April 15, 1952 G. A. ANDERSON ET AL 2,593,085

MATERIAL FOLDING MACHINE

Filed Jan. 18, 1951 8 Sheets-Sheet 1

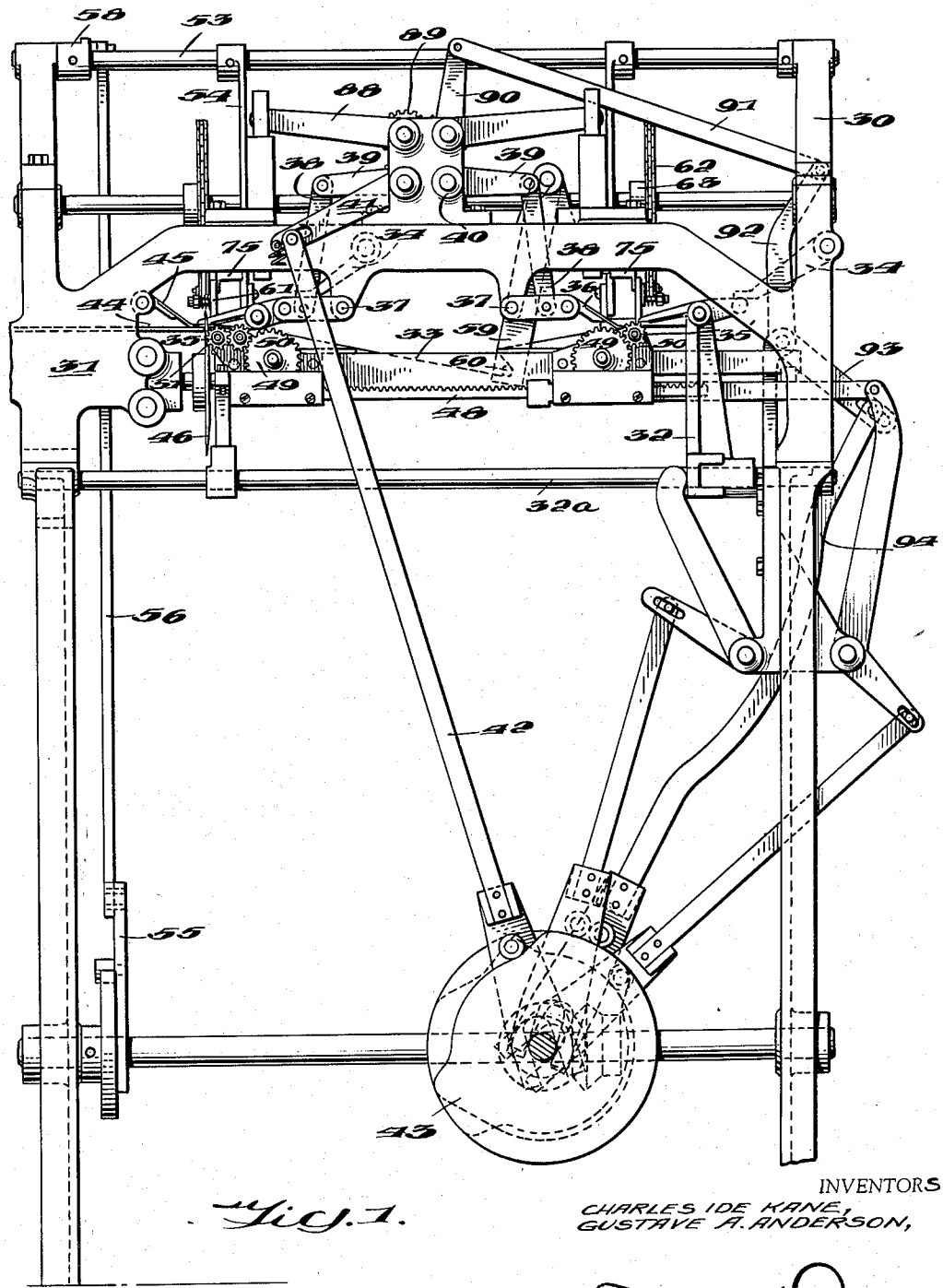


Fig. 1.

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MATERIAL FOLDING MACHINE

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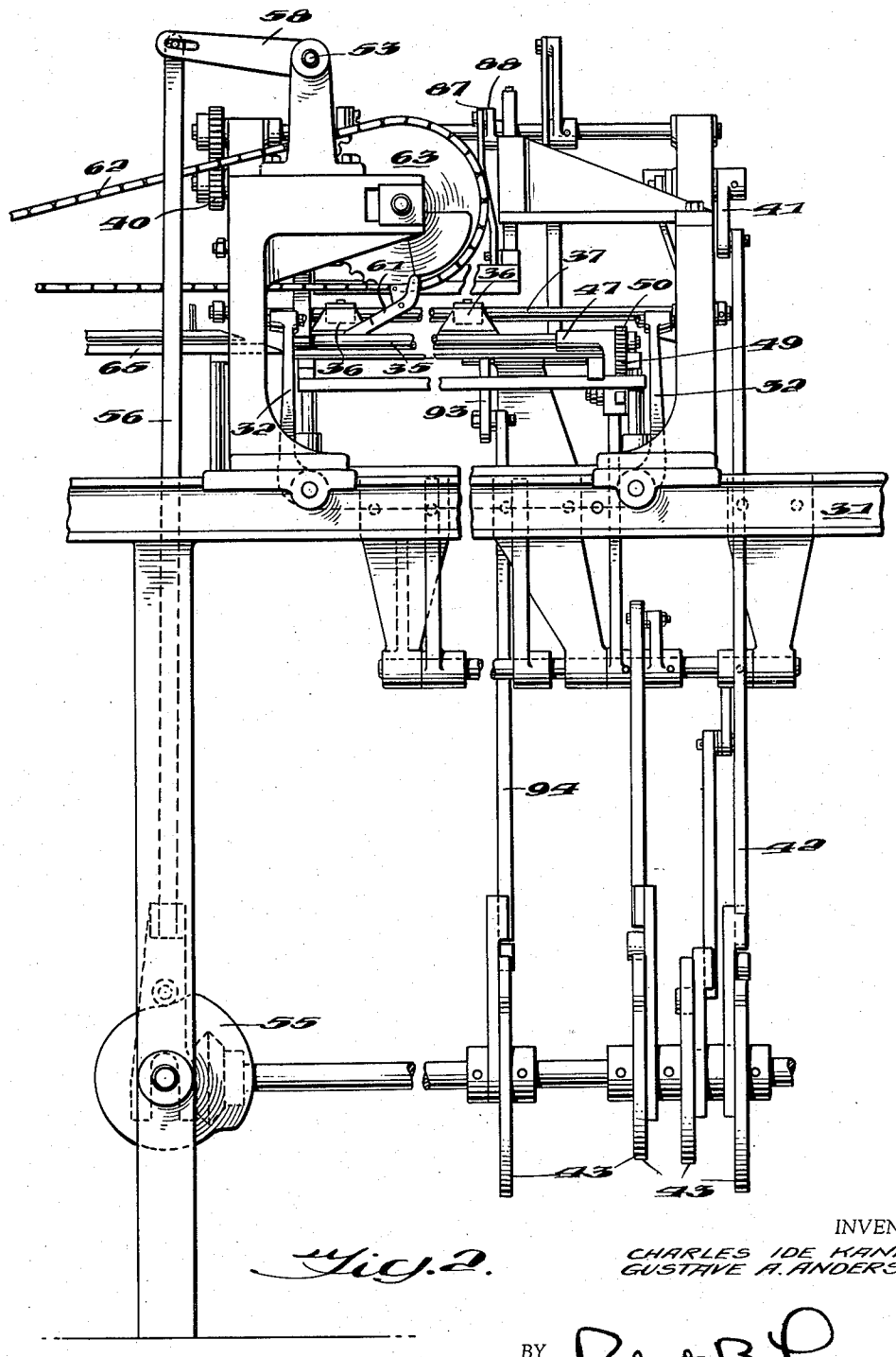


