May 10, 1938. F. E. BICKFORD 2,116,995

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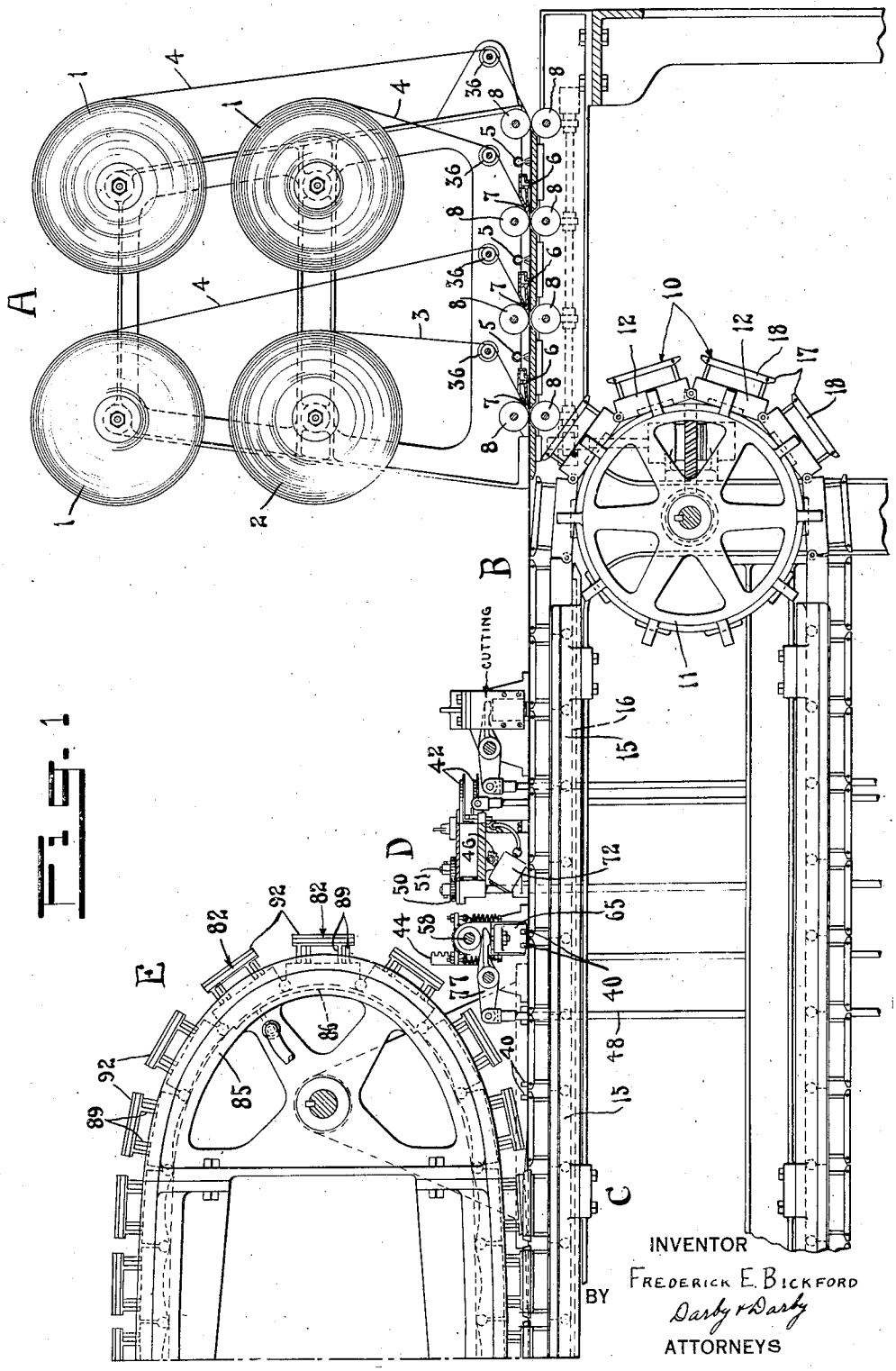

FIG. 1

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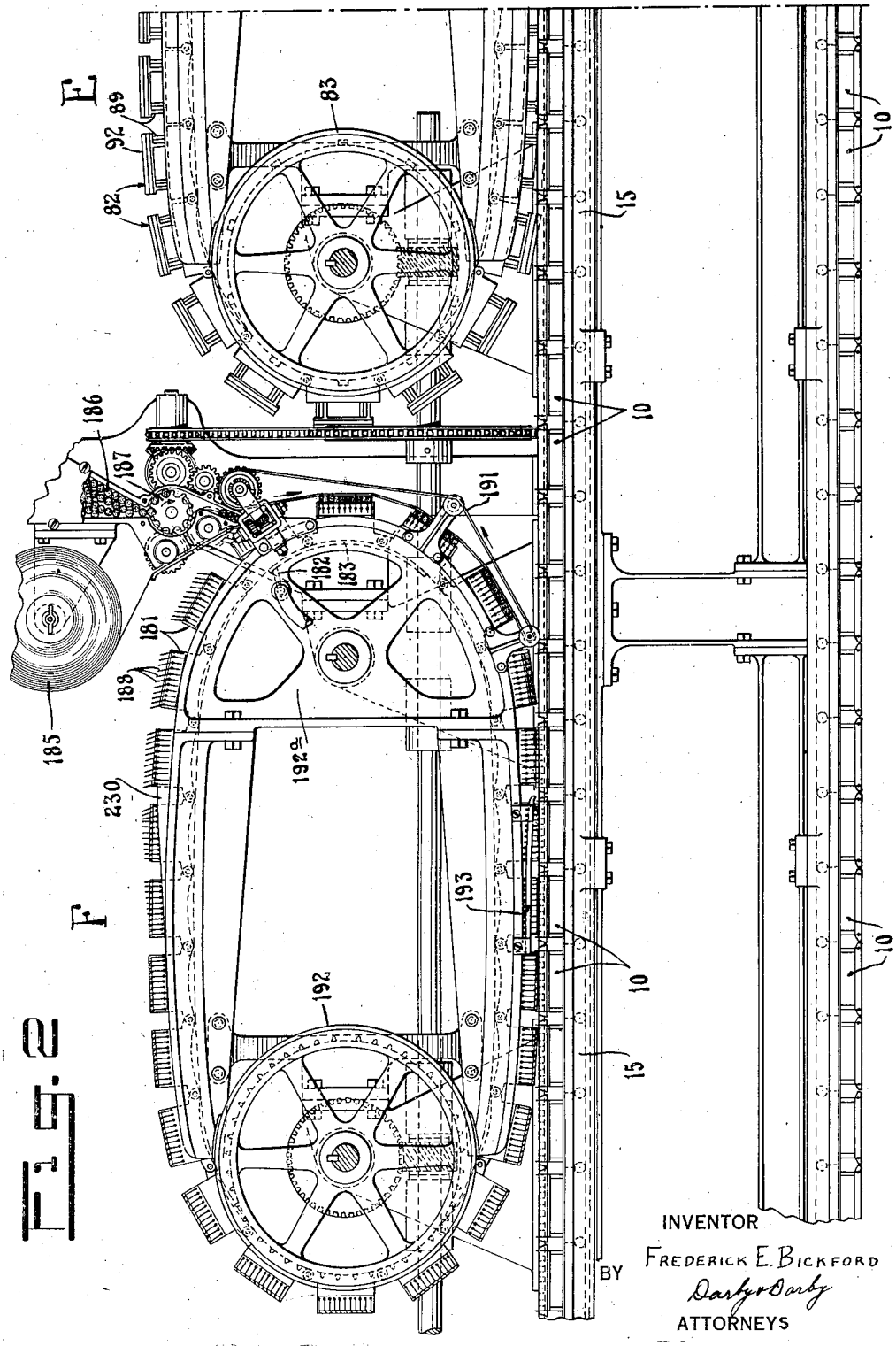

FIG. 2

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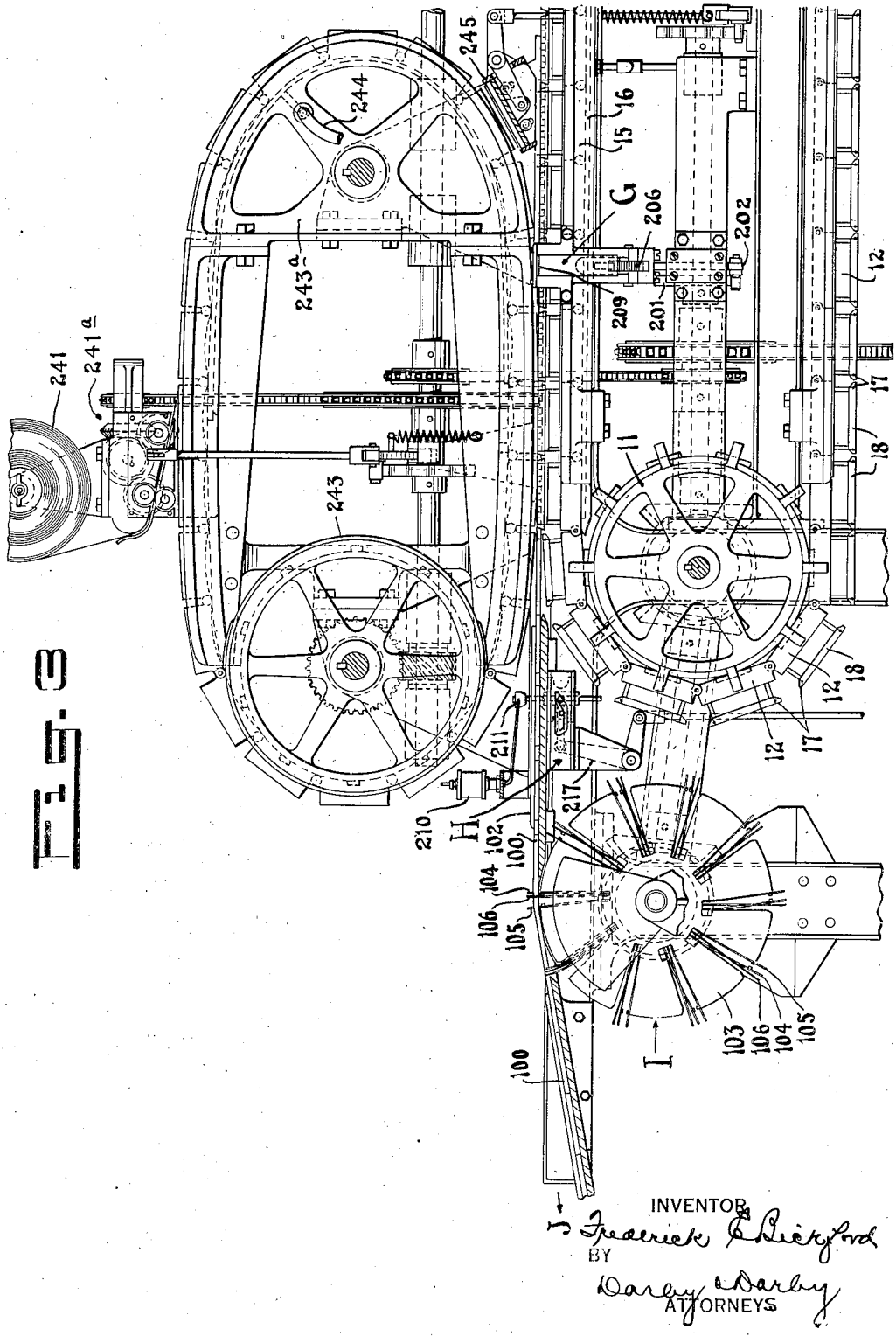

FIG. 3

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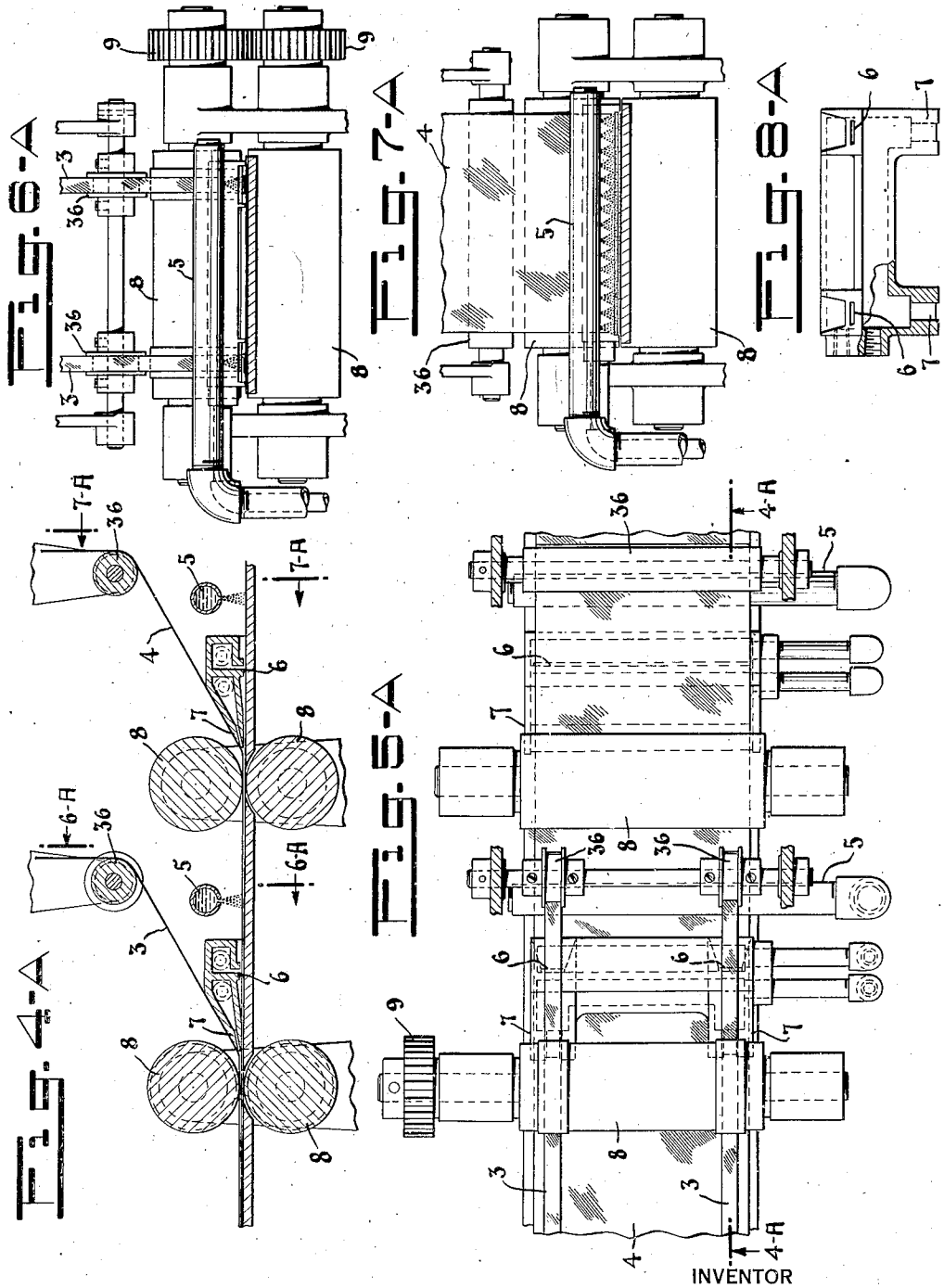

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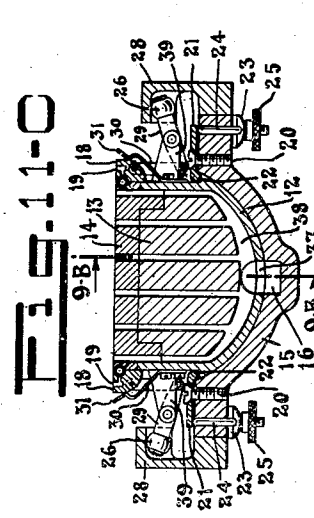

