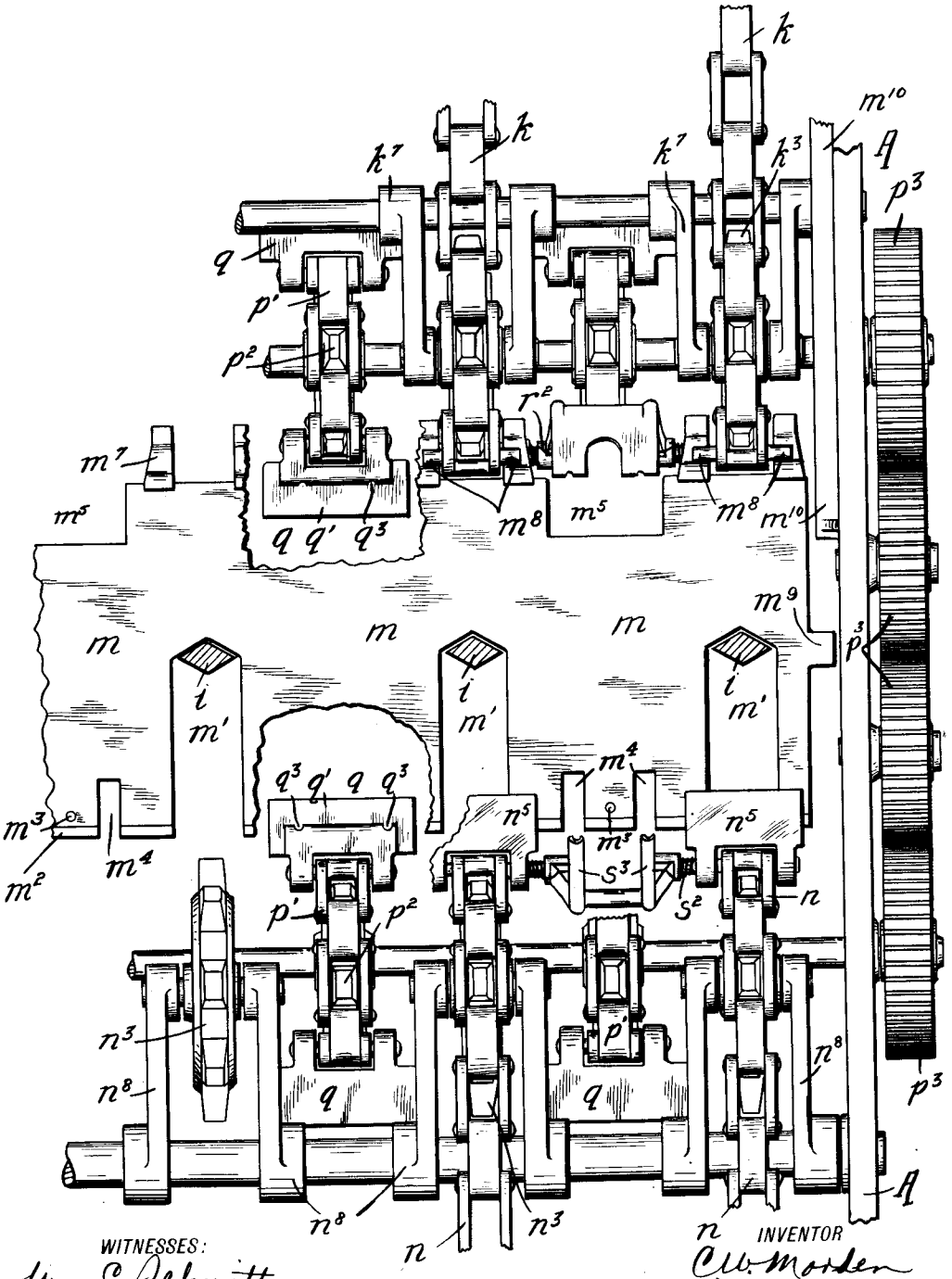

Fig. 13.

UNITED STATES PATENT OFFICE.

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MACHINE FOR FOLDING A CONTINUOUS STRIP OF MATERIAL.