Fig. 2.

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MATERIAL FOLDING MACHINE

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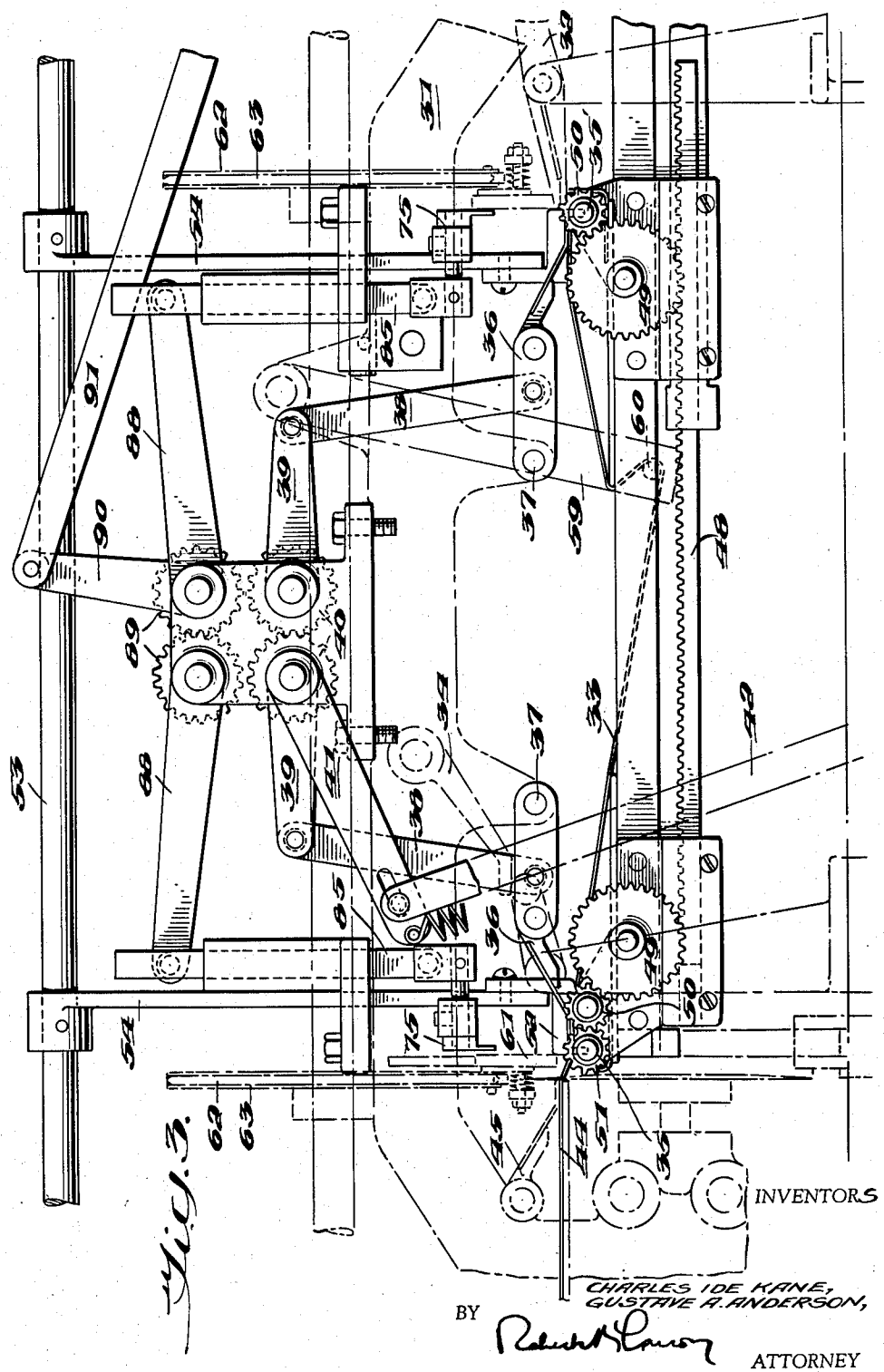