Fig. 11-C

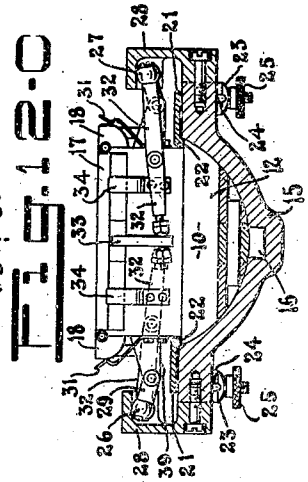

Fig. 12-C

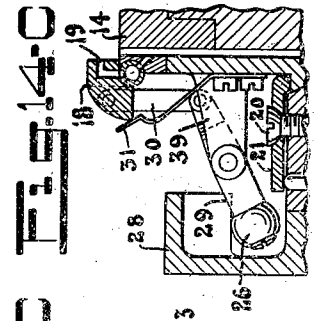

Fig. 14-C

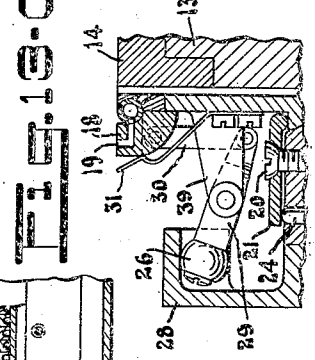

Fig. 13-C

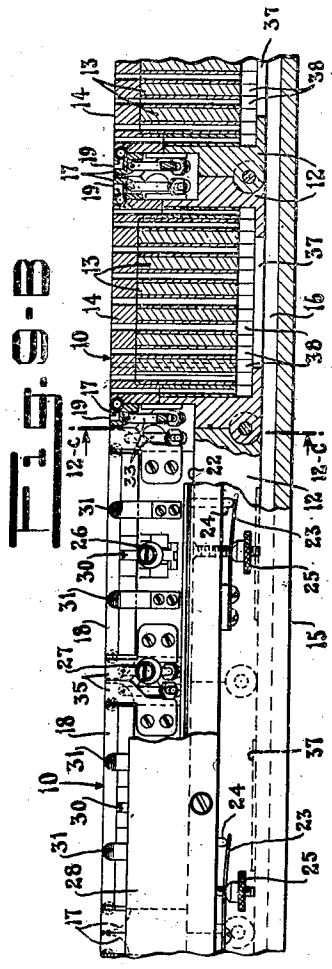

Fig. 9-B

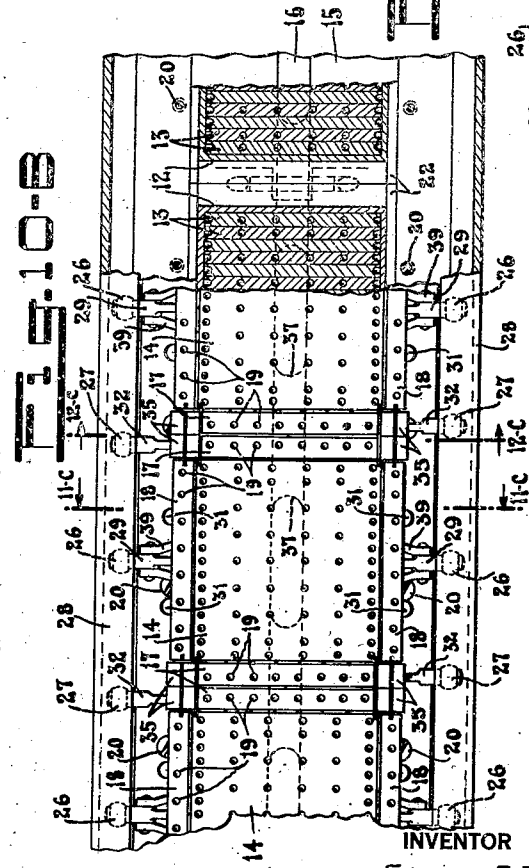

Fig. 10-B

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FIG. 16-D

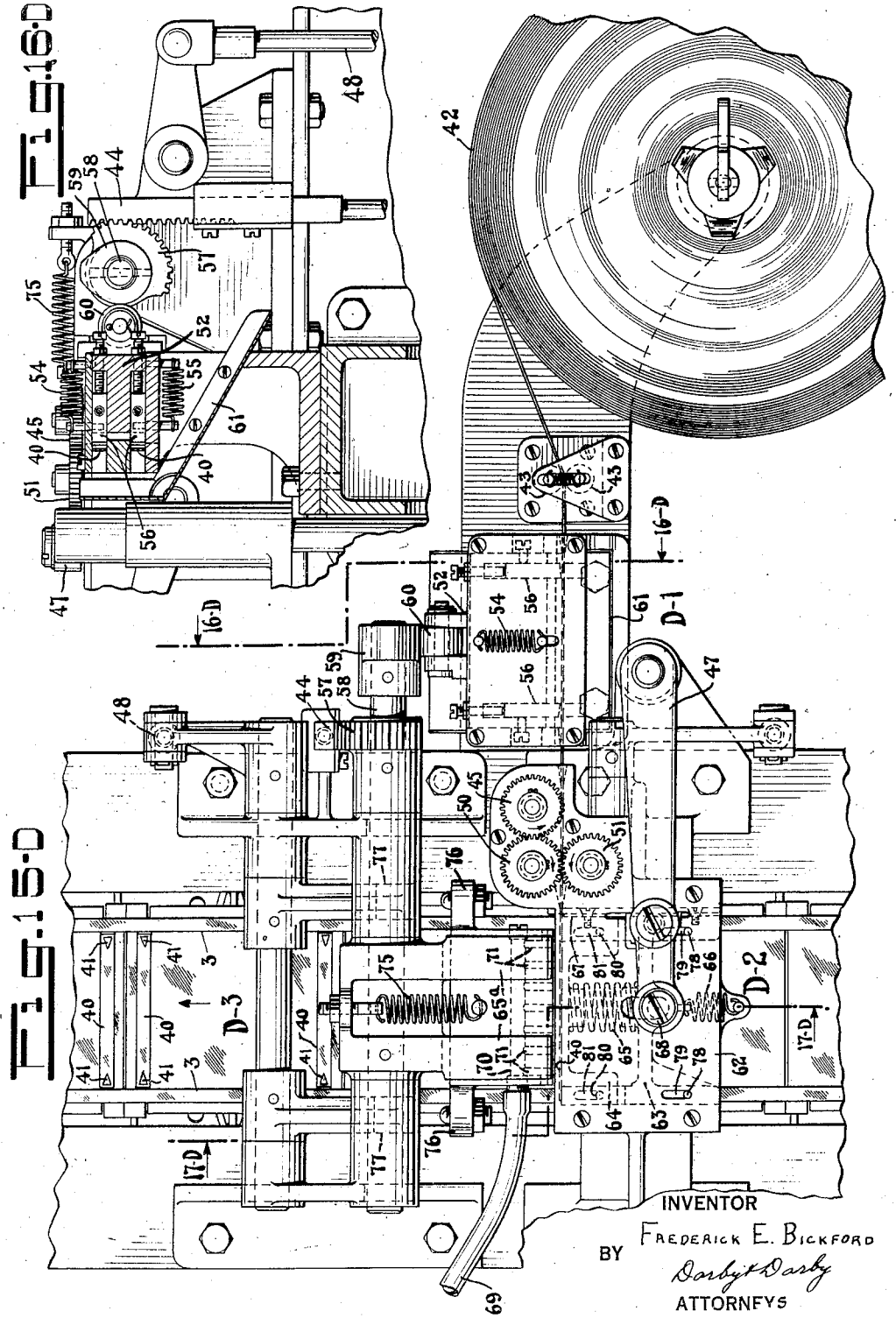

FIG. 15-D

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Fig. 18-D

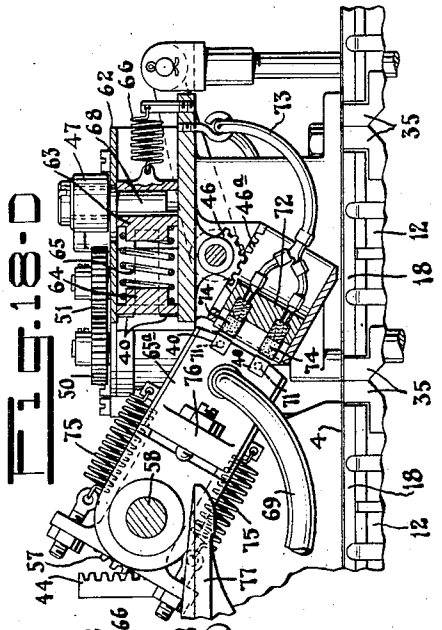


Fig. 17-D

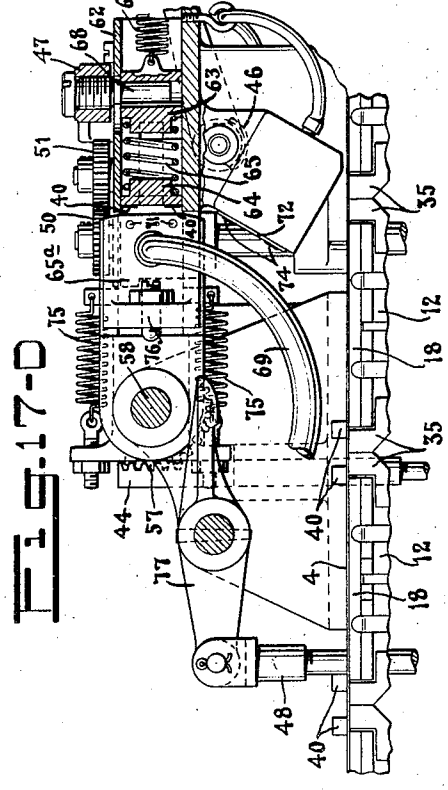


Fig. 20-D

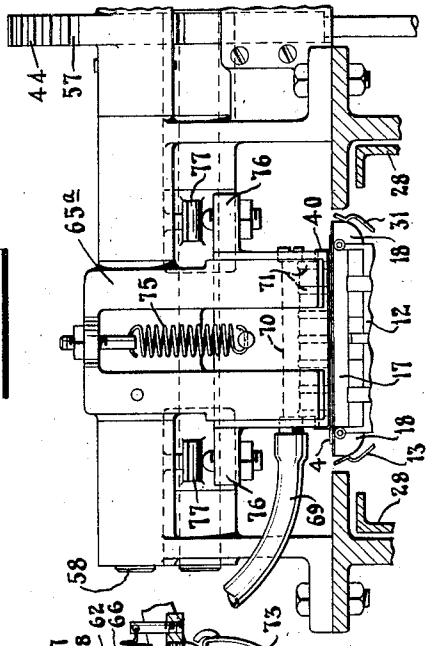
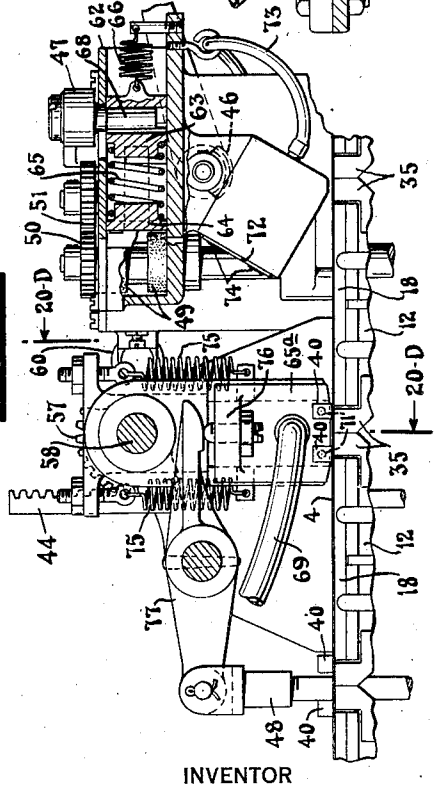


Fig. 19-D



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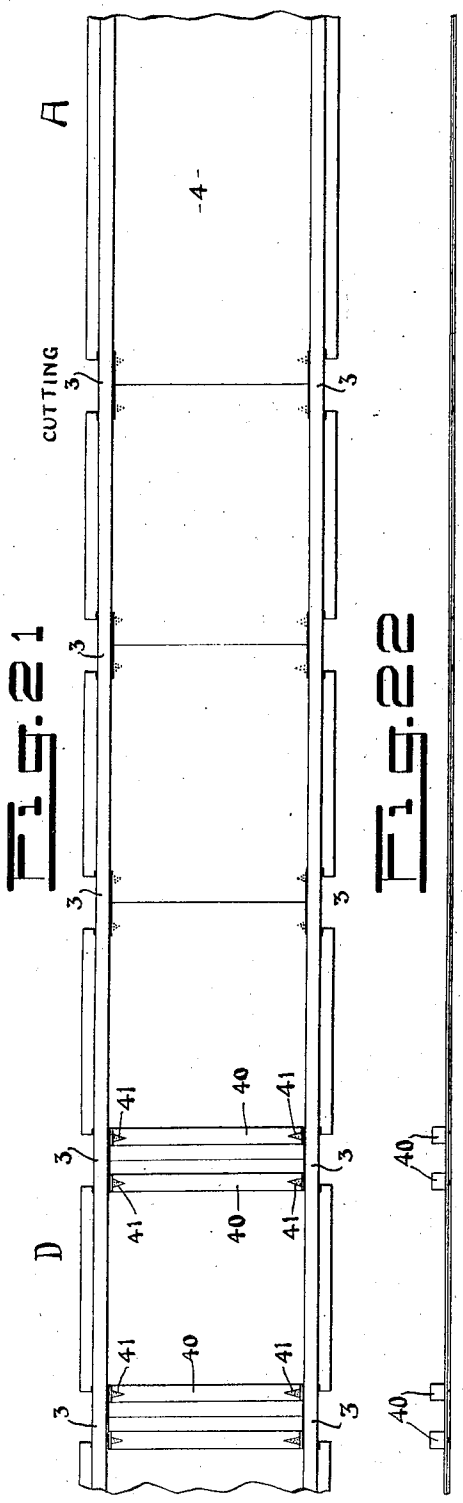