1,182,296. Specification of Letters Patent. Patented May 9, 1916.

Application filed August 27, 1914. Serial No. 858,962.

To all whom it may concern:

Be it known that I, CHARLES W. MORDEN, a citizen of the United States, and a resident of the city of Portland, county of Multnomah, State of Oregon, have invented a certain new and useful Improvement in Machines for Folding a Continuous Strip of Material, of which the following is a specification.

My invention relates to automatic machines for folding a continuous strip of paper or like material into reverse folds for forming a package; and in this application I have shown a machine particularly adapted for producing packages of toilet paper, and paper towels, especially suitable for use in a fixture contemporaneously invented by me and described in a companion application for Letters Patent entitled: "Consecutive sheet package of reversely folded material," filed August 27, 1914, Serial Number 858,961.

One of the main objects of my invention is the providing of a folding machine which will automatically reversely fold a continuous strip of material and assemble, compress, bind and deliver the same in the form of predetermined unit packages; furthermore, a machine capable of operating continuously at high speed and adapted to operate on a wide strip of paper and produce therefrom a gang package of partially connected units, or a plurality of unit packages.

My invention furthermore produces a machine economical to operate with respect to attention required.

The structural details and the mode of operation of the individual mechanisms of my machine are more readily understood by describing the accompanying drawings, in which:

Figure 1 shows a side elevation, in diagrammatic form, of that part of my machine embodying the devices for folding the band of paper in zig-zag form, for carrying and separating unit portions of the folded paper, and the means for compressing and tying such units of paper in package form; Fig. 1ª is a diagrammatic side elevation showing the device carrying the two rolls of paper from each of which a band is drawn, also the devices for perforating, slitting and creasing the bands of paper preceding their conveyance to the package forming mechanism shown in Fig. 1; Fig. 2 is a perspective view of a particular type of package of paper to form which my machine is particularly designed; Fig. 3 is a top or plan view of a portion of the band of paper, showing it perforated, slit and creased ready for conveyance to the folding and package forming mechanism; Fig. 4 is a detail elevation showing the spitting rods and one of the cover portions inserted between the units of the folded paper as supported thereon; Fig. 5 is a perspective view showing the manner in which the reversely folded paper is collected on the spitting rods; Fig. 6 is a perspective view showing an alternate construction of the spitting rod support, which is used when the gang packages are to be separated before delivery from the machine; Fig. 7 is a fragmental view showing a front elevation of the folding rolls; this view is taken from the right in Fig. 1; Fig. 8 is a perspective view of one of the compressing members; Fig. 9 is a perspective view of the lower wire bending clips; Fig. 10 is a perspective view of the upper wire bending clips; Fig. 11 is a fragmental side elevation showing the details of the members which separate the collected paper into predetermined unit groups; Fig. 12 is a fragmental side elevation showing the automatic control of the pasteboard feed chute from which the pasteboard backs are delivered; and Fig. 13 is a fragmental transverse vertical section showing the relative positions of the different parts of the endless carriers and compressing members.

Describing in the first instance the device and operation illustrated in Fig. 1ª, which, as mentioned, shows the means for perforating, slitting and creasing the band of paper preceding the conveyance of the band to the package forming device: *a* represents a pair of mandrels upon which are placed rolls of paper *b*, from which two companion sheets are drawn and fed through my machine.

c are draw rollers which, co-acting with the perforating roller *d*, carry the paper to, around, and from the latter. The perforating roller is provided with rubber surface strips *d'* for the perforating blades *e'* of the perforating roller *e* to work on. Similar devices have been employed in machines heretofore existing, and so I do not deem it necessary to describe the details of construction of these parts.