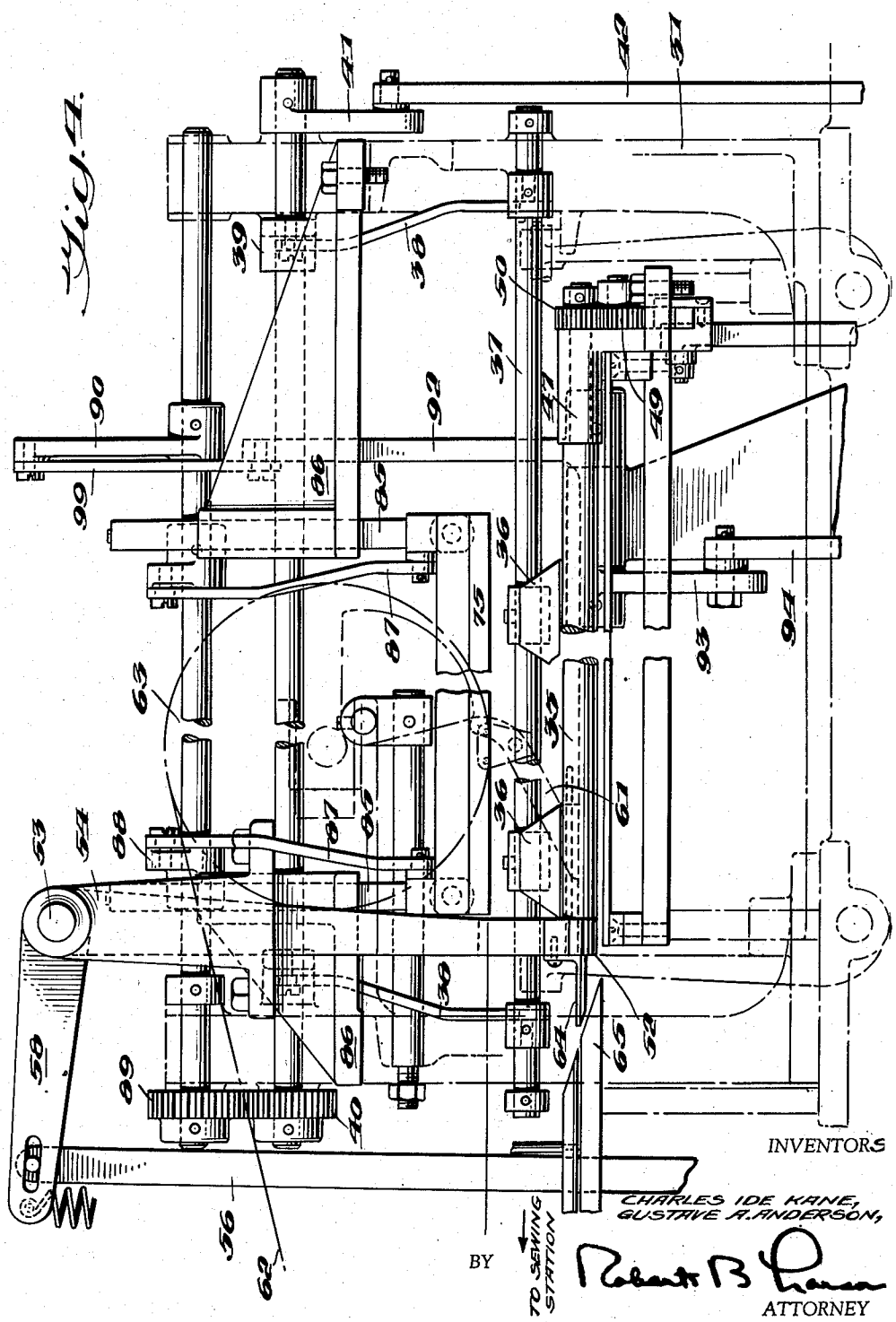
Fig. 3.

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MATERIAL FOLDING MACHINE

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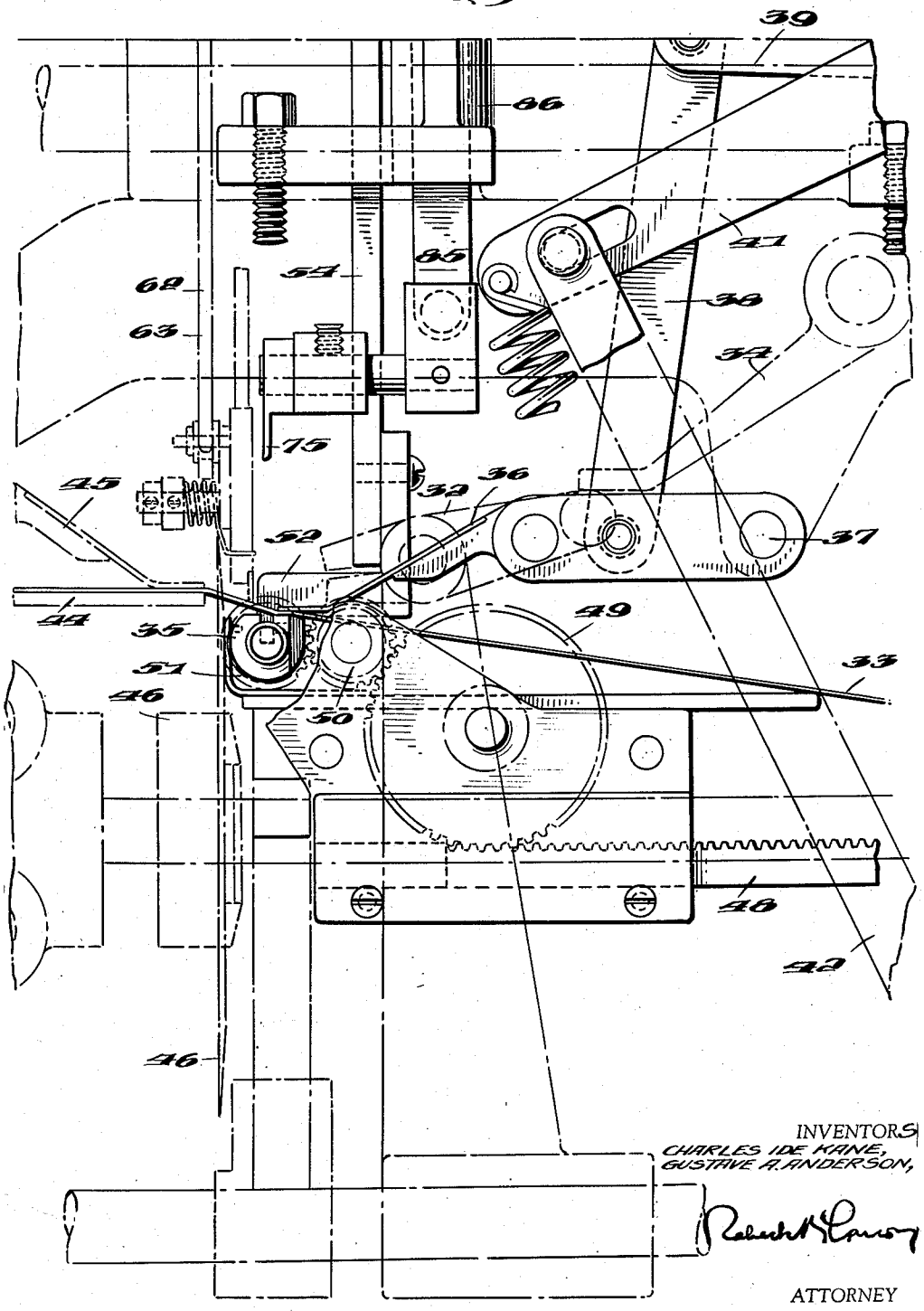
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Fig. 5.