Fig. 21

Fig. 22

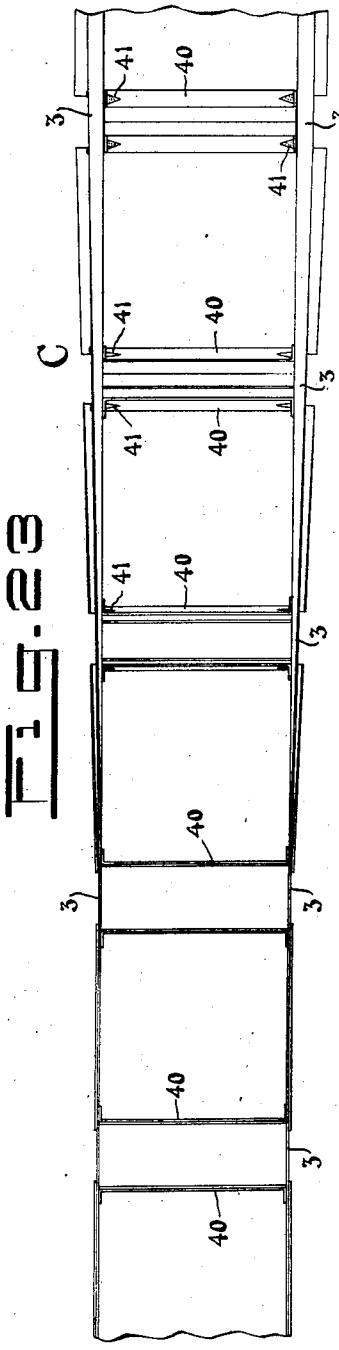

Fig. 23

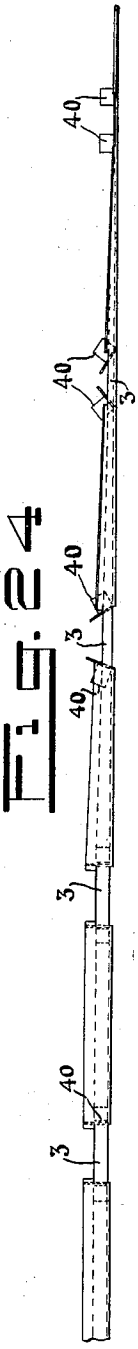

Fig. 24

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Fig. 25-E

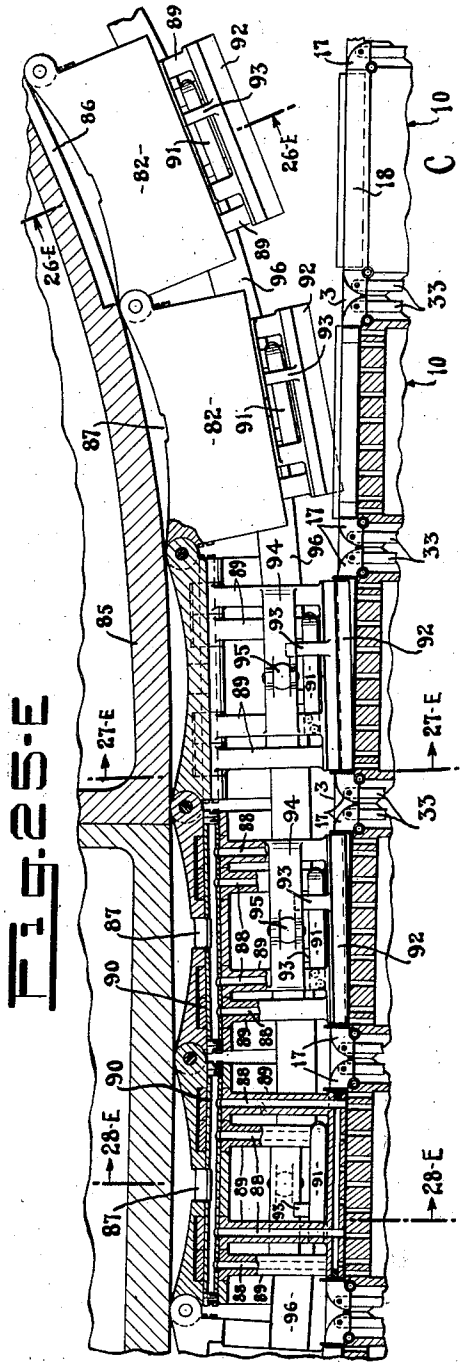

Fig. 26-E

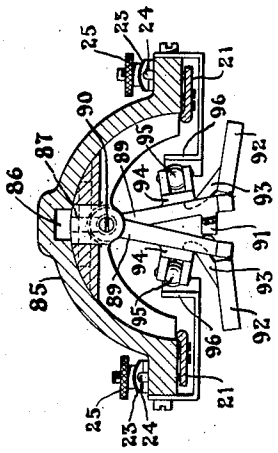

Fig. 27-E

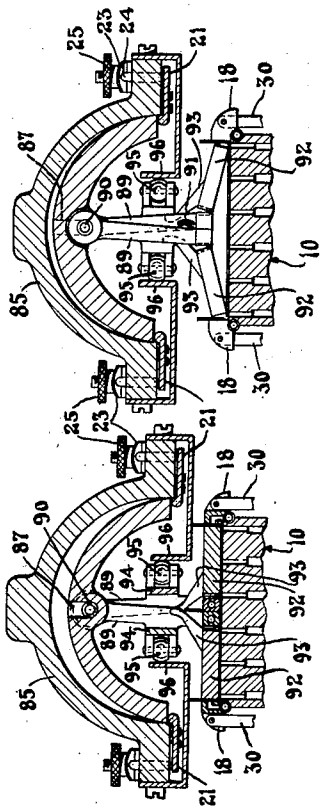

Fig. 28-E

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FIG. 31-E

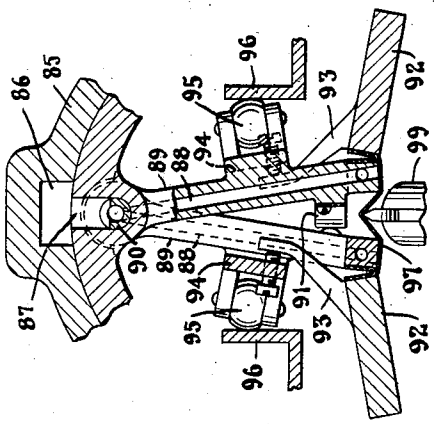

FIG. 34-E

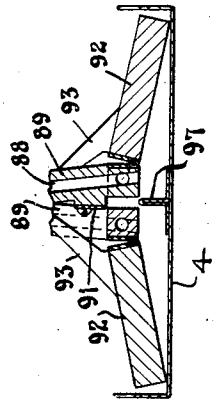

FIG. 30-E

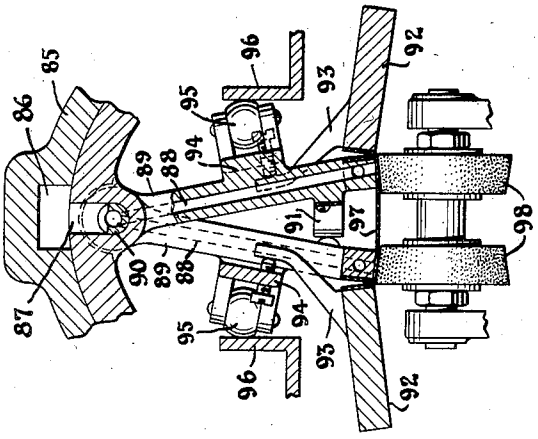

FIG. 33-E

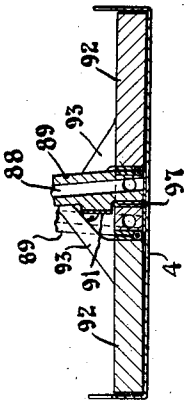

FIG. 29-E

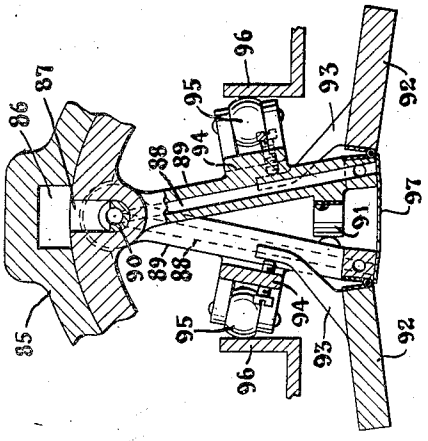

FIG. 32-E

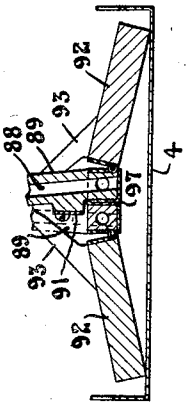

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Fig. 35-F

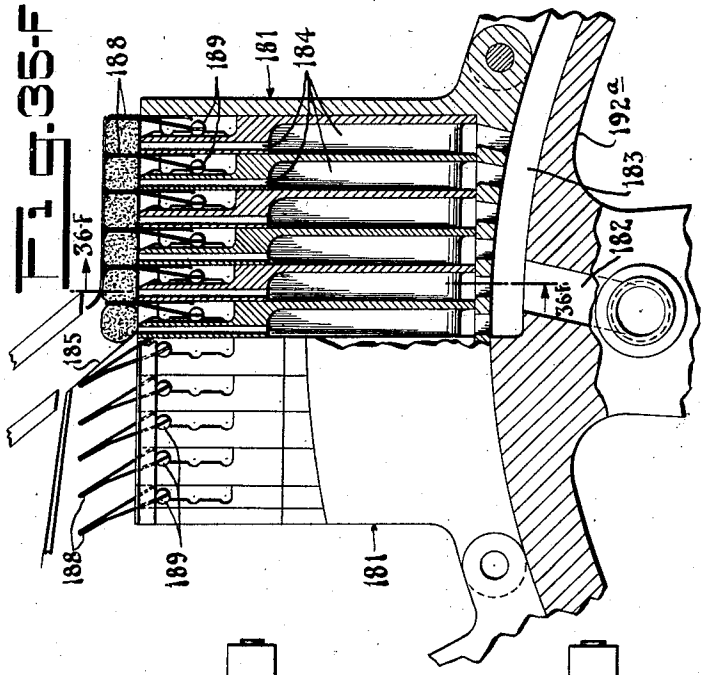


Fig. 36-F

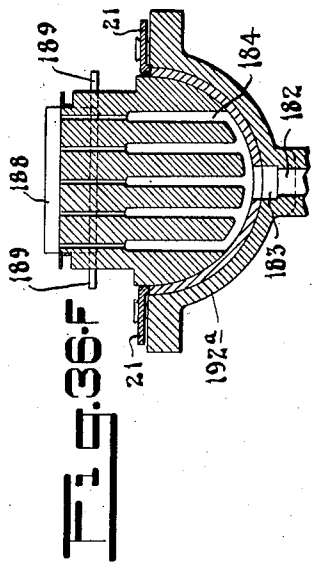


Fig. 37-F

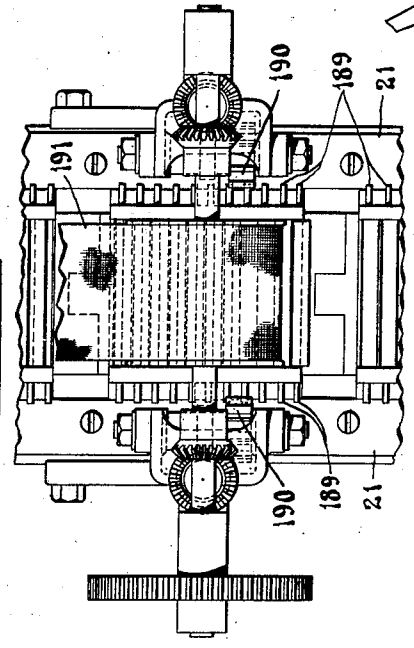
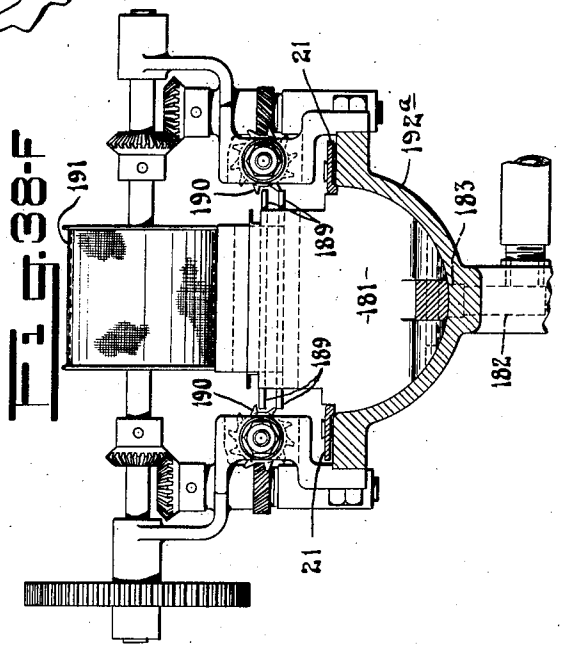


Fig. 38-F



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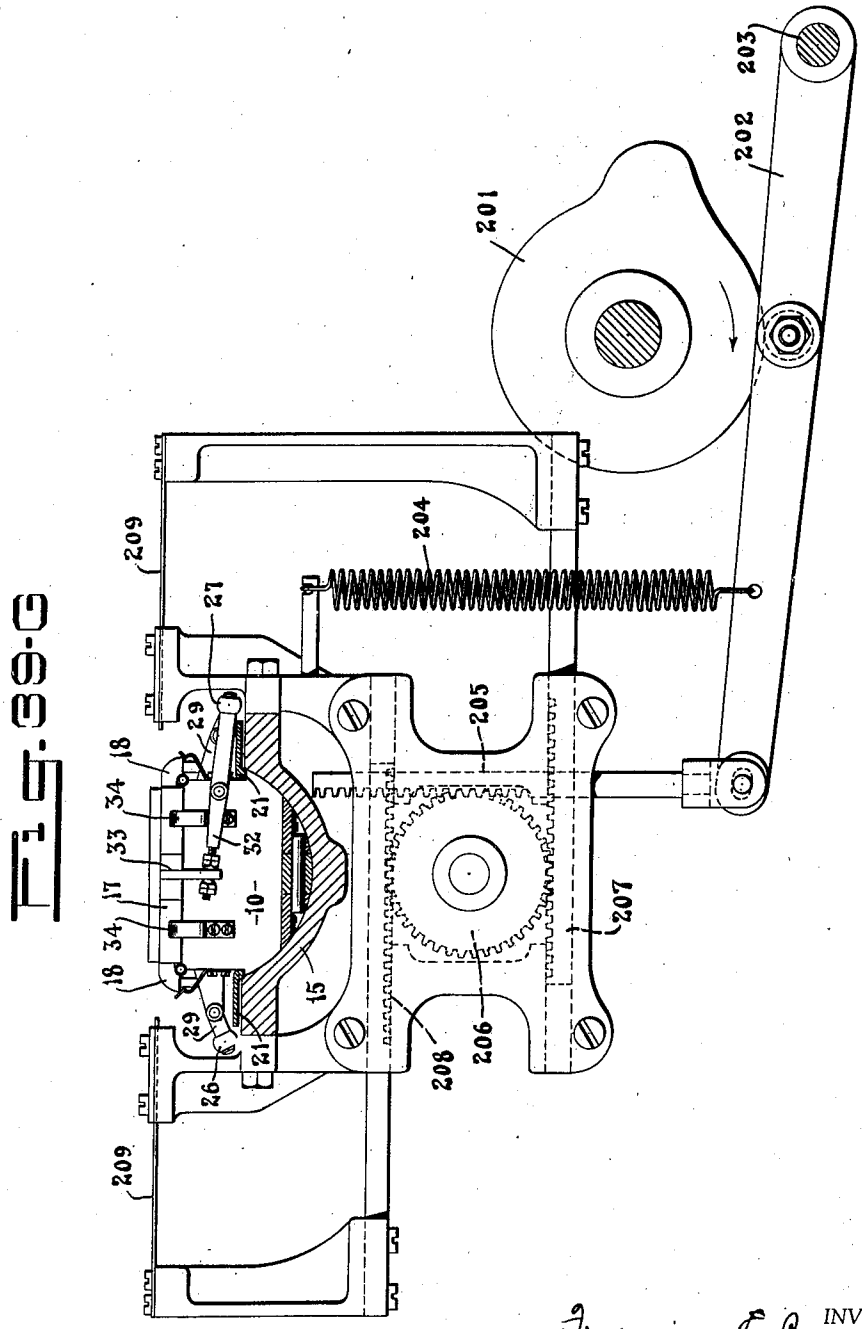

Fig. 39-C

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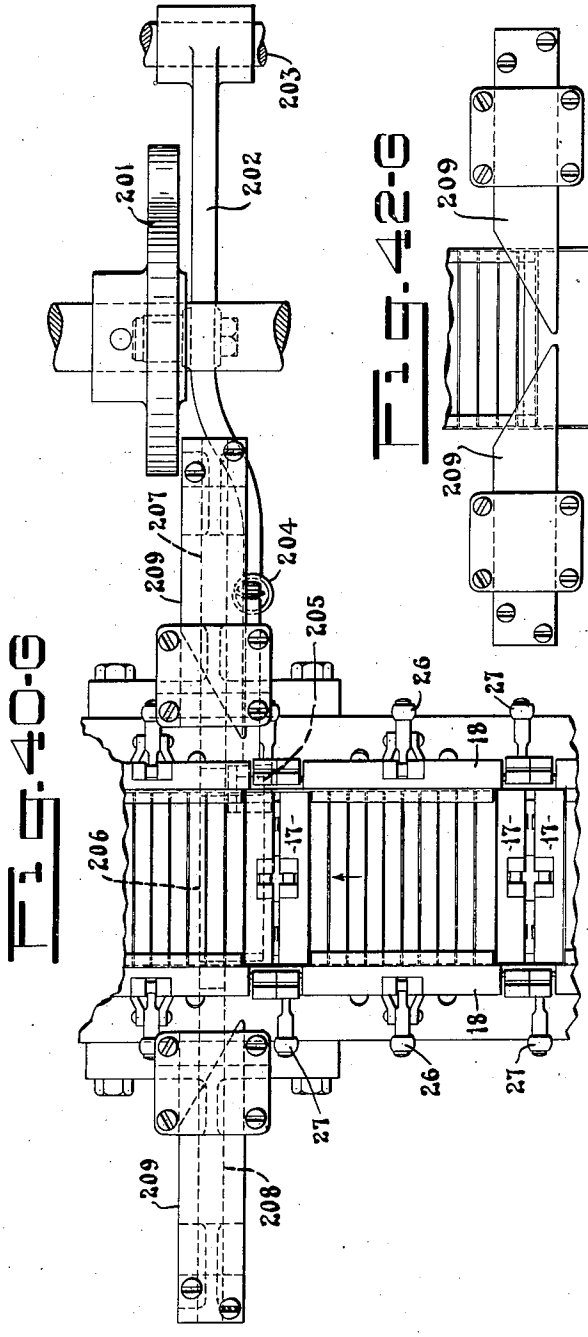