The knives *e'* of the perforating roller are adapted to cut out the perforations b^2, shown in Fig. 3, and also cut the slits b^3 trans-

versely across the sheet on a line intersecting the perforations b^2. From the perforating and slitting roller, e, the band of paper is carried over the draw roller c to the creaser rollers f, which crease the paper along the transverse lines b', as shown in Fig. 3; the creasing device being adapted to assist the ribbon of paper to assume a zig-zag form, so that it may be later arranged in a plica package of the form shown in Fig. 2. The paper next passes to the slitter rollers g where the band of paper is slit longitudinally as shown at b^4. The next step in the operation is carrying the paper to the folding rollers h, shown in the devices illustrated in Fig. 1. The folding rollers are of gear-like form, having intermeshing folding portions h' which fold the paper in zig-zag form as mentioned. In order to support the folded portion of paper in place for forming the package, such portion is spitted on the pointed spitting rods i, compare Figs. 1, 5 and 7. The folding portions h' of the rollers h are made with peripheral longitudinal slits h^2, so as to permit the extension of the spitting rods i into the plane of action of said folding portions of the rollers h. The rods i are supported in horizontal position by the knife blades i^2 on the supports i', the latter being clamped on the cross rods i^3 which are supported in the side frames A of the machine. Said spitting rods i are arranged to enter the transverse notches b^2 of the folded paper and thus collect the same for arranging in package form. The folding rollers h are mounted on shafts h^4 journaled in the frame members A, and are geared together, as shown by h^3 in Figs. 1 and 7, and in revolving tend to thrust the collected and folded paper forward along the rods i to a point where other automatic devices separate the folded portion of paper into units of predetermined size, which are then compressed into a compact package form, then tied in such package form, and finally discharged to a delivery belt u, as shown at v in Figs. 1 and 2.

The automatic devices accomplishing the separation of the folded portion of paper into units and compressing and tying such units in package form, and finally discharging the same from the machine, are constructed and operate as follows: A stud j is loosely mounted in the side frame A of the machine. See Figs. 1 and 11. Fixed on this stud is a lever arm j', bearing a cam roller j^2. A transverse member j^3 is loosely journaled in the extreme end of the lever arm j'. Fixed on the member j^3, at intervals along its length, in alinement with the peripheral slits h^2 of the folder rolls h, are the arms j^4 which extend downward and into the said slits. A cam j^5 is pivoted on a stud j^6 in the side frame of the machine, and the cam roller j^2 is adapted to bear in the groove of said cam. The rotation of the cam will cause the lever arm j' to be rocked on its fulcrum at periodic intervals, thereby causing the arms j^4 to be projected downward, and in a position behind one of the individual folds of paper b. The lever arm j' is made with an enlarged hub j^7 and a rod j^8, having one end pivoted to a lever arm j^9. The rod j^8 is adapted to have a sliding movement in said enlarged hub j^7. A cam j^{10} is loosely mounted on the extended portion of the stud j, and a cam roller j^{11} mounted on the rod j^8 is adapted to bear in the groove of said cam. The cams j^5 and j^{10} are geared together, as indicated by j^{14}, and are constantly driven from the main portion of the machine by a chain j^{12}, and a sprocket wheel j^{13}. The cam j^{10} acts to move the arms j^4 clockwise after they have been lowered to the rear of the fold of paper through the action of the cam j^5, as described. This combined action causes the arms j^4 to separate the folded paper into units of a predetermined number of sheets, and will thrust them forward along the spitting rods i.

Mounted on transverse supports and running in the longitudinal direction of the machine and of the spitting rods is an endless carrier k. Said carrier bears on the sprocket wheels k', k^2, k^3, and the idlers k^4, k^5. Said carrier is constantly driven in the direction of the arrow in Fig. 1, by means of a prime mover which transmits motion to the pulley k^6 by the belt k^{11}. A sprocket k^8 is fixed on the driven sprocket k^2, and the chain drive j^{12} connecting with said sprocket k^8 transmits a constant drive to the cams j^5, j^{10}. The separator plates m, carried by the carrier k, are made with openings m' adapted to straddle the spitting rods i, the beveled front edges m^2, with double pointed pins m^3, with openings m^4, at the lower end of the plates, and with openings m^5 at the upper end of the plates. See Fig. 13. The plates are pivotally attached to the endless carrier k by means of pivot pins m^6, and the bell crank shaped lugs m^7. Stops m^8 are adapted to limit the rotation of the separator plates in either direction. Located on the extreme ends of the separator plates are lugs m^9, which are adapted to slide in guideways m^{10}, the latter located on the side frame walls; such lugs being adapted to act at the time the separator plate is being brought into place behind the unit of paper. The members m^{11} and m^{12} are fixed in relationship with the sprockets k', k^2, so as to form an abutment for the bell crank lugs m^7, and thereby cause the separator plates to be thrown over parallel to the carrier. Rollers m^{13} are located as shown in Fig. 1, and are adapted to press the pasteboard covers onto the pins m^3, as the separator plate bearing the covers passes between these rolls.