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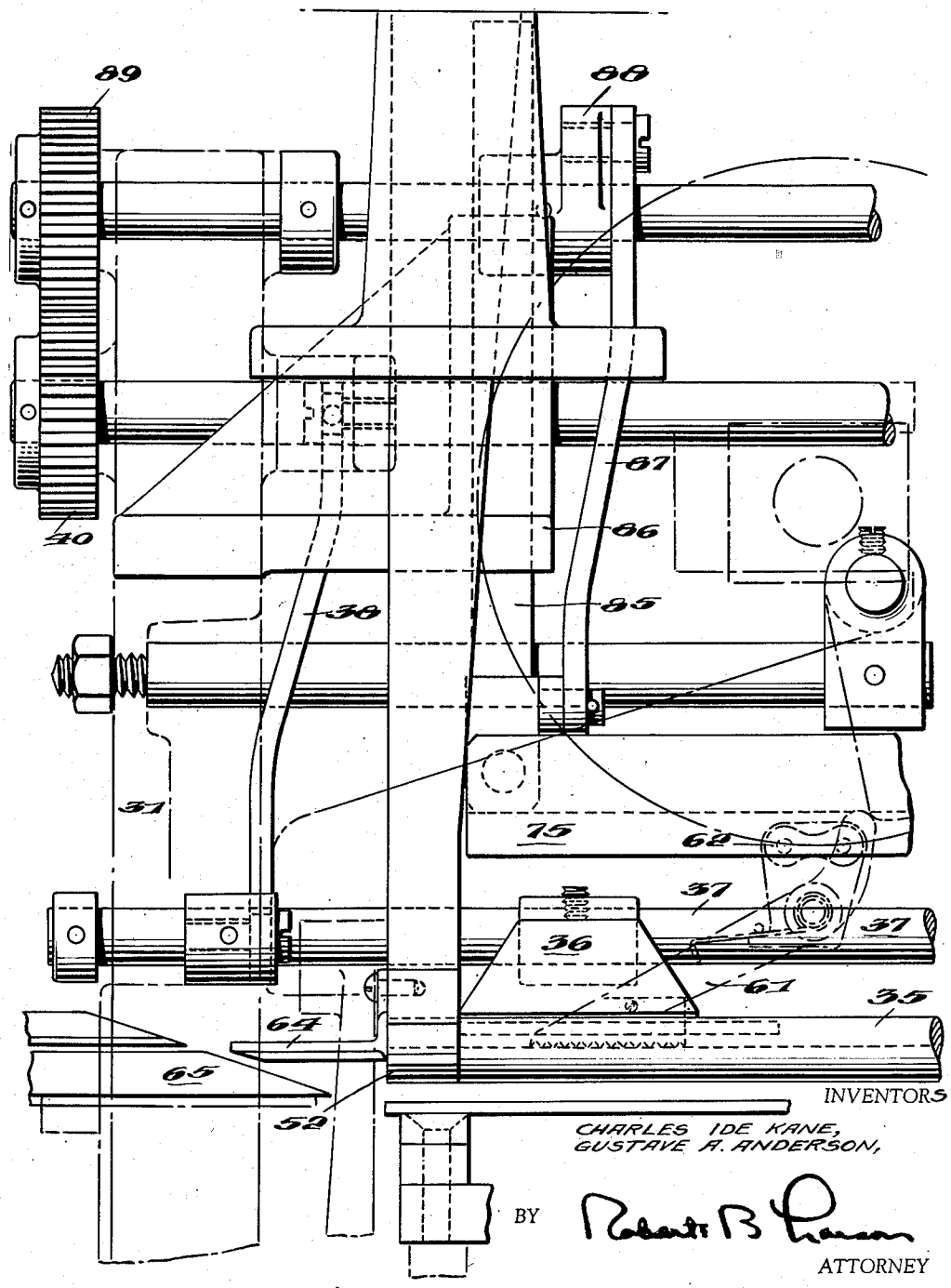
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Fig. 6.



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Fig. 16.

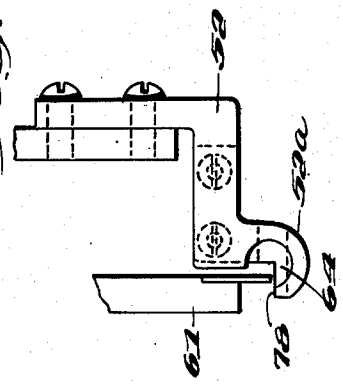


Fig. 17.

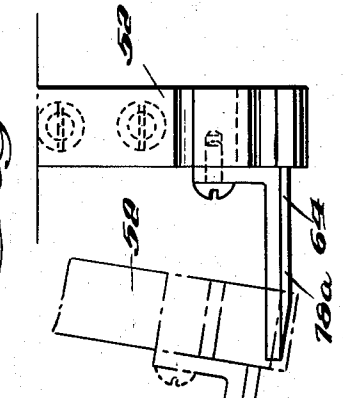


Fig. 16.

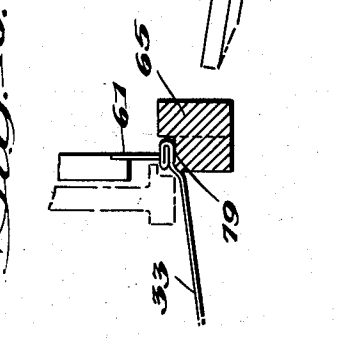


Fig. 7.