FIG. 40-G

FIG. 42-G

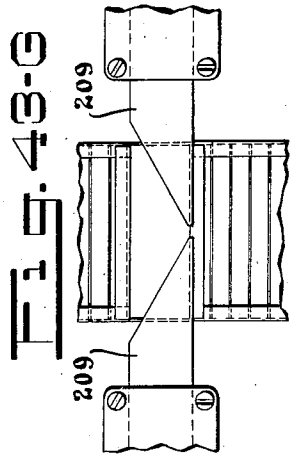

FIG. 43-G

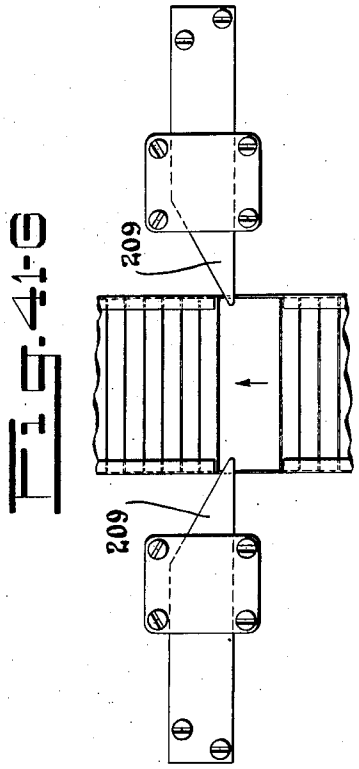

FIG. 41-G

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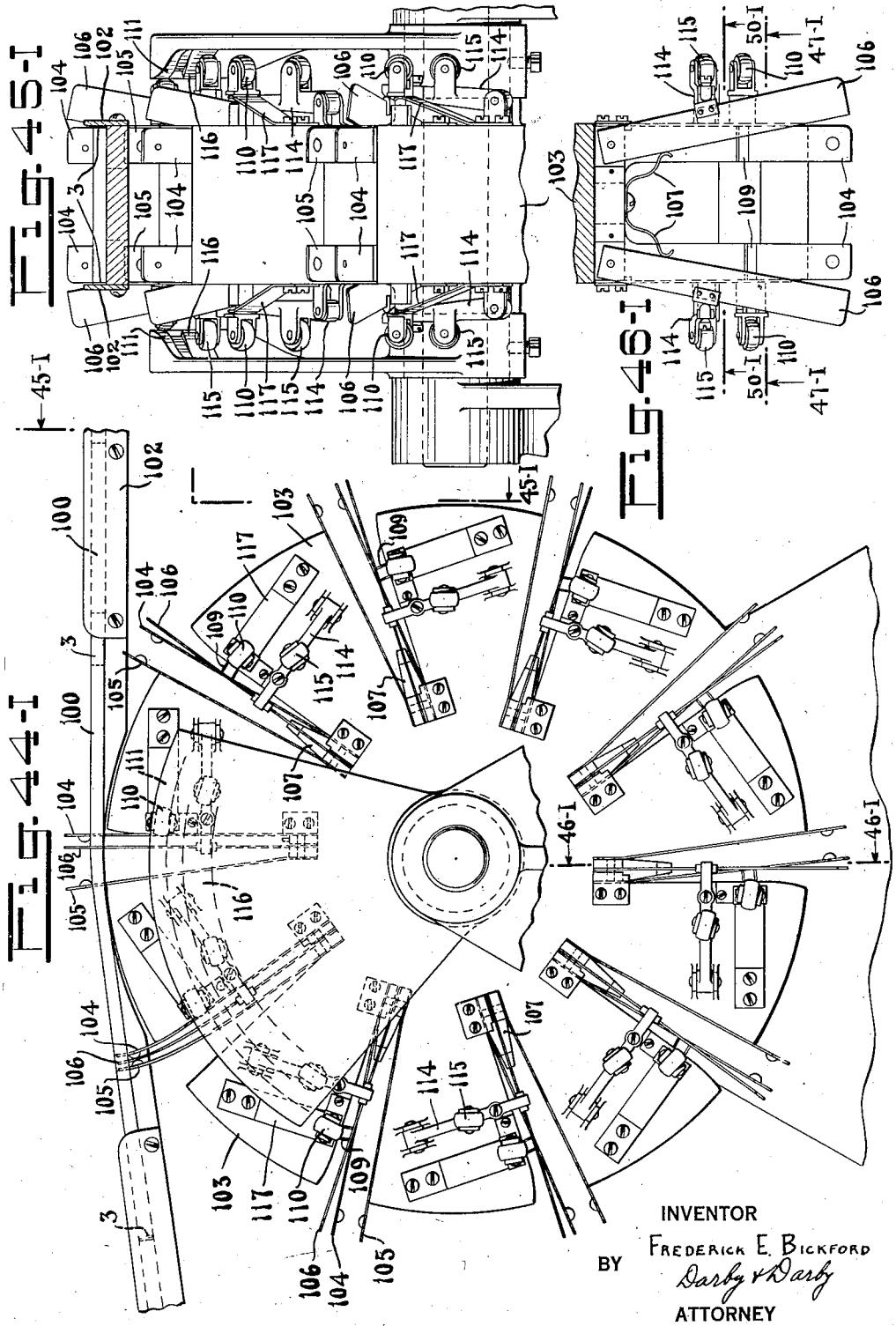

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Fig. 50-1

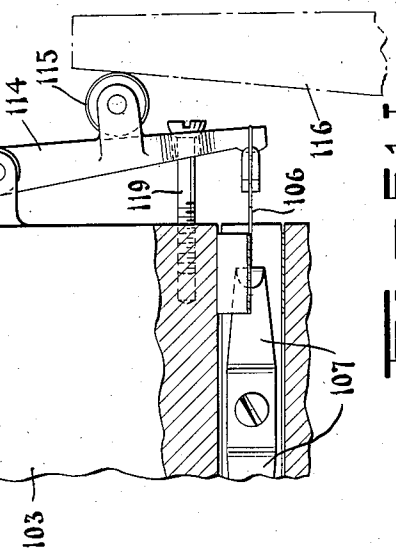


Fig. 51-1

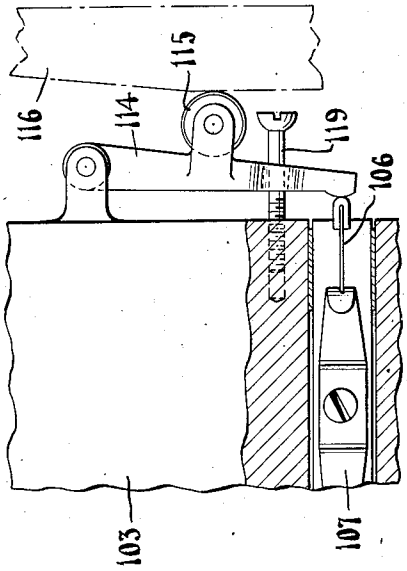


Fig. 47-1

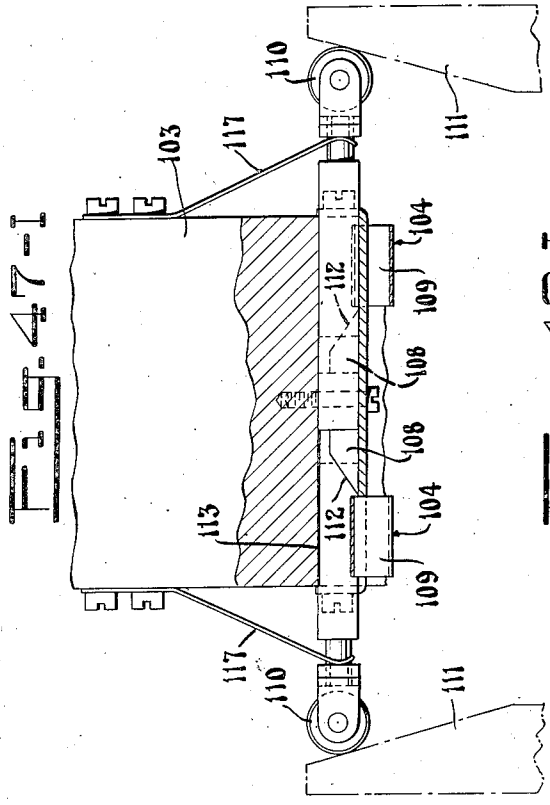


Fig. 48-1

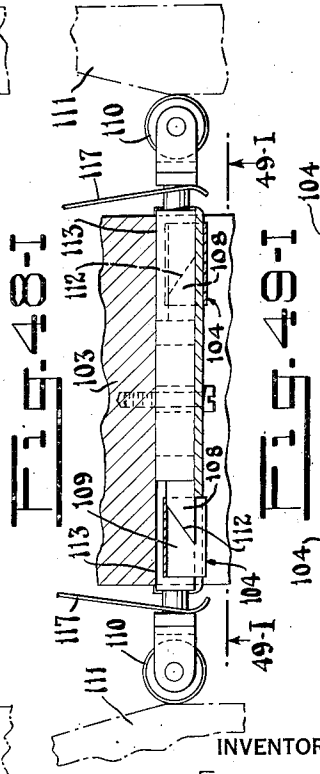
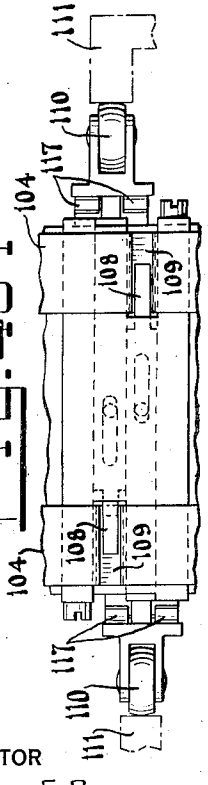


Fig. 49-1



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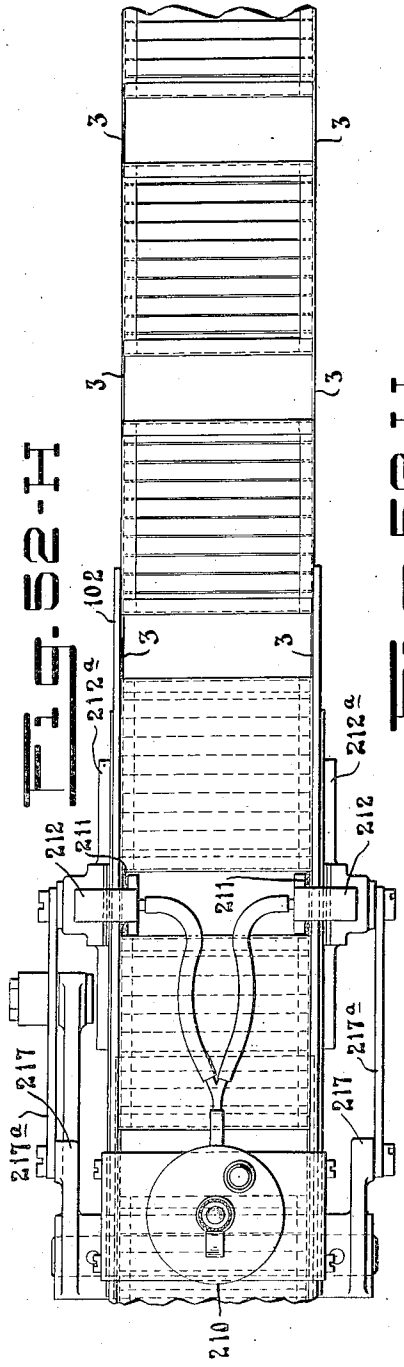

FIG. 52-H

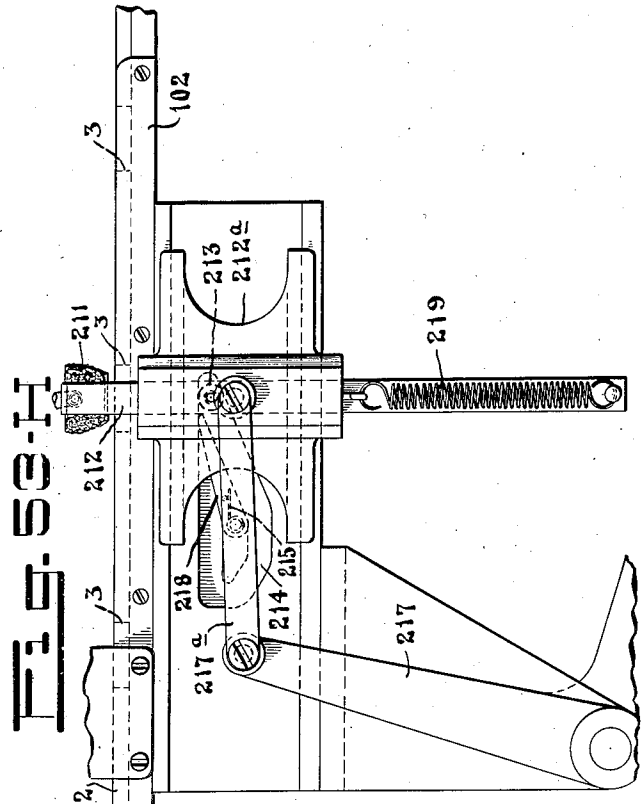

FIG. 53-H

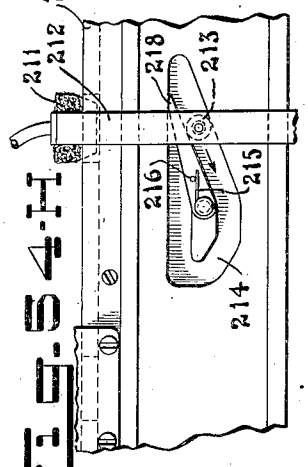

FIG. 54-H

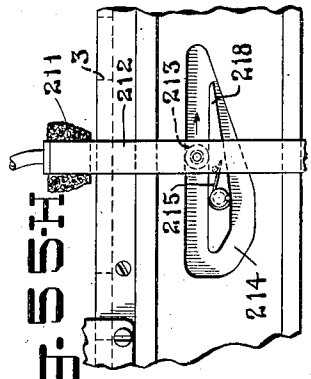

FIG. 55-H

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FIG. 56-J

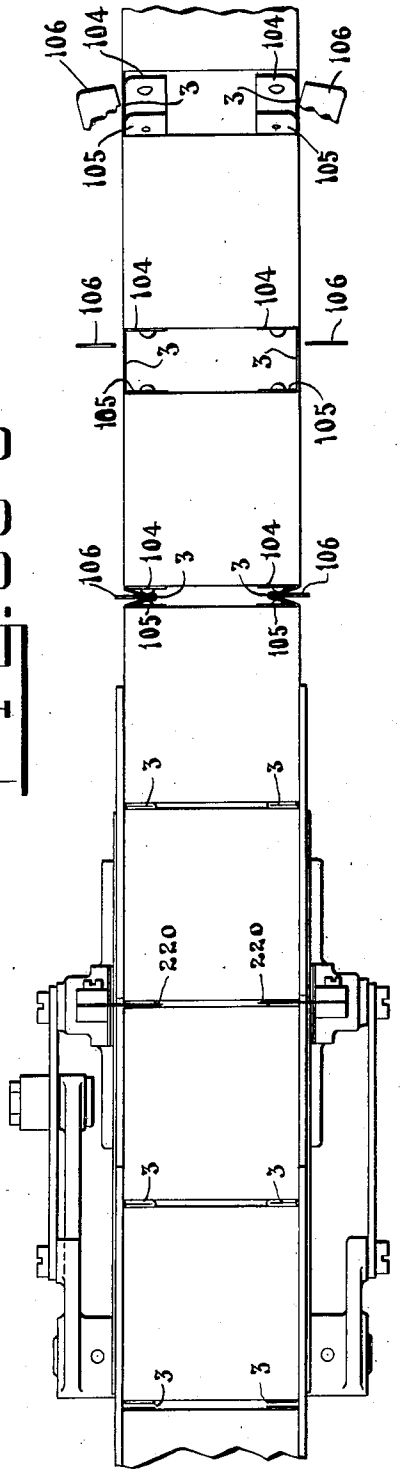
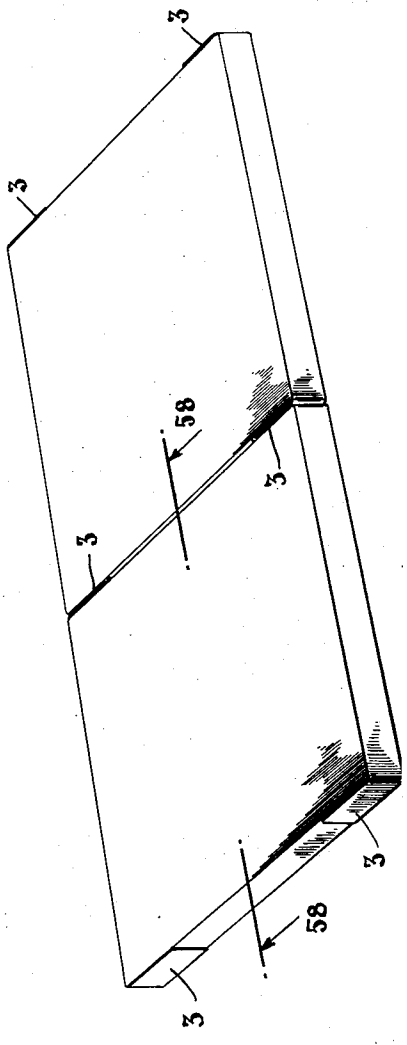