Located beneath the spitting rods i and

in parallel alinement with the endless carrier k, is another endless carrier n, running on the sprockets n', n^2, n^3. A chain drive n^6 and gear train n^7 transmit rotary motion from the folding rolls h to the carrier n. Gear connections n^4, between the sprockets k', n' transmit a constant drive from the carrier n to the carrier k in the direction indicated by the arrow in Fig. 1. By changing the gear train n^7 the carriers can be made to run relatively faster or slower with respect to the folder rolls, and the size of the package will vary accordingly. Said carrier n is provided at intervals with fixed blocks n^5, and the carriers are so timed that the blocks n^5 will bear on the rear of the lower end of the plate m, so as to form a second form of support for said plate as the latter carries the paper along the spitting rods i. A suction element o is made with grooves o' and is exhausted by means of a suction pump o^2, the latter being driven from the pulley o^3 by a belt o^4. The exhaust pipe o is made with a door o^5, through which ingress is obtained to said pipe for the purpose of removing collected paper.

For the purpose of avoiding interferences, the sprockets k^3, n^3 are supported between crank arms k^7, n^8. Located intermediate the ends of the carriers k and n are the compressing elements p. The latter comprise endless carriers p' traveling on idler sprockets p^2, and are geared together as indicated by p^3, so that they will move together, as indicated by the arrow in Fig. 1. A brake element p^4 enables any resistance desired to be placed on the compressor element. Fixed at intervals on the endless carriers p' are the blocks q provided with a flat face q' against which the upper and lower ends of the paper will bear. Said blocks are also made with transverse portions q^2, provided with parallel grooves q^3 and said blocks are adapted to hold the ends of each compressed unit. Also pivoted on the endless carrier k on the pins r, in close proximity to the separator plate pivots, are the spring finger clips r', see Figs. 1 and 10. Said clips are angular in form and are normally held in the position indicated by the springs r^2. In the ends of the clips are notches r^3 which lie in the same vertical plane as the grooves q^3 of the blocks q. On the endless carrier n, and in close proximity with the blocks n^5, are the finger clips s. See Figs. 1 and 9. The latter are pivoted on pins s' and are normally held in the position shown in Fig. 1 by the springs s^2. Said clips are also angular in form and are provided with grooves s^3, which are in alinement with the notches r^3, and the grooves q^3, shown in Figs. 8 and 10.

Located above the endless carrier k is a bottomless container t, in which the pasteboard covers l', l^2, which form the front and rear covers of the finished package, are contained. The cover l' is shown in Fig. 4, which shows a continuous strip of pasteboard provided with slits l^4 and the openings l^6 the upper ends l^5 of which are adapted to straddle the bars i. The binding wires l^3 are made a part of this cover. The rear cover l^2 is similar to that shown in Fig. 4, with the exception that the wires l^3 are omitted. These covers are placed alternately in the container one above the other. The lower cover bears directly on the endless carrier k, but is restrained from moving with the latter by means of a spring finger t' bearing in a guide-way t^2. The lower end of the container t is provided with openings which permit the passage of the separator plate and the two lower covers beneath. The means for lifting the restraining finger t' is as follows: On the extreme ends of the carrier k are pins t^3. The fingers t' are supported on a cross bar t^6, which is carried between the bell cranks t^4, located on opposite ends of the container, and a spring t^5 normally holds said bell cranks in the position shown in Figs. 1 and 12. During the travel of the carrier k the pins t^3 will rock the bell cranks t^4, thereby lifting the fingers t'. After an interval the springs t^5 will cause the fingers t' to resume their normal restraining position.