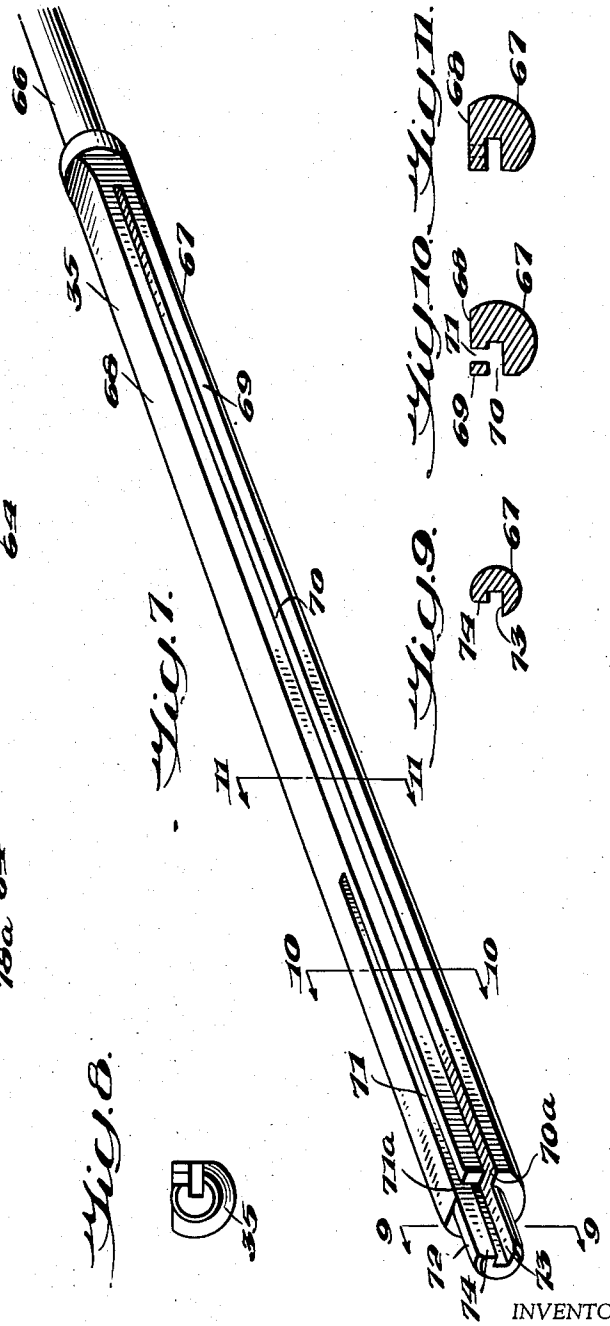


Fig. 8.

Fig. 11.

Fig. 10.

Fig. 9.

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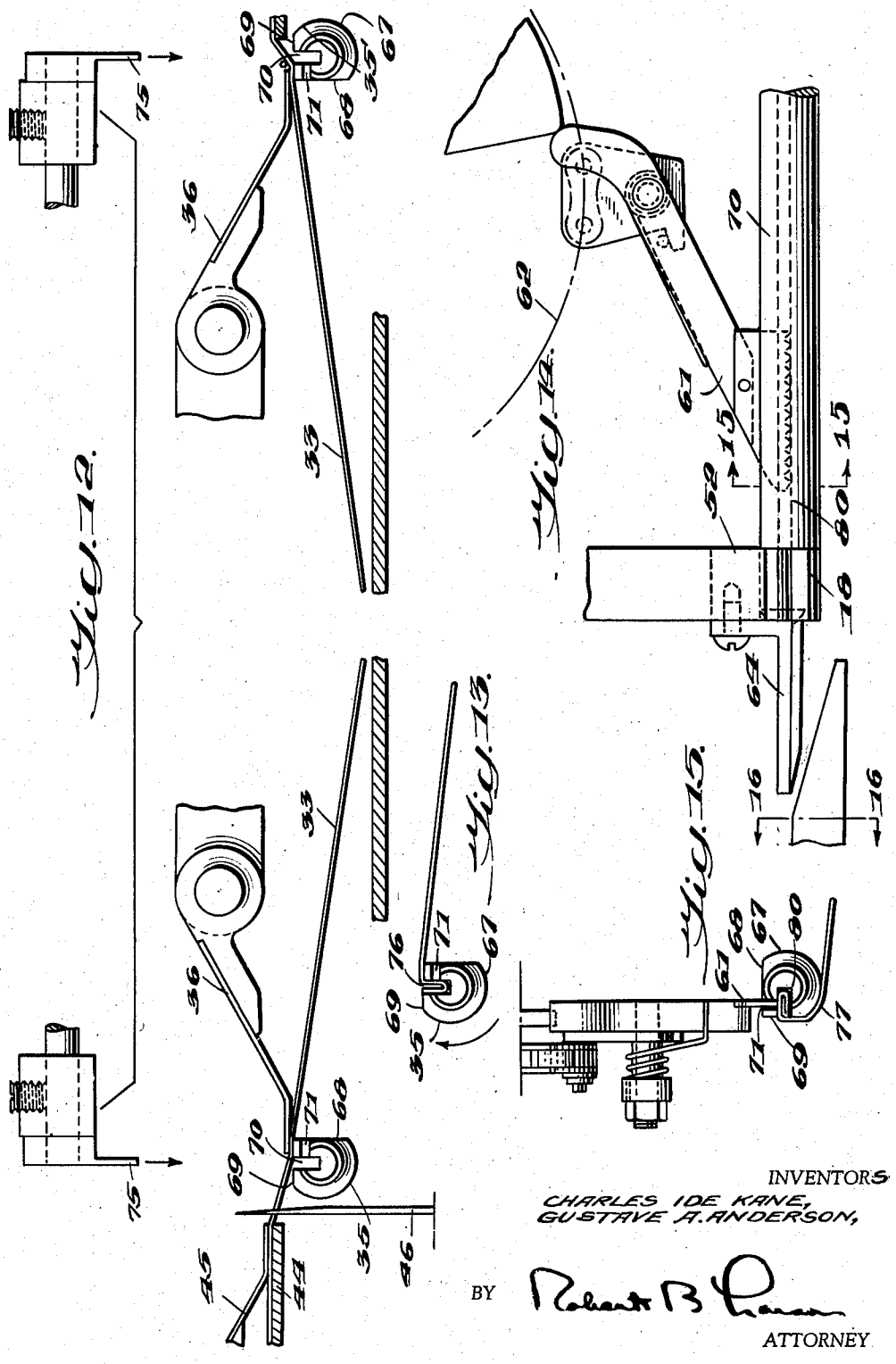
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MATERIAL FOLDING MACHINE

Filed Jan. 18, 1951 8 Sheets-Sheet 8



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Patented Apr. 15, 1952

2,593,085

UNITED STATES PATENT OFFICE

2,593,085

MATERIAL FOLDING MACHINE

Gustave A. Anderson, New York, and Charles Ide Kane, Rye, N. Y., assignors to The International Handkerchief Manufacturing Company, Long Island City, N. Y., a corporation of New York

Application January 18, 1951, Serial No. 206,626

8 Claims. (Cl. 112—2)

1

This invention relates to structure for folding sheet material, such as in forming a hem in a fabric. The invention includes means for moving the folded material from the folding apparatus, and, in one embodiment, advancing the folded fabric to the next work station, which may be a sewing station. In particular this invention relates to folding a hem in a handkerchief blank.