FIG. 57



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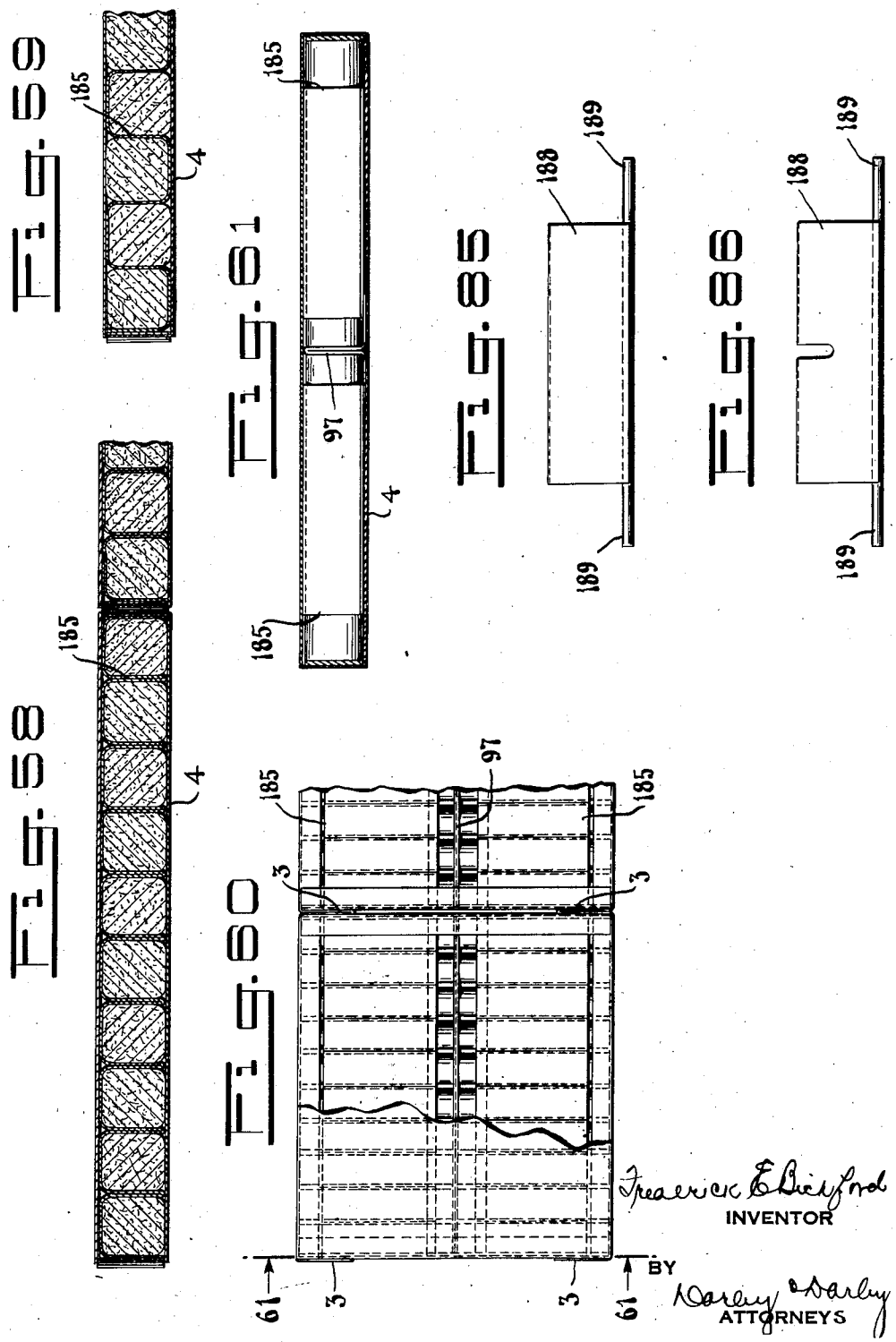

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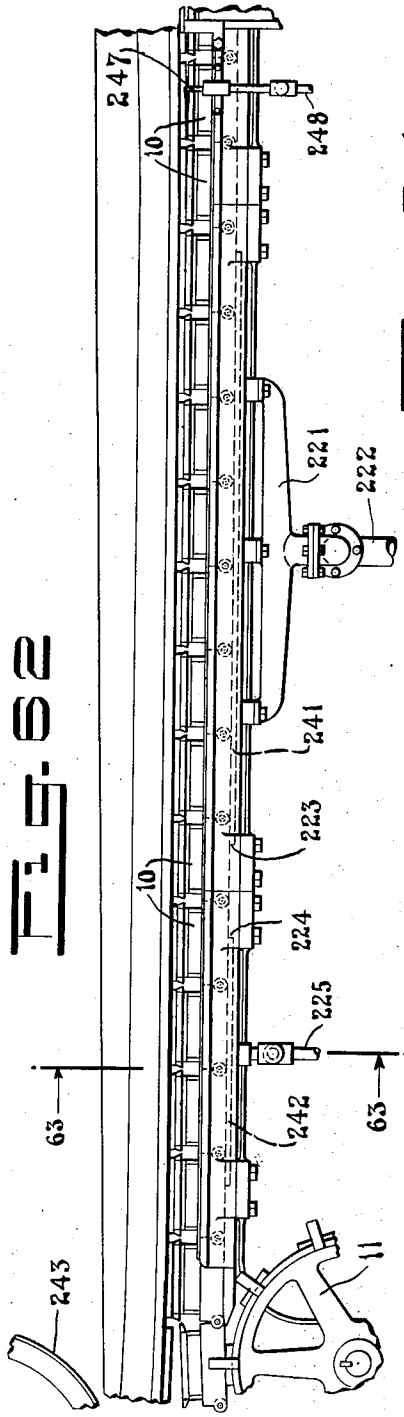

FIG. 62

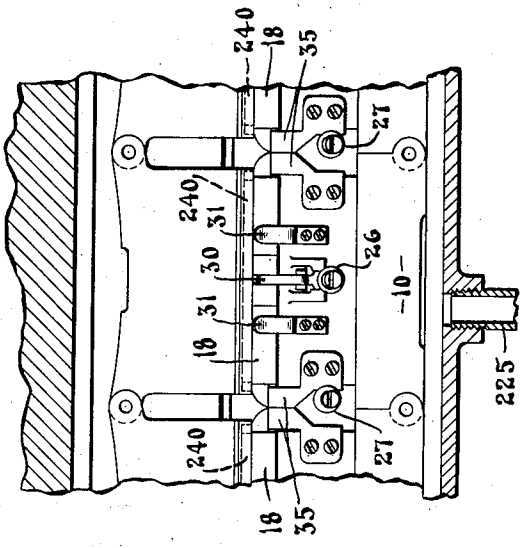

FIG. 64

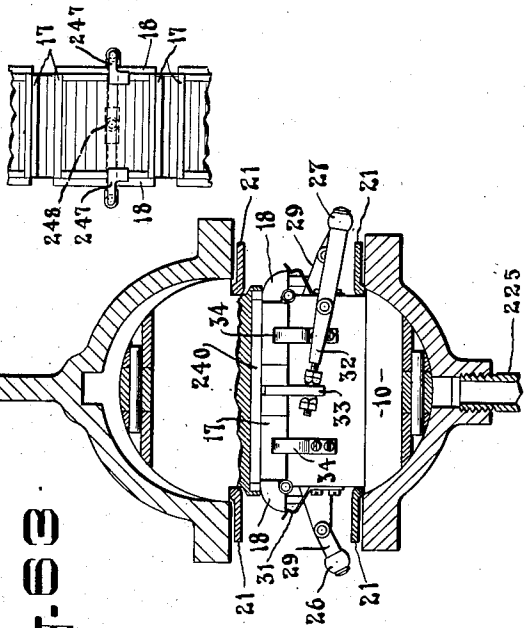

FIG. 63

FIG. 63-S

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Fig. 65

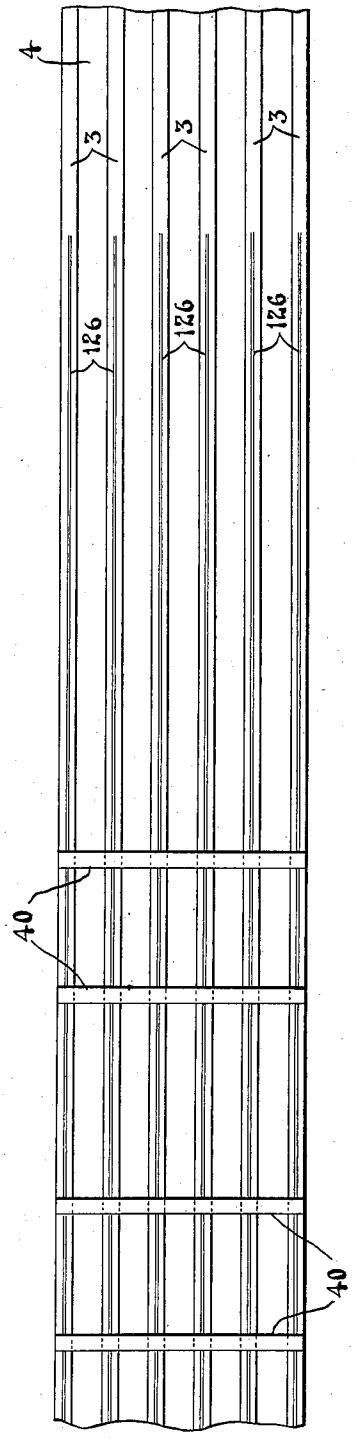

Fig. 66

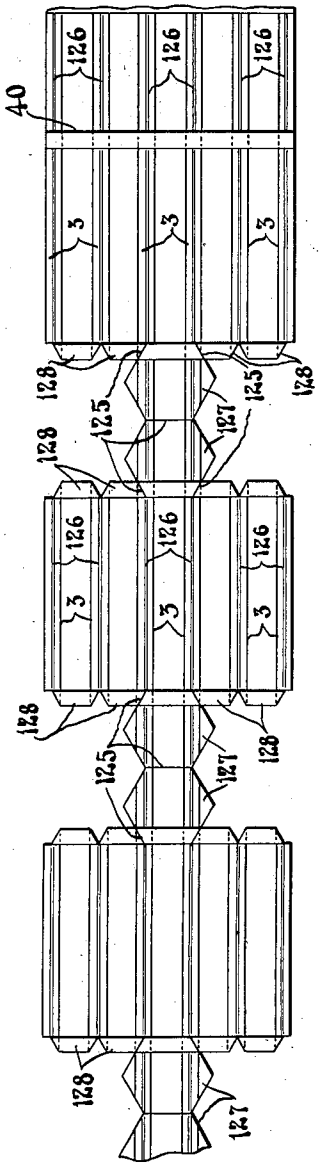

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Fig. 68-C

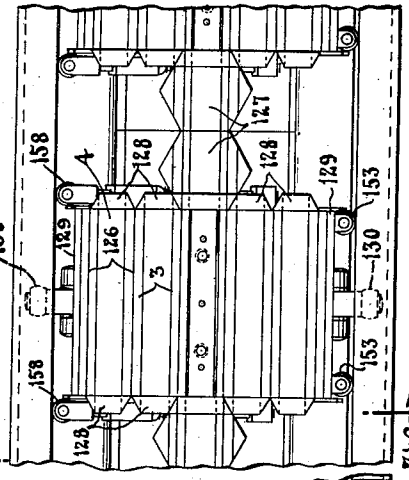


Fig. 70-C

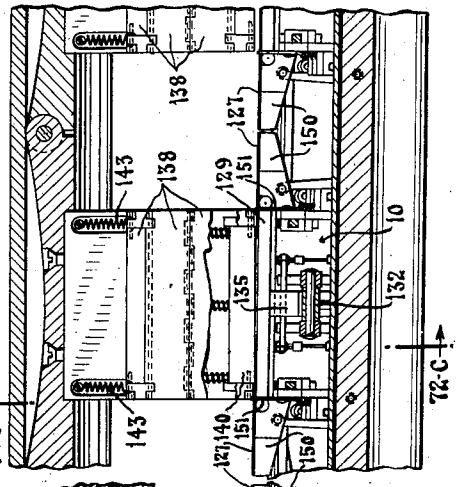


Fig. 67-C

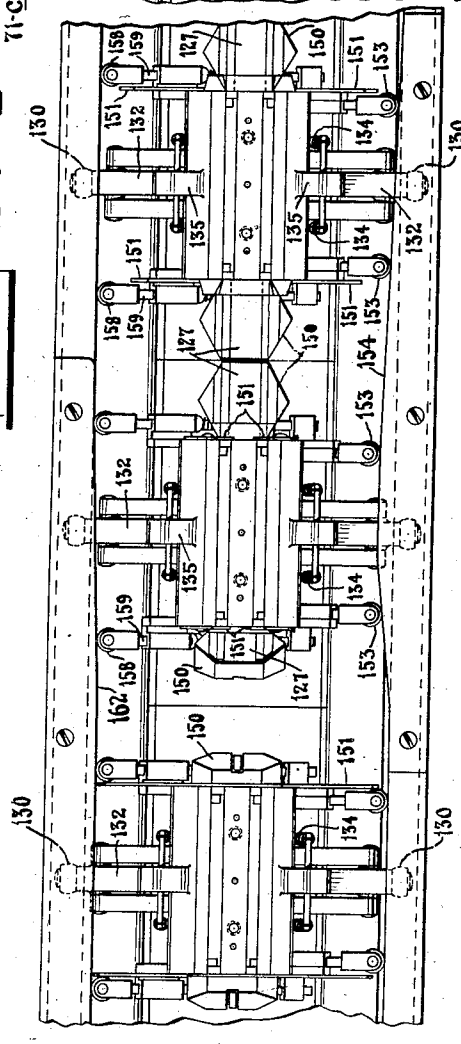
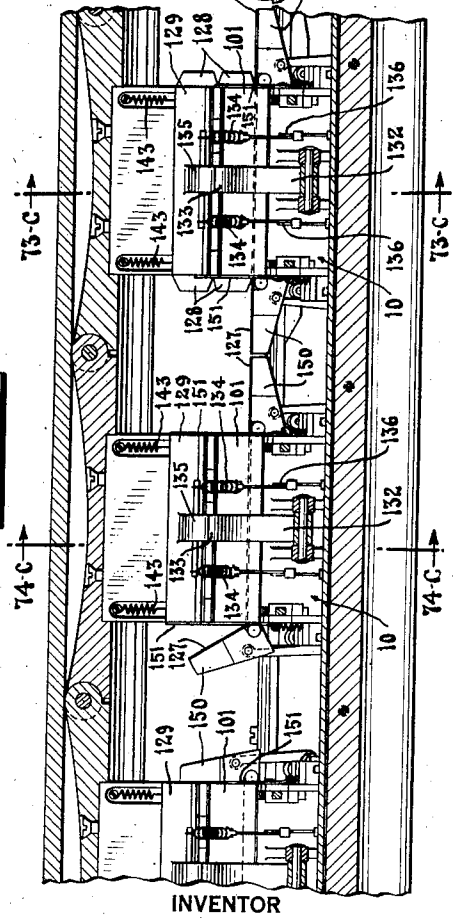


Fig. 69-C



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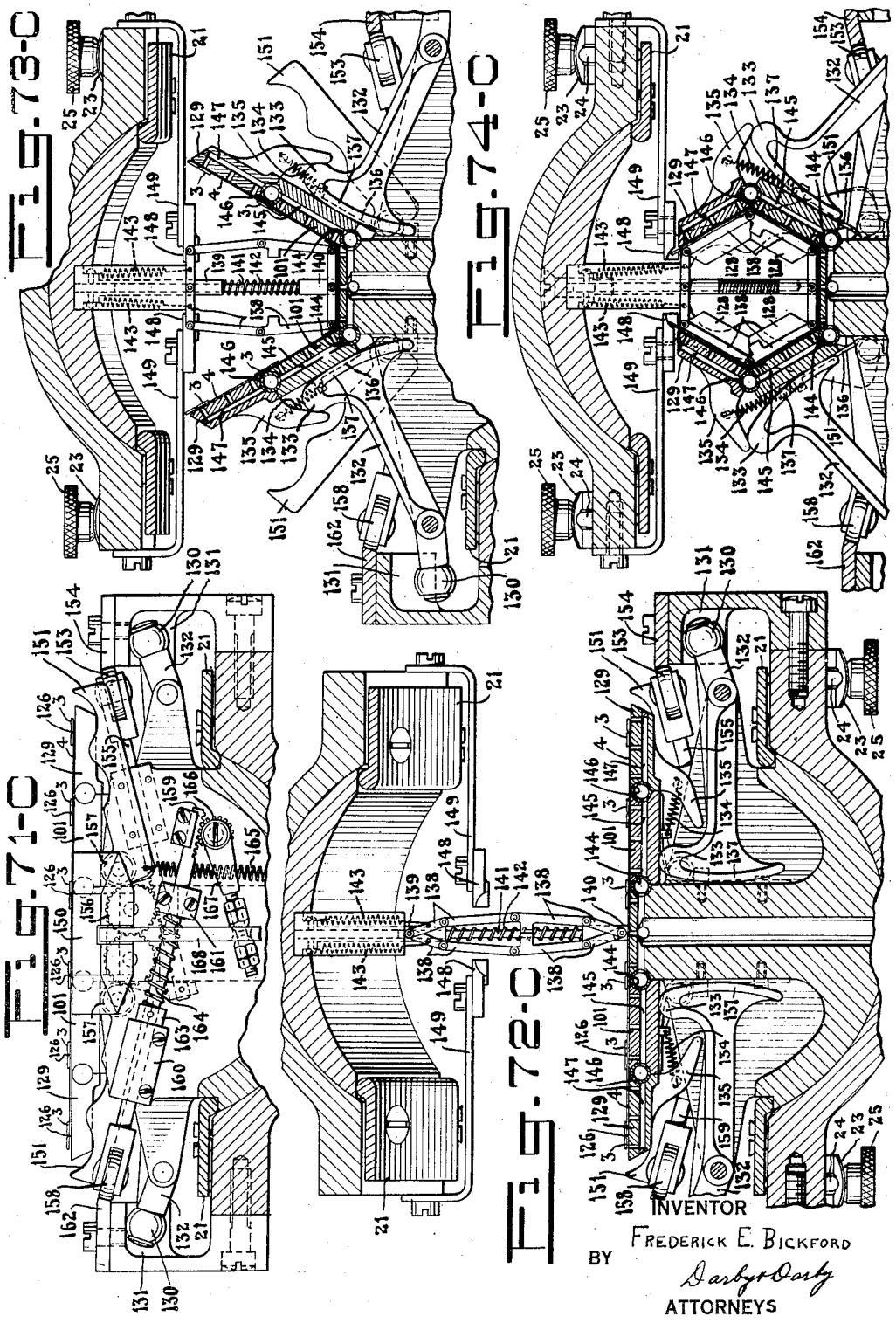