The action of the whole machine is as follows: After the folding rolls have made a predetermined number of revolutions, the fingers j^4 will be rocked down and forward, thereby causing the paper to be passed forward along the spitting rods i. The separator plate m will then pass into position behind the unit of paper, the lower end of the separator plate causing the fold to tear along the perforations b^3. This fold, which is indicated by b^5 in Fig. 1, will then be sucked down through the exhaust pipe. The wires l^3 will pass through the slot o' and also pass the sprockets k^3, n^3, without any interference because of the fact that the latter are journaled on the crank arms k^7 and n^8. As the carrier k moves forward the separator plate will press the paper forward along the spitting rods. As the paper is pressed forward along the spitting rods the front cover l' will contact with the blocks q. The ends of the wire l^3 will also contact with said blocks and will be bent laterally over the upper and lower ends of the compressed unit, the grooves q^3 and flat faces q' forming the bending dies. As the carriers k and n move still farther forward they will exert a pressure on the paper higher than the point which the resisting member p^4 has been set for, and the carriers p' will thereupon be caused to move forward. As the clips r', s pass forward under the carriers p', they will be forced toward each other and will bend the ex-

treme ends of the wires l^3 into the final binding position, as shown in Fig. 2. The carriers will then continue their forward movement until the package v is pushed off the rear ends of the spitting rods onto the endless belt u. As the separator plate m continues its travel, the lugs m^7 will strike the abutment member m^{11} and be thrown down into the position shown in the top portion of Fig. 1, and then pass under the container t, the beveled end m^2 inserting itself between the two lowermost covers, and as it passes forward beneath the rolls m^{13}, said covers will be pressed lightly down upon the pins m^3, so as to hold said covers on the plate until such time that they are carried in position on the spitting rods. It is to be noted that as the separator plate passes into position behind the predetermined number of units, it is given a slight longitudinal movement instead of being brought vertically downward.

I claim:

1. A machine of the character described comprising means for partially severing a strip of material into sheets, means for reversely folding the material, means for automatically segregating a predetermined unit of the folded material, and means for compressing and binding such unit.

2. A machine of the character described comprising means for partially severing a strip of material into sheets, means for reversely folding the material, a supporting way for the folded material, means for aumatically segregating a predetermined unit of the folded material, means for compressing and binding such unit, and means for delivering such unit.

3. In a machine of the character described, the combination of a pair of folding rollers having radiating protuberances and gear-like intermeshing action, a way arranged to receive the folded material from said rollers, means for segregating a predetermined unit of the folded portion of the material, and means for dropping covers between units of the folded material.

4. In a machine of the character described, the combination of a pair of folding rollers having radiating protuberances and gear-like intermeshing action, a way arranged to receive the folded material from said rollers, means for segregating a predetermined unit of the folded portion of the material, and means for binding said unit of material.

5. A machine of the character described comprising means for partially severing a strip of material into sheets, means for reversely folding the material, means for automatically segregating a predetermined unit of the folded material, and means for binding such unit.

6. A machine of the character described comprising means for partially severing a strip of material into sheets, means for reversely folding the material, a supporting way for the folded material, means for automatically segregating a predetermined unit of the folded material, and automatic means for delivering such unit.

7. A machine of the character described comprising means for partially severing a strip of material into sheets, means for reversely folding the material, a supporting way for the folded material, means for automatically segregating a predetermined unit of the folded material, means for binding such units and automatic means for delivering the latter.

8. In a machine of the character described, the combination of means for reversely folding a strip of material, means for segregating a predetermined unit of such folded material, and means for dropping separating elements between units of such material.

9. In a machine of the character described, the combination of means for reversely folding a strip of material, means for segregating a predetermined unit of such folded material, means for dropping separating elements between units of such material, and means for compressing the units separated by said separating elements.

10. In a machine of the character described, the combination of means for reversely folding a strip of material, means for segregating a predetermined unit of such folded material, means for dropping separating elements between units of such material, and means for compressing and binding the units separated by said separating elements.

11. In a machine of the character described, the combination of a pair of folding rollers having radiating protuberances and gear-like intermeshing action, means for segregating a predetermined unit of the material folded by such folding rollers, and means for compressing and binding said units of material.

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