Much of the structure of the machine in this application has been shown in Patents Nos. 2,053,257 and 2,449,044, and 2,451,648. The present invention constitutes an improvement in the machines shown in these patents, but much of the structure and operation is the same. Throughout the specification reference will be made to that which is old structure and it is to be understood that such reference is to the patents mentioned above.

The old method of folding the hem is shown in Patent No. 2,053,257. By the old method, the hem is formed in successive stages as the fabric blank advances toward the sewing machine. We have found it to be impracticable to make a narrow hem with the old hemming method, as the amount of "turn-in" was so small that the edge of the blank had a tendency to slip out of the folding mechanism, thus producing an excessive amount of damage and resulting in a waste of time and material.

In the new device the complete hem is formed as soon as the handkerchief blank has been cut from the fabric web, thus insuring a hem with an exact "turn-in" along the entire width of the handkerchief blank before it is advanced to the sewing machine. (The "turn-in" of a hemmed handkerchief is that portion of the cloth which turns in or folds back along the upper layer of the hem, forming a loop.)

It is an object of our invention to provide apparatus which will form a narrow hem as readily as a wide hem.

It is also an object of our invention to provide a mechanism for making the complete fold in the hem in one operation.

It is another object of our invention to provide a machine for folding a fabric to form a hem, comprising the combination of at least one rotatable hem forming bar having at least one longitudinally extending slot therein, means for advancing the fabric to the hem folding position where the end portion of the fabric overlies the slot in said bar with the edge being substantially parallel to the longitudinal axis of the bar, releasable means holding said fabric in the overlying position, means for depressing said fabric into the slot in said bar and forming a loop thereby, means for rotating said bar to draw the fabric around the bar thereby forming a second loop which completes the folding of the hem, and means for advancing the fabric to the next work station, which may be a hem sewing station.

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Another object of our invention is to provide a hem folding bar having two intersecting slots extending longitudinally along the length of the bar, the first of the slots being adapted to cooperate with a straight edge to form the fold and the second of the slots being adapted to cooperate with moving gripper feet which advance the folded fabric to the sewing station.

Another object of our invention is to provide a bearing for one end of the hem forming bar, which bearing is swingable from its supporting position to a position which is clear of the grippers which advance the fabric web to the hemming apparatus.

Another object of our invention is to provide an extension on the bearing for the hem forming bar to form a support for the fabric blank when it is being removed from the hem forming bar to the sewing station or other following station.

Another object of our invention is to provide clamping means which will hold a fabric web firmly against hem forming bars while the blank is being measured and while it is being cut.

Another object of our invention is to provide a device for folding a fabric to form a hem, comprising a hem forming bar having a longitudinally extending slot therein and positioned to receive the fabric with an end portion thereof overlying the slot, means for depressing the end portion of said fabric into the slot in said bar to form a loop therein, and means for rotating said bar to draw the fabric around the bar and thereby to form a second loop which completes the folding of the hem.

These and other objects will become more apparent from the following description and claims when read in conjunction with accompanying drawings, in which:

Fig. 1 is a side elevational view of the apparatus embodying the invention;

Fig. 2 is an end elevational view looking from the left side of Fig. 1;

Fig. 3 is a side elevational view similar to Fig. 1, but showing only the upper portion of the apparatus;

Fig. 4 is an end view similar to Fig. 2, but showing only the upper portion of the apparatus, as viewed from the left of Fig. 3;

Fig. 5 is a fragmentary side elevational view of the lower left hand portion of Fig. 3;

Fig. 6 is an end elevational view of the lower left hand portion of Fig. 4;

Fig. 7 is a perspective view of the hem forming bar;

Fig. 8 is an end elevational view of the bar shown in Fig. 7;

Fig. 9 is a cross sectional view taken on line 9—9 of Fig. 7;

Fig. 10 is a cross sectional view taken on line 10—10 of Fig. 7;

Fig. 11 is a cross sectional view taken on line 11—11 of Fig. 7;

Fig. 12 is a fragmentary view showing details of the folding mechanism;

Fig. 13 is a detail end view of one of the hem forming bars showing a fabric loop formed therein;

Fig. 14 is a detail side view of the hem forming bar showing the engagement therewith of the gripper feet;

Fig. 15 is a view looking from the left side of Fig. 14 as indicated by line 15—15;

Fig. 16 is a cross sectional view taken along lines 16—16 of Fig. 14;

Fig. 17 is a detail side view of the bearing of the hem forming bar; and

Fig. 18 is an end view of the bearing shown in Fig. 17.

Referring now to Figs. 1 through 6, the machine is shown supported by frame 31. Slidably mounted on a guide 32a carried by the frame are grippers 32 which receive the web 33 from the right in Fig. 2 and move it to the left, lengthwise of the machine, to draw it to a hem folding position over the hem forming bars 35, 35', shown in the two extreme positions that they occupy. The grippers 32 may be operated in a number of different ways, one method being that shown in Patent 2,053,257.

The grippers 32, which are normally closed, are opened by gripper actuators 34 which are in turn operated by the cam and lever system shown in Patent 2,053,257.

The web is held to hem forming bars 35, 35' by clamps 36 (Fig. 3) which are rotatably mounted on the frame by bar 37 (Fig. 4). The clamps 36 are actuated through levers 38, 39, gears 40, levers 41, 42, and cam mechanism 43 (Figs. 1, 2 and 3). The web is also held to platform 44 by clamp 45 while it is being cut by rotating knife 46 (Fig. 5).

The hem forming bars 35, 35' are rotatably mounted on the frame by brackets 47 (Fig. 4). In the preferred embodiment which is shown in these drawings, the two hem forming bars 35 and 35' are positioned in parallel spaced relation and are connected to a rack 48 (Fig. 3) by their respective gear trains 49, 50, 51 in such a manner as to be rotated simultaneously and in opposite directions when rack 48 is moved transversely as viewed in Fig. 3.