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Fig. 75

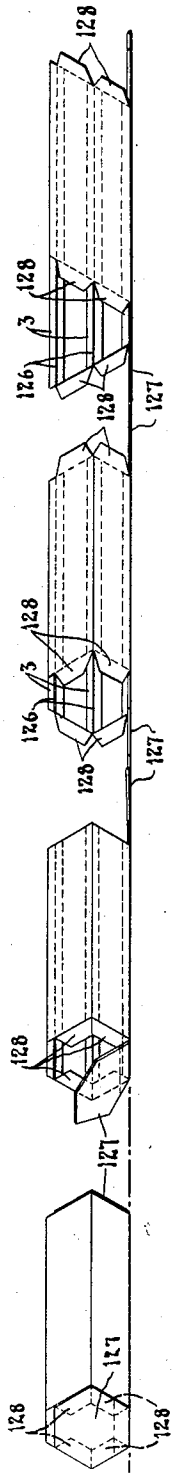


Fig. 76

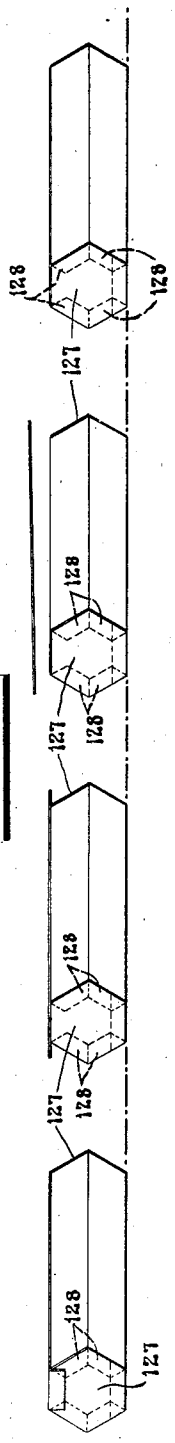
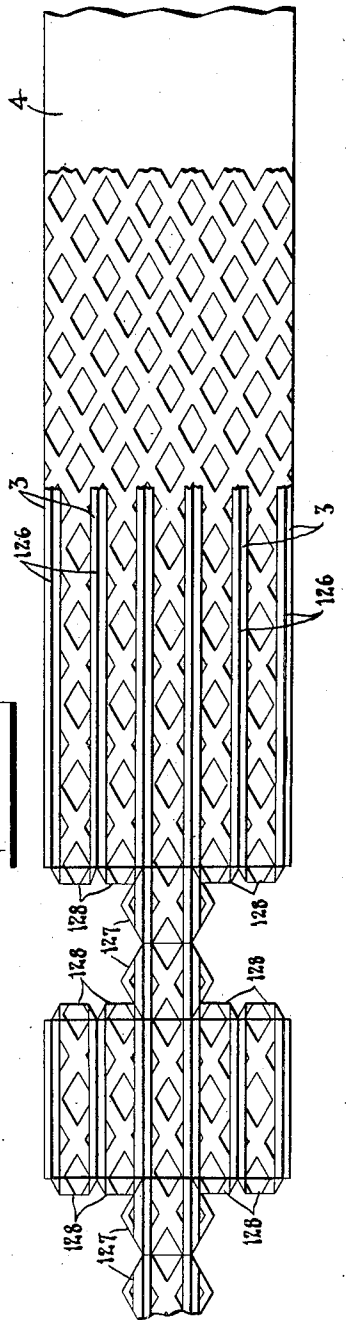


Fig. 77



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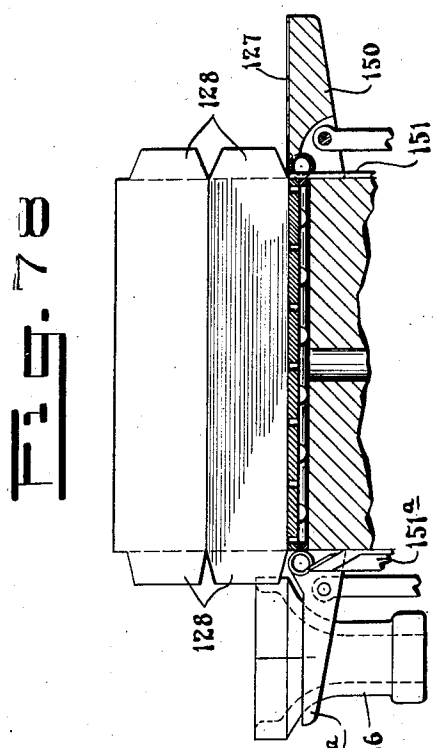

FIG. 78

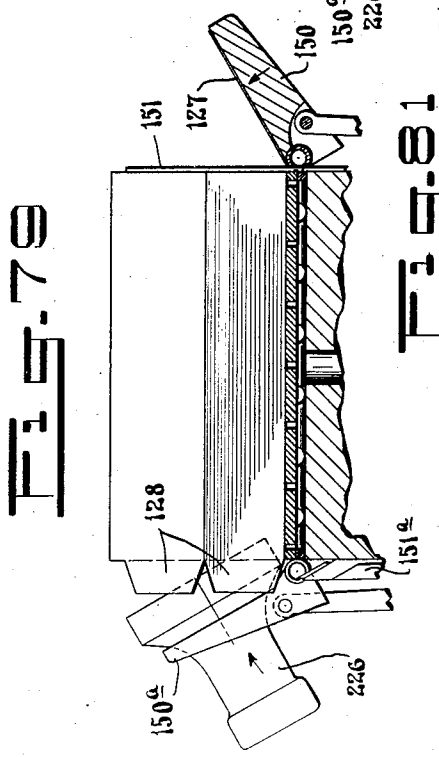

FIG. 79

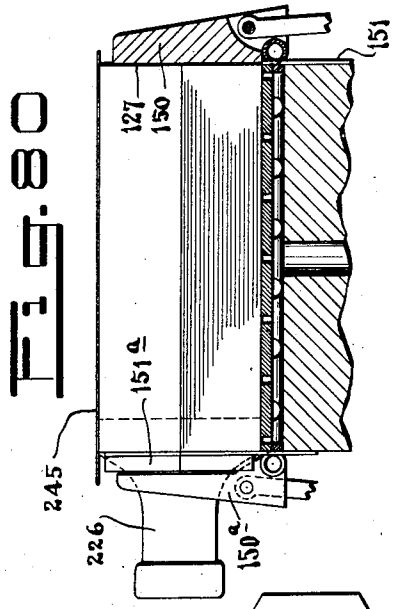

FIG. 80

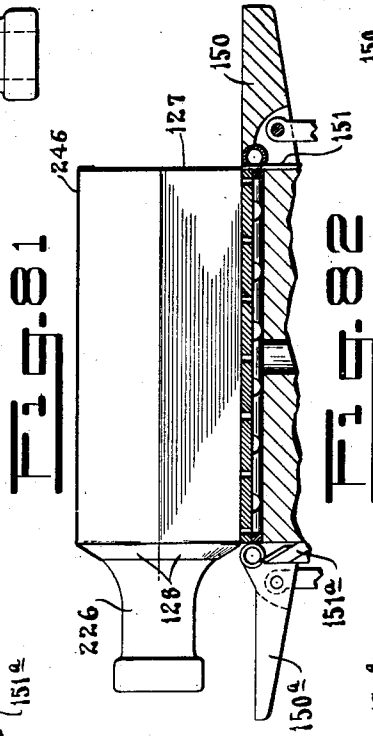

FIG. 81

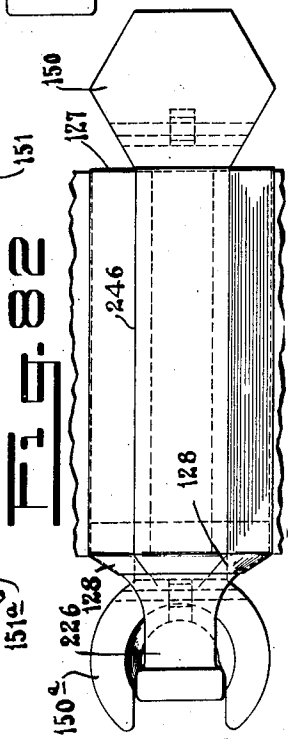

FIG. 82

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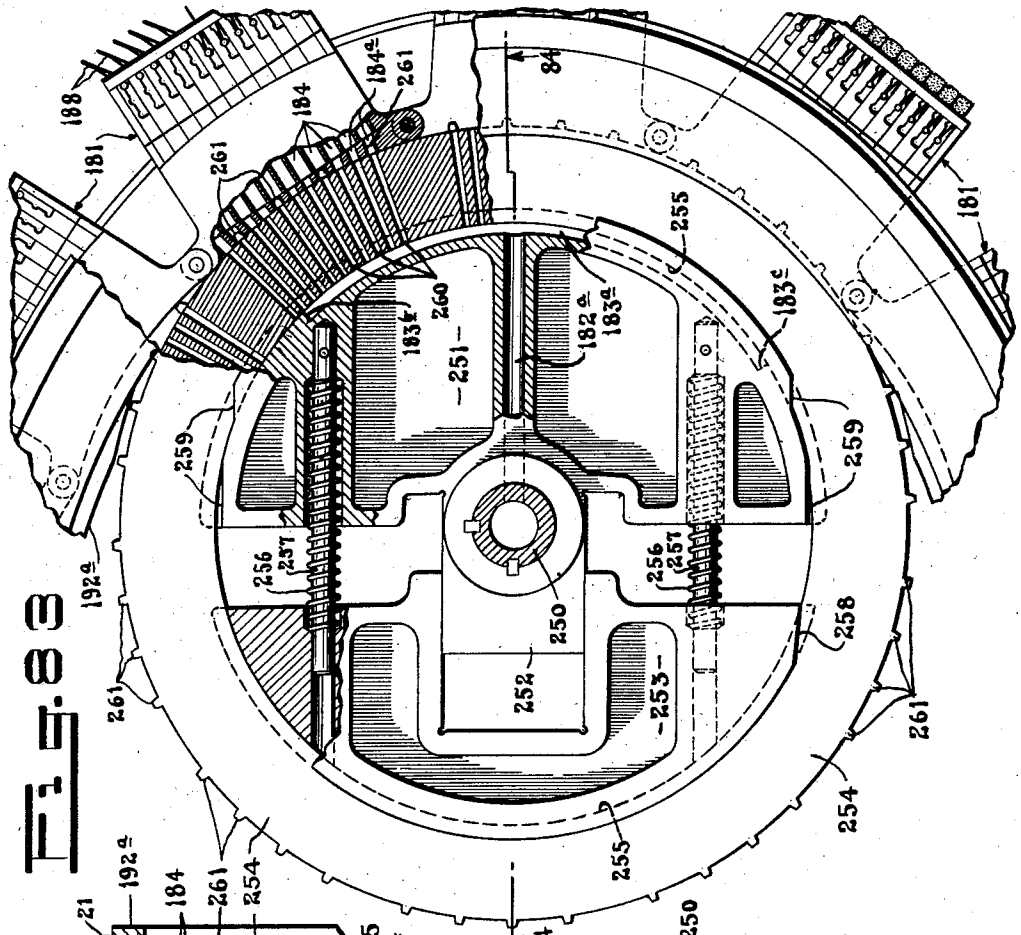

Fig. 83

Fig. 84

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Fig. 88

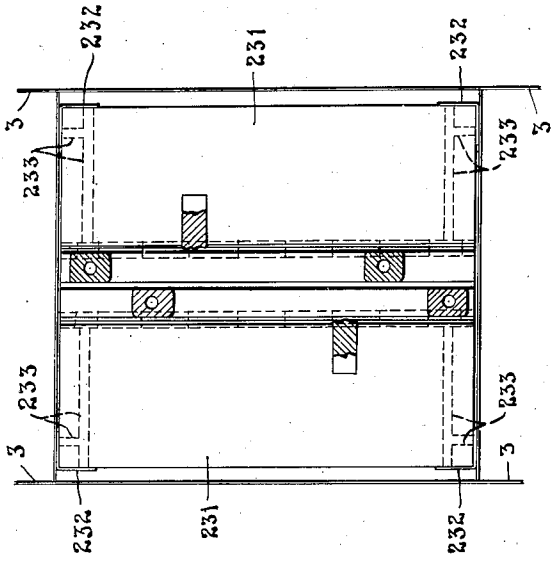


Fig. 88

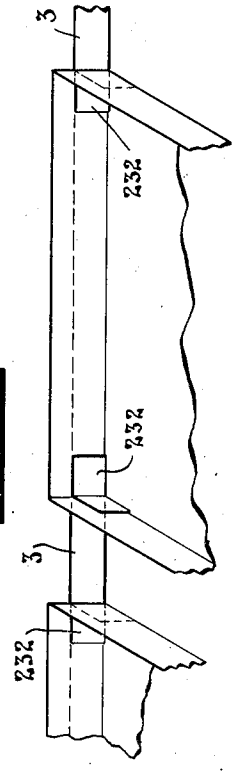
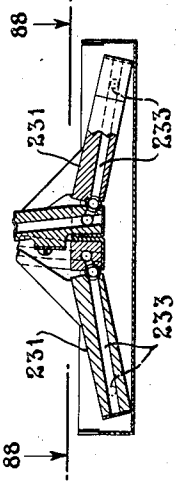


Fig. 87



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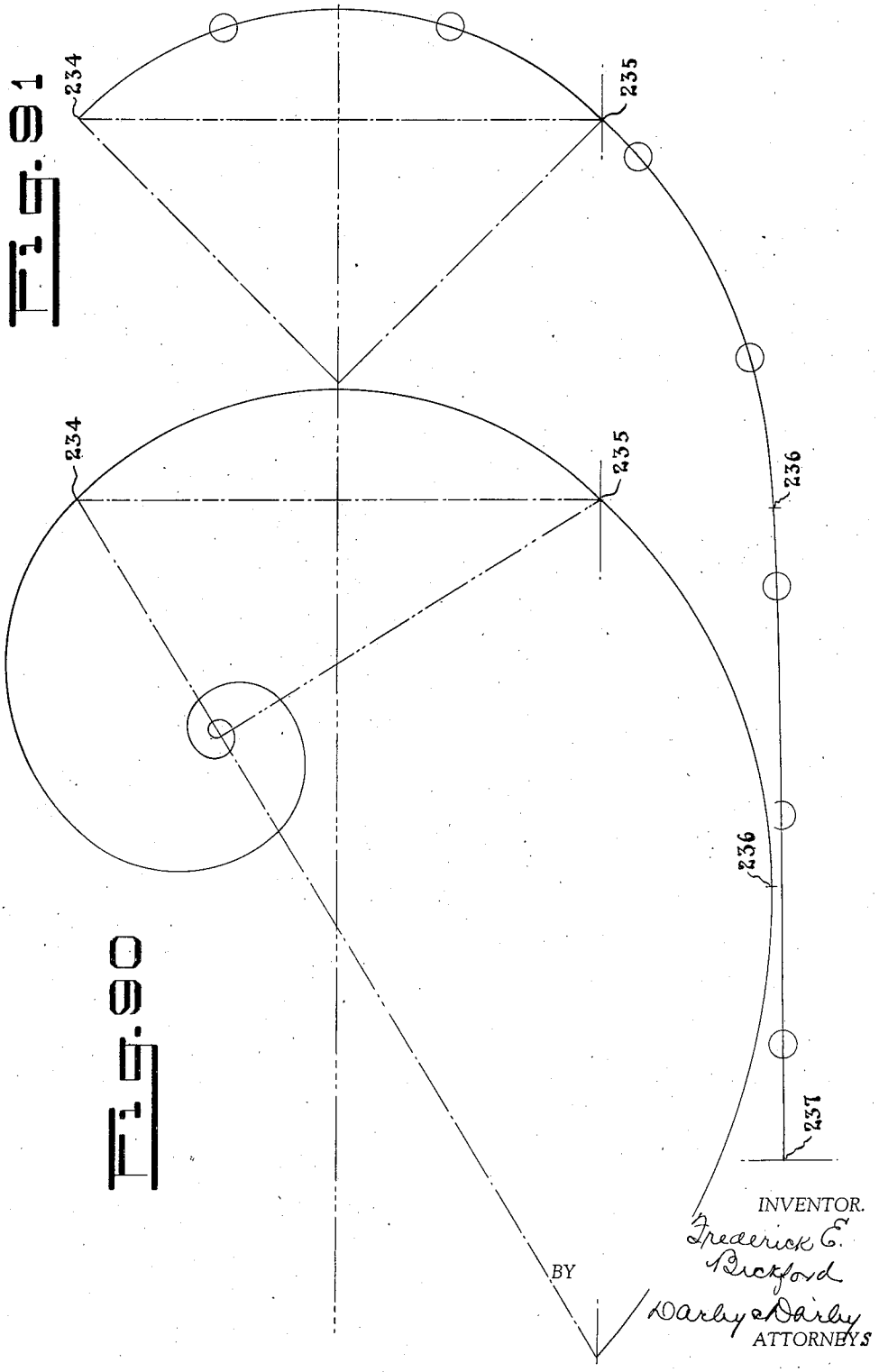

Fig. 91

Fig. 90

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Patented May 10, 1938 2,116,995

UNITED STATES PATENT OFFICE

2,116,995

PACKAGING MACHINE

Frederick E. Bickford, Rye, N. Y.

Application September 21, 1934, Serial No. 744,928

30 Claims. (Cl. 93—3)

This invention relates to a machine for making packages or containers and filling said containers with a commodity, and particularly to such container which shall be composed of transparent material, such as "Cellophane" or a cellulose derivative.

A feature of the invention is the provision of means for forming a package of such material and inserting the contents within said package in a continuous operation.

An object of the invention is to provide a packaging machine for making packages of the kind mentioned in which the package shall be exhausted of air and filled with an inert gas.

Other objects and features of the invention will be apparent from the following description and claims.

In the drawings,

Figures 1, 2 and 3 show a diagrammatic view of the entire machine, Figure 2 adjoining the left of Figure 1, and Figure 3 adjoining the left of Figure 2. Figures 1, 2 and 3 contain reference letters indicating particular portions of the machine, and the remaining figures are suffixed by these reference letters indicating that any figure so suffixed illustrates that particular portion of the machine;

Figure 4—A is an enlarged portion of the lower part of the structure shown at A in Figure 1;

Figure 5—A is a plan view of the structure shown in section 4—A;

Figure 6—A is a section along the line 6A—6A of Figure 4—A;

Figure 7—A is a section along the line 7A—7A of Figure 4—A;

Figure 8—A is an inverted plan view of a portion of the structure shown in Figure 6—A;

Figure 9—B is a view, partly in section, of the carriers 10 in Figure 1;

Figure 10—B is a plan view, partly in section, of said carriers;

Figure 11—C is a section across one of the carriers and channel member 15 at a position corresponding to line 11S—11C of Figure 10—B, when such carrier is at position C of Figure 1;

Figure 12—C is a section of one of the carriers along the line 12C—12C of Figure 10—B, when such carrier is at position C of Figure 1;

Figure 13—C is an enlargement of a portion of Figure 11—C;

Figure 14—C is a view of the same apparatus as shown in Figure 13—C, when the carrier has progressed a slight distance farther in its travel;

Figure 15—D is a plan view of the apparatus shown at D in Figure 1;

Figure 16—D is a section along the line 16D—16D of Figure 15—D;

Figure 17—D is a section along the line 17D—17D of Figure 15—D;

Figure 18—D is a view, partly cut away, of the same apparatus as Figure 17—D at a slightly later stage of the operation of this apparatus;

Figure 19—D is a view, with other parts cut away, of the same apparatus as shown in Figure 17—D at a still later stage in its operation;

Figure 20—D is a section along the line 20D—20D of Figure 19—D;

Figure 21 is a diagrammatic plan view of the development of the packing strip from the positions A to D of Figure 1;

Figure 22 is a side elevation of Figure 21;

Figure 23 is a diagrammatic plan view similar to Figure 21 illustrating the formation of the tray portion of the package at the positions D and E of Figure 1;

Figure 24 is a side elevation of Figure 23;

Figure 25—E is a view partly in section of the parts at E in Figure 1 showing the shaping members engaging the carriers 10;

Figure 26—E is a section of one of the shaping members at E;

Figure 27—E is a section along lines 27E—27E of Figure 25—E;

Figure 28—E is a section along the lines 28E—28E of Figure 25—E;

Figures 29—E to 34—E are a modification of the apparatus illustrated in Figures 25—E to 28—E, and show means for shaping the packages and at the same time applying a longitudinal compartment strip thereto;

Figure 29—E is a section showing one of the shaping members at the right of the apparatus E just as it begins to turn downward with a partition strip suctionally held against its lower extremities;

Figure 30—E is a section of the shaping member slightly further along showing adhesive being applied to the outer portions of the strip;

Figure 31—E is a section of the shaping member at a slightly later time, showing a folding member engaging the center of the strip;

Figure 32—E is a section of the shaping member showing it approaching the interior of a container formed by a carrier 10 which is not shown;

Figure 33—E is similar to Figure 28—E but illustrates the shaping member in contact with the interior surface of the formed container;

Figure 34—E shows the shaping member moving away from the container, leaving the folded longitudinal compartment strip in position;

Figure 35—F is a partial side section of one of the feeding carriers on the central chain shown at F in Figure 2, and shows the movable lateral partitions in the suction plate;

Figure 36—F is a cross-section along the lines 36F—36F of Figure 35—F;

Figure 37—F is a plan view of the apparatus of Figure 35—F plus the mechanism for supplying cigarettes to the feeding carriers;

Figure 38—F is an end view of the apparatus shown in Figure 37—F;

Figure 39—G is a cross-section of the apparatus for turning down the end flaps of a package to which a cover sheet is to be secured, as indicated at G of Figure 3;

Figure 40—G is a plan view of the apparatus of Figure 39—G;

Figure 41—G is a detail of the apparatus of Figure 40—G;

Figure 42—G is another detail of the apparatus of Figure 39—G;

Figure 43—G is another detail of the apparatus of Figure 39—G;

Figure 44—I is a side view of the apparatus shown at I in Figure 3, for sealing the packages;

Figure 45—I is an end view of the apparatus shown in Figure 44—I looking in the direction of the arrows marked 45—I;

Figure 46—I is a section along the line 46—I of Figure 44—I;

Figure 47—I is a section along the line 47I—47I of Figure 46—I;

Figure 48—I is a view of the apparatus shown in Figure 47—I at a slightly later stage in its movement;

Figure 49—I is a section along the line 49I—49I of Figure 48—I;

Figure 50—I is a section along the line 50I—50I of Figure 46—I;

Figure 51—I is a view of the apparatus shown in Figure 50—I at a slightly later stage in its movement;

Figure 52—H is a plan view of the apparatus for applying adhesive to the connecting strips between successive packages, as indicated at H in Figure 3;

Figure 53—H is a side elevation of a portion of the apparatus shown in Figure 52—H;

Figure 54—H is a detail of a portion of the apparatus shown in Figure 53—H, partly broken away, at a slightly different stage of the operation;

Figure 55—H is a view of the apparatus shown in Figure 54—H at another stage in the operation;

Figure 56—J is a diagrammatic plan view of the operations performed on the package by the apparatus illustrated in Figure 44—I, plus a plan view of apparatus for cutting the connecting strips between packages;

Figure 57 is a perspective view of a finished package consisting of two connected sections;

Figure 58 is an enlarged section along the lines 58—58 of Figure 57 showing the partitions between the cigarettes;

Figure 59 is a section of a completed package to which the cigarettes have been fed in a slightly modified manner, and illustrates a possible variation in the arrangement of partitions;

Figure 60 is a partial plan view of a modified form of package having a longitudinal center partition;

Figure 61 is a view along line 61—61 of Figure 60 to show the center partition and individual article partitions;

Figure 62 is an elevation of an extended portion of the cover feed of Figure 3 modified to permit the exhaustion of the package and package chamber, and the injection of an inert gas in the package;

Figure 63 is a section along the lines 63—63 of Figure 62;

Figure 63—S is a diagrammatic plan view of auxiliary suction members shown at the right hand side of Figure 62 which pull down the side edges of the cover sheet to prevent wrinkling;

Figure 64 is a side elevation of the apparatus shown in Figure 63;

Figure 65 is a diagrammatic view of a package strip being formed according to a modification of the invention for forming a package of more than four sides;

Figure 66 is a diagrammatic view of the continuation of the package strip shown in Figure 65 showing how it is cut before being formed;

Figure 67—C is a plan view of the modification of the carriers 10 which form the package referred to in connection with Figures 65 and 66, showing the hinged carriers corresponding to carriers 10 of Figure 1 being folded to form the package;

Figure 68—C is a plan view of the apparatus of Figure 67—C at a slightly earlier stage in its movement;

Figure 69—C is a side view partly in section of the apparatus shown in Figure 67—C with a modified form of shaping members of apparatus E, Figure 1, coming into engagement therewith;

Figure 70—C is a side view partly in section of the apparatus shown in Figure 68—C showing the modified shaping members of the apparatus at E, Figure 1, coming into engagement therewith;

Figure 71—C is a view of a section along the lines 71C—71C of Figure 68—C;

Figure 72—C is a section along the lines 72C—72C of Figure 70—C;

Figure 73—C is a section along the lines 73C—73C of Figure 69—C;

Figure 74—C is a section along the lines 74C—74C of Figure 69—C;

Figure 75 is a diagrammatic view illustrating the operation of the apparatus shown in Figures 67—C and 69—C, and 73—C and 74—C;

Figure 76 is a continued diagrammatic view showing the application of a cover sheet to this type of package, which is accomplished in the same manner as with the package for which the apparatus is shown in the drawings;

Figure 77 is a diagrammatic view of a modified form of the arrangement shown in Figures 65 and 66, and illustrates an open-work construction with no cross strips;

Figure 78 is a view, partly in section, illustrating the formation of a bottle in a modified form of my invention; the neck and shoulder of the bottle may be of molded plastic material;

Figure 79 is a similar view at a later stage in the operation;

Figure 80 is another view showing the application of a cover sheet to complete the bottle;

Figure 81 is another view showing diagrammatically the cover sheet and end flaps secured;

Figure 82 is a plan view of Figure 81;

Figure 83 is a partial side view of a modified suction mechanism having a rotary or floating valve arrangement for creating a suction in the individual links of the carrier chains illustrated in Figures 1, 2 and 3;

Figure 84 is a section taken along the line 84—84 of Figure 83;

Figure 85 is a view of the movable lateral partition supports or fins 188 of Figure 35—F to be used in packages which do not have longitudinal partitions;

Figure 86 is a view of fins similar to those shown in Figure 85 except that they are cut for straddling longitudinal partitions as indicated, and are used with packages in which longitudinal partitions are used;

Figure 87 is a section of a modified form of apparatus for applying corner strips to a package. This apparatus may be used instead of the apparatus of Figures 15—D to 20—D, in which event, of course, the cross strips would not be used;

Figure 88 is a plan view of the apparatus of Figure 87 showing the suction holes by means of which the corner strips are retained on the hinges until placed in position in the package;

Figure 89 is a diagrammatic perspective view of corner strips in position;

Figure 90 is a diagram of a logarithmic spiral which illustrates the design of the channel for the chains illustrated in Figures 1, 2 and 3, carrying devices for shaping the package, inserting the contents, and applying the cover sheet; and

Figure 91 is a diagram of a portion of the spiral of Figure 90 connected at either end to the arc of a circle, illustrating the contour of the channel.

In Figure 1 a plurality of rolls **1** of flexible packaging material **4**, such as "Cellophane", a cellulose derivative, etc., are provided and so disposed as to be continuously fed to the machine. Two additional rolls **2** (Figure 1), one behind the other (Figure 5—A), supply strips of reinforcing material **3**. The covering material **4** is the entire width of the carriers on which they are to be positioned as they pass through the machine. The strips **3** and **4** are guided by suitable rollers **36**. These strips may be firmly secured together without wrinkles by the means shown more in detail in Figures 4—A to 8—A. Suitable material for causing the strips to adhere to one another, such as an adhesive or a solvent for the material used for example, "Cellosolve", may be supplied to each strip in any suitable manner as by sprays **5**. After a strip has been sprayed it approaches a wiping edge **6** which removes therefrom any excess of material to prevent clogging or wrinkles. A suction is maintained at the opening adjacent the wiping edge **6** in order to dispose of the excess material. After passing the wiping edge **6** the strips approach a suction nozzle **7** which draws the two strips smoothly and evenly together and they are permanently adhered by passing through rollers **8** which press them together, embedding the reinforcing strips of heavier material into the covering sheet to such an extent as to make an indentation on the surface thereof to thus form weakening lines or tearing lines for opening container. The wide strips of sheets **4** and the narrow reinforcing strips **3** are pulled from the rollers by the friction rollers **8** shown at the left of Figures 4—A and 5—A which are actuated by any suitable source of power attached to the gears **9**, as shown in Figure 6—A.

As Figure 7—A is a section across the line **7A**—**7A** of Figure 4—A where a wide sheet is being applied, it will be noted that in this figure the adhesive material is shown sprayed across the entire width of the strip. As Figure 6—A is a section across line **6A**—**6A** of Figure 4—A where the two narrow strips **3** are being applied, it will be seen that the adhesive is sprayed only on the portion to be covered by these two narrow strips.

The reinforcing strips **3** may be of any suitable material, such as paper or cardboard, but are preferably of transparent flexible material such as that which comprises the rest of the package, but of heavier material than the wider sheets. Any desired number of wide sheets may be thus laminated, depending upon the class of goods to be inserted in the package and the particular characteristics as to strength, flexibility, etc., which it is desired that the finished package shall have.

After the narrow strips **3** are applied the material is fed forward and engages a series of linked carriers **10** which are continuously driven by the sprocket wheels **11** (Figures 1 and 3). These carriers are shown in more detail in Figures 9—B to 14—C. They consist of a body member **12**, a plurality of plates **13**, and a cover plate **14**. The cover plate **14** is provided with a plurality of holes, as shown in Figure 10—B, which register with corresponding holes in the plates **13**. The frame member **12** is rounded at its bottom to slide along a channel member **15**. The member **15** has a longitudinal groove **16**, along its entire length, which is in communication with means for pulling a suction through the groove. The frame body member **12** has an opening **37** at its bottom which registers with the groove **16**, and the plates **13** each have a semi-circular section **38** cut out at their bottoms to form a passageway within which to permit the suction to be applied to the holes in the plates **13** and cover **14**. Each carrier is provided with a hinged portion **17** at each end (Figures 9—B and 10—B), and another hinged portion **18** at each side (Figures 11—C to 14—C). These hinged portions are provided with apertures **19** which communicate with the groove **16** by apertures through the hinges to the hinged portions of the plates so that a suction may also be pulled through these hinged members.

It is necessary in working with material such as "Cellophane", to secure registration of such material with the apparatus at all times. If such material is put under tension it will stretch to a considerable extent. By registering each section of the material with each carrier on which it is to be formed into a package by means of suction it may be controlled so that it can be handled efficiently throughout the machine.

As there is a continuous suction along the guiding member **15** for the entire distance between the sprockets **11** it is necessary that the carriers shall rest snugly in the guiding member. In order to insure this result I provide at intervals along the guiding member **15** screws **20** (Figs. 11—C, 13—C, 14—C) having the under surface of their heads rounded to engage seating strip **21**. The strip is pressed against flange **22** of the carriers by means of springs **23** bearing against pins **24** which engage the outer edge of the seating strips. The tension may be adjusted by means of thumb screws **25** which adjust the degree of pressure of the springs **23**.

After a particular carrier has passed the point B, it next comes to the cutting member, so marked in Fig. 1, then to the apparatus D, and then to the point C. At the point C the hinged sides and ends of the carrier are swung up and by means of apparatus which will be described at this time, as it is illustrated in Figs. 11—C to 14—C in connection with Figs. 9—B and 10—B which illustrate the carriers themselves.

Each carrier has secured thereto two rollers **26** which cooperate with means for swinging the side hinges, and two rollers **27** which cooperate with means for swinging the end hinges. Secured to the guiding member **15** are a pair of members **28** having inclined surfaces which engage the rollers **26** and **27** to exert a cam action thereon.