Bars 35 and 35' are supported by bearings 52 at their ends remote from bracket 47. Bearings 52 (Figs. 14, 17 and 18) are swingably supported by rod 53 through arms 54 (Fig. 4). The rod 53 is rotatably mounted and when rotated, causes bearings 52 to swing outwardly (to the left in Fig. 4) from their normal supporting positions engaging hem forming bars 35 and 35' by cam mechanism 55 (Figs. 1 and 2) through lever arms 56 and 58. Bearings 52 are thus swingably mounted in order to permit, without obstruction, the longitudinal movement of web grippers 32.

When the web is in position across bars 35, 35', the blank to be cut by knife 46 is measured by arms 59 which hold rod 60 and move it against web 33. The operation of slack bar 60 is shown in my patents referred to above. At this point the folding operation, to be described later, takes place and the hem is formed.

After the hem is formed in the blank, the blank is removed from the hem forming bars and advanced to the next work station, which may be a sewing station (not shown) by fabric engaging means such as gripper feet 61 (Figs. 2, 4 and 14). The gripper feet are mounted on a chain 62 which passes around and is guided by sprocket 63. Sprocket 63 is rotated by a belt and pulley arrangement (also not shown). This gripper feet arrangement and the drive means therefor are old structure shown in previous patents.

Extension 64 mounted on bearing 52 (to be described in more complete detail below) provides a bridge for supporting the blank as it moves from the hem forming bars 35, 35' to platform 65 which leads to the sewing station (Fig. 4).

Hem forming bar

Figs. 7–11 show hem forming bar 35 in detail. Bar 35 has a cylindrical end portion 66 by which one end is supported by frame 31. The main part of the bar has as its outer configuration a cylindrical surface 67 and two flat surfaces 68 and 69 which intersect at approximately a right angle. From surface 69 a slot 70 extends inwardly to approximately the center of the bar and extends longitudinally almost the whole length of the main part of the bar. It is in slot 70 that the first fold, or turn-in of the hem is formed.

A second slot 71 extends inwardly from surface 68 and intersects slot 70. The slot 71 is offset slightly from the center of the bar. It is through slot 71 that gripper feet 61 engage the folded fabric, and therefore it is necessary for the slot to extend only a portion of the length of the main part of the bar. End portion or extension 72 located at the end of the bar remote from cylindrical end portion 66, is adapted to engage bearing 52 to receive support therefrom. End portion 72 has two inwardly extending flat surfaces 73 and 74, each of which constitutes a continuation of the two facing surfaces 71a and 70a of slots 70 and 71, as best seen in Fig. 7.

Bearing and bridge extension

In Figs. 6 and 14 through 18 the bearing 52 and its bridge extension 64 are shown. As previously explained, each bearing 52 (there being one for each bar 35, 35') is carried by an arm 54, and the lower portion of part 52 extends transversely of the arm 54. This lower portion of part 52 has a downwardly extending hook-like portion 52a which terminates in a horizontal flat surface 78. The interior surface of portion 52a is cylindrical and dimensioned for snugly but slidably receiving reduced end portion 72 of the corresponding bar 35 or 35'.

The bridge extension 64 extends sideways from part 52 and is generally L-shaped in cross section, the upwardly facing surface of which is denoted by reference numeral 78a and which forms a continuation of surface 78 of the hook shaped part 52a. When the bearing 52 is in its supporting position with extension 72 of the hem forming bar 35 located in the hook shaped portion 52a, surface 78 forms a continuation of surface 73 on the extension 72 of the hem forming

bar. Surface 79 of slot form 65 also forms a continuation of the surface 78.

Folding operation

The folding operation is shown in Figs. 12, 13 and 15. After the web 33 has been drawn across hem forming bars 35, 35' by grippers 32, slack bar 60 (Fig. 3) travels downwardly, measuring the length of the handkerchief blank and creating slack in the web. Then web clamps 36 move down into engagement with the web, holding the web securely against hem forming bars 35, 35'. The web clamps 36 engage surfaces 69 of the hem forming bars, but remain clear of slots 70 so that these slots are not obstructed (Fig. 12). Knife 46 then cuts a blank from the web.

When clamps 36 hold the blank securely, loop forming blades 75 move downward, depressing the cut edges of the blank into slots 70 of the hem forming bars 35, 35', to cause a first loop, or turn-in, 76 to be formed in the blank. The loop forming blades are fixed to rods 85 (Figs. 4, 5, and 6) which are slidably mounted in bearings 86 attached to the frame 31. The movement of blades 75 is caused by links 87 joined to levers 88 which are operated by gears 89 through a connecting shaft (Figs. 1 and 6). The gears 89 are rotated by lever 90 through arm 91, linkage 92, 93 and 94. Follower 94 is actuated by the cam arrangement shown at 43. This loop 76 is the turn required to make a finished hem. The blank is now in the position shown in Fig. 13.

Clamps 8 move upward and the loop is held in the slots by the frictional engagement of the loop with the sides of the slot.

The hem forming bars 35, 35' now rotate ¾ of a revolution in opposite directions respectively thus forming a complete hem as shown in Fig. 15.

Operation of the gripper feet

After the folding of the hem is completed, gripper feet 61 are moved into slot 71 and press loop 76 against the wall 80 of slot 70. The gripper feet 61 advance the blank 33 along slot 71 across bridge 64 and onto platform 65 from which it is advanced to the sewing station.

Overall operation of the folding of the hem

Having now described the preferred embodiment of our invention the following is a brief description of the overall operation of the machine.

Before the hem folding operation performed by the apparatus of the present invention is begun, the longitudinal edges of the web have already been formed with a hem. Bearings 52 have been swung outwardly from their supporting positions on hem forming bars 35, 35'. Web grippers 32 pick up the web at the position to the left of the machine as viewed in the side views (Figs. 1, 3 and 5) of the drawings. The grippers 32 draw the web 33 toward the right side of the machine and across hem forming bars 35, 35' so as to cover slots 70. Bearings 52 swing down, engaging extensions 72 of the hem forming bars. The slack bar 60 then measures the length of the blank and creates the slack in the web. Web clamps 36 hold the web against the hem forming bar. Knife 46 cuts the blank from the web. Then loop forming blades 75 move down into slot 70, pressing the edges of the blank into the slot 70 and thus forming the first loop. The clamps 36 then move upwardly. The hem forming bars rotate ¾ of a revolution as shown in Fig. 13, forming the second loop 77. Gripper feet 61

move into slot 71 engaging the first loop 76 of the hem and advance the hem along the slot 70, over surface 78a of bridge 64, onto surface 79 of platform 65, and onto the sewing machines (not shown). The hem forming bars 36 now rotate ¾ of a revolution to their original position and outer bearings 52 swing outwardly allowing free passage of gripper 32 and thus the machine is ready to repeat the operation.

In a general manner, while we have, in the above description, disclosed what we deem to be practical and efficient by embodiments of our invention, it should be well understood that we do not wish to be limited thereto as there might be changes made in the arrangement, disposition and form of the parts without the departing from the inventive concept as expressed by the accompanying claims. We also wish it to be understood that the invention is applicable to the folding of other sheet material besides handkerchief material, and the advancing of such material from the folding apparatus.

We claim:

1. In a machine for folding material to form a hem, the combination of at least one rotatable hem forming bar, said bar having at least one longitudinally extending slot therein, means for advancing the material in a direction transverse to the length of said bar to hem folding position with the end portion of the material overlying and extending slightly beyond the slot in said bar and with an edge of the material substantially parallel to the longitudinal axis of the bar, releasable means for holding said fabric in the overlying position against said bar, means cooperable with said slot for depressing the material into the slot in said bar to form a loop in the material, means for rotating said bar to draw the material around the bar and thereby to form a second loop in the material which completes the folding of the hem, and means movable longitudinally of said bar and cooperating with said bar for moving said hemmed material from the bar.

2. In a machine for folding material to form a hem, the combination of at least one rotatable bar, having at least one longitudinally extending slot therein, means for advancing the material in a direction transverse to the length of said bar to a folding position with an edge portion of the material overlying and extending slightly beyond the slot in said bar, means cooperable with said slot for pressing said material into the slot in said bar to form a loop in the material, means for rotating said bar to draw the material around and form a second loop which completes the folding of the hem, and means movable longitudinally of said bar and cooperating with said bar for moving said hemmed material off of the bar.

3. In a machine for folding material to form a hem, the combination of at least one rotatable bar having at least one longitudinally extending slot therein, supporting means for the bar including swingably mounted bearing means located at one end of said bar when in normal, supporting position, means normally lying clear of said bearing means and movable through the normal position of said swingable bearing means for advancing the material in a direction transverse to the length of said bar to a holding position with an edge portion of the material overlying and extending slightly beyond the slot in said bar, means for swinging said bearing away from said bar to a position clear of the path of said

advancing means and for subsequently returning said bearing to normal supporting position after return of said advancing means to its normal position, means cooperable with said slot for pressing said material into the slot in said bar to form a loop in the material, and means for rotating said bar to draw the material around the bar and form a second loop in the material which completes the folding of the hem.

4. In a machine for folding a fabric to form a hem, and advancing said folded fabric to a subsequent work station the combination of at least one rotatable hem forming bar, said bar having two longitudinally extending, intersecting slots therein, said bar being positioned to receive the fabric with an end portion thereof overlying and extending slightly beyond the slot, means cooperable with said slot for depressing an end portion adjacent a free edge of said fabric into the slot to form a first loop therein, means for rotating said bar so that said first loop in the slot moves in a direction to wrap the fabric about the free edge and to draw the fabric around the bar thereby forming a second loop which completes the forming of the hem, fabric engaging means slidable in the second of said slots in frictional engagement with the first loop in said fabric, and means for moving said fabric engaging means in a direction longitudinally of said bar to remove said hemmed fabric from said bar to the next work station.

5. In a machine for forming hems in the edges of fabric blanks cut from a long fabric web, the combination of at least two rotatable hem forming bars in parallel spaced relation, each of said bars having at least one longitudinally extending slot formed therein, means for advancing the web in a direction transverse to the length of said bars to a hem folding position where a portion of the web comprising a blank lies across the bars and spans the space between said bars with the free end extending slightly beyond the second of said bars, releasable means holding said web across said bars, cutting means located near the first of said bars and on the side of said first bar remote from said second bar to cut said blank from the web leaving the cut edge of said blank extending slightly beyond said first bar, means cooperable with the slots in said bars for depressing the bar overlying portions of said blank into the slots in said bars to form loops therein, means for rotating said bars to draw said fabric around said bars thereby forming second loops which completes the folding of the hems, and means movable longitudinally of said bar and cooperating with said bar for moving said hemmed blank off the bars to the next work station.

6. Apparatus according to claim 5, wherein said bar rotating means comprises a reciprocating rack drivably connected to pinion means mounted on said bars.

7. In a machine for forming a hem in the edges of a fabric blank cut from a long fabric web, the combination of at least two rotatable hem forming bars in parallel spaced relation, each of said bars having at least one longitudinally extending slot formed therein, means for advancing the web to a hem folding position where the web lies

across both of said bars, means for simultaneously measuring the length of a blank and creating slack in the web between said bars, cutting means to cut the blank from said web, leaving the cut end portions of said blank extending a predetermined length beyond said bars, means cooperable with the slots in said bars for depressing the end portions of said blank into the slots in said bars forming hem loops therein, means for rotating said bars to draw said fabric around said bars thereby forming second loops which completes the folding of the hems in each of said end portions, and means movable longitudinally of said bar and cooperating with said bar for advancing said hemmed blank to the next work station.

8. In a machine for folding a fabric to form a hem and for advancing the fabric to the next work station, the combination of at least one rotatable hem forming bar, said bar having at least two longitudinally directed slots therein, said slots intersecting each other substantially perpendicularly and with the first of said slots extending inwardly beyond the location of the intersection with the second of said slots, a swingably mounted bearing supporting the other end of said bar, means movable through the normal supporting position of said bearing for advancing the fabric to a hem folding position where the end portion of the fabric overlies the first of the slots in said bar with the edge of the fabric being substantially parallel to the longitudinal axis of said bar and extending slightly beyond said bar, means for swinging said bearing away from said bar to a position clear of the path of travel of said advancing means and for returning said bearing to supporting position after said advancing means is clear of said bearing, means for temporarily holding said fabric in the overlying position, means cooperable with said first slot for depressing said fabric into the first slot in said bar to form a first loop in the fabric, means for rotating said bar to draw the fabric around the bar thereby forming a second loop which completes the forming of the hem, gripper feet adapted to slide in the second of said slots and to frictionally engage the first loop in said fabric, means for moving said gripper feet in a direction longitudinally of said bar toward said bearing means to remove said folded fabric from said bar to the next work station, and a platform mounted on said bearing so that it forms a continuation of said bar when said bearing is in supporting position, and forms a bridge-like support for said folded fabric as it is advanced from said bar.

GUSTAVE A. ANDERSON.
CHARLES IDE KANE.

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