In Fig. 11—C two rollers **26** which are directly opposite one another, are just reaching the cam

surfaces on the members 28. The rollers 26 are mounted on levers 29 secured to links 30 and pivoted at their center in bracket 39. These links connect the levers 29 with the hinges 18. As the rollers 26 engage the cam surfaces they are forced downward and the links 30 are forced upward, as shown in Fig. 14—C. A spring 31 is secured to each side of each body member 12 of the carriers and is arranged as shown so that when the hinge members 18 are raised these springs will retain them in their raised position. The rollers 27 likewise engage the cam surfaces of members 28 and raise levers 32. These levers are provided with rounded adjustable heads which seat in links 33 secured to the end hinged members 17. The end hinges are accordingly raised in the same manner as the side hinges and are held in their raised position by springs 34 similar to the springs 31.

Returning now to the cutting apparatus shown between points B and D of Fig. 1, it will be noted from Fig. 10—B that the ends of the side hinges, and sides and ends of the end hinges, and corner pieces 35, form a cutting die. At the cutting block a knife, actuated by suitable apparatus indicated diagrammatically, cuts the packaging material between each carrier along the lines indicated in Fig. 21. This leaves the material which is to form the individual packages joined only by the reinforcing strips 3 and the portion of the wider strips directly underneath the reinforcing strips.

At this time also a plurality of needle holes may be punched in each portion of the material which will be directly underneath the triangular holes 41 in cross strips 40 now to be described. These needle holes permit evacuation of the packages, and filling them with an inert gas.

At D in Fig. 1, reinforcing cross strips 40 (Fig. 15—D) similar to the reinforcing longitudinal strips 3 are prepared and applied to the packages. These strips each have a triangular section 41 punched out at each end in order to provide an aperture for evacuating the package after it is completed. Two rolls 42 of the material of which the strips 40 are made are mounted on reels and are fed to the apparatus at D. Each roll first passes through a pair of guide rolls 43 to equalize tension and to direct the material to the rest of the structure.

The apparatus shown in Figs. 15—D to 20—D comprises generally three parts which are indicated in Figs. 15 as D1, D2 and D3. At D1 the triangular holes are punched in the strips. At D2 the strips are cut and supplied to a suction head at D3, which moves through an angle of 90 degrees as shown in Figs. 18—D to 20—D, and applies the strips to the packages being formed. The motion for the apparatus shown at D is supplied to a rack 44, driving pinion 45 to a second driving pinion 46 (Fig. 18—D), arm 47 (Fig. 15—D), and connecting rod 48.

The prime mover is not shown but the various movements are of course suitably timed to perform the functions to be described in their proper order by means of cams or in any other suitable manner. The strips of material are moved through the apparatus by friction rollers 49 (Fig. 19—D) which are driven from pinion 45 by pinions 50 and 51. A movable punching head 52 (Fig. 16—D) is secured in position by springs 54 and 55. The punching head contains punches 56, triangularly shaped to cut the sections 41 from the strips 40. The rack 44 drives pinion sector 57 mounted on shaft 58, which shaft carries a cam 59 adapted to engage roller 60 attached to the punching head. The cam 59 therefore drives the punching head forward or to the left (Fig. 16—D), and punches the triangular sections from the strips. A trough 61 catches the triangular pieces and conveys them to a suitable receptacle not shown.

After the triangular pieces have been punched from the strips the strips are fed forward by means of rollers 49 until they are between the two sections D2 and D3. The apparatus at D2 has a cutting head which cuts the strips into suitable lengths, and at the same time causes them to engage the movable portion D3 of the apparatus.

The portion D2 of the apparatus may be best described from Figs. 17—D to 19—D, where it is shown in section. The apparatus consists of a cover 62 and a pair of members 63 and 64 having opposed bosses which are maintained in spaced relation by a spring 65 engaging said bosses. A second spring 66 retains the member 63 in position. Pins 78 engage slots 79 in cover 62 to retain member 63 in position while the pins 80 carried in the extended arms of the member 63, engage in slots 81 cut in the ends of member 64. These pins 81 retain member 64 in position against the pressure of the spring 65.

Arm 47 has secured thereto a cutting blade 67 (Fig. 15—D) and a pin 68 (Fig. 17—D). The pin 68 engages member 63 for driving the same forward. It will be noted in Fig. 17—D that there is a slight space between the pin 68 and the surface of member 63 to the left of the pin. This space permits a slight movement of the arm 47 to drive the cutting plate 67 forward before the members 63 and 64 begin to be moved forward as a single unit. When the arm 47 is moved, therefore, the blade 67 cuts the strip 40. The pin 68 then engages member 63 and drives members 63 and 64 forward. The member 64 engages the surface of suction head 65^a and presses the strip against it. Member 64 is restrained from further movement by the suction head. Pin 68 however continues to be driven forward by the arm 47 and continues to move the member 63 compressing the spring 65 and extending the spring 66. The extended arms of member 63 therefore pass ahead of the member 64 and press the ends of the strip 40 around the sides of the member 65^a as shown in Figs. 18—D and 19—D.

A suitable hose connection 69 draws a suction through the hole 70 and through the smaller holes 71 in the end and sides of member 65^a so that the strip 40 is retained in position on the member 65^a. The arm 47 then returns to its first position, leaving the strip against member 65^a with its ends folded around the edges of this member. The member 65^a is mounted on shaft 58. At this point rack 44 begins to rise, turning pinion sector 57 and shaft 58 and turning the entire member 65^a as shown in Figs. 18—D to 20—D. When the member 65^a has been turned to approximately 30 degrees it pauses for an instant in its motion opposite a member 72 which supplies suitable adhesive to the strips. This member 72, which is shown in section in Fig. 18—D, is supplied with the adhesive by a flexible connection 73. Pads of felt or other suitable material 74 are fed with the adhesive. When the member 65^a pauses, pinion 46 is operated and rack 46^a moves the pads 74 forward to engage the front and sides or turned up ends, of the

strip 40. The pads are immediately returned to their first position, and the member 65a continues its motion to the point where it deposits the strips on the package. The suction continues to be applied to the connection 69 through this movement.

When heat and pressure are used to secure the cross strips, instead of adhesive, the apparatus for applying the adhesive will of course be unnecessary, and the pause of the member 65a at the 30 degree position will of course be omitted.

When the member 65a has arrived at the position shown in Figs. 19—D and 20—D, the slidable suction head of the member 65a is restrained from downward movement by springs 75. It will be noted that the slidable suction head of member 65a has projections 76 (Figs. 15—D and 20—D) at its sides. When it reaches the position shown in Fig. 19—D, these projections are already engaged by a pair of levers 77. The strips 40 are at this time directly above the package. At the instant when the carriers 10 are at the position to have the strips applied thereto the suction is removed from hose 69, and connecting rod 48 is actuated by suitable means, not shown, to cause the levers 77 to move the suction head of member 65a the remaining distance downward to bring the strips 40 in contact with the package. As the strips have the adhesive applied thereto they adhere to the package in the position as shown in Fig. 15—D. The lever 77 permits the suction head of member 65a to rise immediately by means of springs 75. Rack 44 begins to operate in the opposite direction and the member 65a is returned to the position shown in Figs. 15—D and 17—D. Pinion 45 is now operated, feeding additional strips forward to engage the member 65a. When these strips are in position and arm 47 begins to move, a suction is again applied to hose 69 to cause the end strips to adhere to the member 65a.

Figs. 21 to 24 show diagrammatically the development of the packages through the stages described above. In Fig. 21 at A is shown the wide strips with the longitudinal strips applied thereto. At the position marked "Cutting" is indicated the cuts made to form packages. At D is shown the cross strips applied, and at C the side and end tabs are turned up.

The apparatus at D which has been described above applies the cross strips 40 to the packages. When the carriers 10 reach the position C the sides and ends of the carriers are turned up by the apparatus already described to form sides and ends for the package. A plurality of shaping members 82 (Fig. 1) linked together in a chain formation which are revolved by the sprockets 83, shown in Fig. 2, engage the linked package bodies formed on the carriers 10 as illustrated in Fig. 25—E. A stationary channel member 85 through which the members 82 are pulled by the sprockets 83, is semi-circular over a portion of its length, and has a groove 86 at this semi-circular portion through which a suction may be pulled. The shaping members 82 have apertures 87 (Fig. 25—E) which register with the groove 86 to pull a suction through holes 88 in the fingers 89.

The fingers 89 are hinged at 90 (Fig. 26—E) and are maintained spaced apart by springs 91 mounted thereon. Hinged sections 92 have arms 93 which engage suitable members 94, illustrated in Fig. 29—E to permit them to hang at a slight angle. This permits the shaping member to enter the package as the shaping member descends into engagement therewith. A pair of rollers 95 on the fingers 89 engage a pair of cam surfaces 96 which are secured to the channel member 85 and cause the fingers 89 to close. They are retained closed until the shaping member has made engagement with the package, and is again removed therefrom. As the shaping member enters the package, as shown in Fig. 27—E the sections 92 ride on the surface of the package and are spread out flat so that a surface is presented to the hinged flaps at the sides and ends of the carriers 10 against which they may press to cause the package to be properly shaped. When the fingers 89 are used to help form the package bodies illustrated in Figs. 21 to 24, the suction in the groove 86 is shut off.

In the modification illustrated in Figs. 29—E to 34—E, a longitudinal strip is secured in the package to form two compartments therein. In these figures the apparatus already described and marked with the same reference numerals, operates as before. When the shaping member is thus beginning to turn downward at E a strip of material composed of "Cellophane", cellulose derivative, or any other desirable substance 97 is supplied to the fingers 89 in any suitable manner not shown, and is retained in position by the suction on said fingers through the holes 88. As the shaping members progress a pair of adhesive applying rolls 98 apply adhesive to the outer edges of the strips 97. When the shaping members reach the cam surfaces 96 the fingers 89 begin to close and at the same time a folding member 99 engages the strip 97 to cause it to fold in the middle. The fingers then close and the shaping member descends to engagement with the carriers 10 as shown in Figs. 32—E and 33—E. In case the longitudinal strip 97 is to be applied the shaping members are designed so that there is a slight space between them and the edges of the package, as shown in Fig. 33—E. This permits fingers 89 to separate slightly as the shaping members leave engagement with the package, thus releasing the strip 97 and leaving it to engagement with the package.

After the side and end tabs of the package have been turned up and secured in position as described above in connection with the figures having a suffix C the package is to be filled with a commodity. I have chosen to illustrate this commodity as cigarettes, as this is one example where the invention is of value and presents special problems which are illustrative in general of the many commodities which may be inserted in the package.

The mechanism for inserting the cigarettes in the package is shown at F in Figure 2 and details of the mechanism for preparing a packet of cigarettes to be inserted in the package are shown in Figs. 35—F to 38—F. From these figures it will be noted that again a suction is used in the feeding carrier 181. This suction is supplied through a passage 182 to a groove 183 in the channel member 192a around which the carrier is revolved and from this groove through suction holes 184 to individual compartments which are supplied with cigarettes. A roll 185 of "Cellophane" or cellulose derivative or other similar substance is provided which is fed over the top of the feeding carriers which are driven by a gear 192 as they are supplied with cigarettes from the hopper. The cigarettes are indicated at 186, Fig. 2, and are fed through a sprocket wheel arrangement 187 so that they are supplied individually to the compartments in the feeding carriers. As a particular carrier arrives at the position where

it is being fed the cigarettes, as illustrated in Fig. 35—F, a suction is applied to each individual cigarette compartment just as the cigarette is fed to it. This suction pulls the "Cellophane" 185 down into the compartment, permitting the cigarette to enter.

Each compartment is supplied with a removable fin 188. These fins have extended cross arms 189, Fig. 36—F, which are engaged by sprockets 190 as the cigarettes are supplied. These sprockets are driven by a train of gears illustrated in Figs. 37—F and 38—F. The fins are thus driven to the position indicated by those at the right hand side of Fig. 35—F and succeeding pairs of fins grip the cigarettes between them, while the "Cellophane" is held tightly over the moving fins by suction as well as friction. In addition, a belt 191 is provided to keep the cigarettes in position as the feeding carrier is revolved by the sprocket 192, Fig. 2. The stationary channel member 192a is identical with the channel member 85 described and illustrated in Fig. 1. When the individual carrier 181 reaches a position where it is to deposit its packet into the package the fins 188 engage a cam 193, Fig. 2. It will be noted from Fig. 35—F that grooves are provided in the surface of the space in which the fins 188 recede and that in the position of the fins at the right of Fig. 35—F these have receded to the second groove, and are held in position by the spring effect of the arms of the fin. When these fins engage cam 193, Fig. 2, they recede further to the third groove at the bottom of this space and hence release the cigarettes and permit them to be fed to the packages which are traveling along under each feeding carrier for that purpose. Another cam 230 (Fig. 2) restores the fins to the position to receive the next charge of cigarettes.

The partition strips 185 are cut between successive packages by suitable means so the entire packet may be enclosed within the package.

In Fig. 3 is illustrated apparatus for supplying a cover sheet to the package. Before this cover sheet is applied the end flaps must be turned down so the cover sheet can be secured thereto to form a closed package. Apparatus for performing this function is indicated generally at G in Fig. 3, and in detail in Figs. 39—G to 43—G.

In Fig. 39—G a cam 201 is driven to actuate at time intervals the lever 202 pivoted at 203. This lever is normally held against action of the cam by a spring 204. When the lever is moved by the cam it carries with it a rack 205 which engages a pinion 206. The pinion in turn engages racks 207 and 208. Secured to the racks 207 and 208 are arms 209 having diagonal edges as shown in Figs. 41—G to 43—G. The mechanism is timed so that the lever 202 is actuated when a package has just passed the points of the arms 209, as illustrated in Fig. 41—G. These arms 209 are accordingly moved toward one another. This movement is at a rate which is faster than the travel of the package. Accordingly, the surfaces of the arms 209 catch up with the package which has just passed and turn down the end flap of that package. The arms remain in position long enough for the next succeeding package to reach them, and the end flap at the forward end of such succeeding package is accordingly also turned down before the arms recede. This operation is repeated for each succeeding package so that all of the end flaps are turned down in succession.

The cover sheet is supplied from a roll of "Cellophane," cellulose derivative, or other flexible material of a similar nature 241 (Fig. 3) and is cut to size and supplied by the mechanism indicated at 241a to the linked vacuum plates 242 which are revolved by the sprocket 243. The suction is pulled through pipe 244 and a groove in the semi-circular channel member 243a in a manner generally similar to apparatus already described. The cover sheet has adhesive applied to its edges by apparatus indicated at 245, which operates in a manner substantially similar to similar apparatus already described. The width of the surface to which the adhesive is applied is just a little less than the width of the end and side flaps of the package in order to prevent the adhesive contacting with the contents of said package.

The apparatus indicated at H in Fig. 3 applies adhesive to the longitudinal strips 3 which connect the packages so that when these strips are folded in they will adhere to the ends of the package and seal it. This apparatus is illustrated in detail in Figs. 52—H to 55—H. A container of suitable solvent or adhesive material 210 supplies this adhesive to felt pads 211. These pads are mounted on the guide bars 212 which are supplied with rollers 213 which travel around a cam track 214. The guide bars are slidably mounted in the reciprocating slide members 212a.

Within each cam track is a frog 218 which is normally maintained in the position shown in Figs. 53—H and 54—H by a spring 215 pressing against a pin 216. Levers 217 and their connecting links 217a suitably actuated, move the slide members 212a backwards and forwards while the guide bars 212 are moved up and down by reason of the cam track 214 engaging the roller 213. When the roller 213 is traveling along the upper surface of the cam track the frog 218 is forced downward to the position shown in Fig. 55—H and in this position holds the pads out of engagement with the strips between the packages. When the roller reaches the position shown in Fig. 53—H, however, the frog is free to move upward and on the return motion of the slide members 212a the roller 213 engages the undersurface of this frog and the felt pads 211 are brought downward to engage the strips, as shown in Fig. 54—H. The brushes 211 are normally held out of engagement with the strips by springs 219 which are fastened to the lower ends of the guide bars 212, and which are anchored to the bottoms of the slide members 212a as shown in Fig. 53—H.

In Figures 68—C and 70—C the package material is shown on a carrier just before it engages one of the shaping members at E. Figures 67—C and 69—C illustrate from right to left successive stages in the operation of shaping the package. The first step is to fold up the inner hinged sections 101, best illustrated in Figure 71—C. This is accomplished by means of rollers 130 which engage cam surfaces 131. The rollers are mounted on levers 132 (Figure 72—C) having a surface 133 which engages the bottom of the inner hinge sections 101. Springs 134 are provided which tend to restore these sections after lever 132 is removed. As the carriers 10 continue their movement to the point across which section 73—C is taken, it will be seen from Figure 73—C that the rollers 130 continue to ride along the cam surfaces 131 until surface 133 engages the under surfaces of arms 135 (Figure 73—C), which are attached to the outer hinged sections 129 of the carriers 10. These sections are accordingly folded up, as shown in Figure 74—C.

Additional springs **136** are provided which tend to restore the inner hinged sections **101** when the levers **132** have been removed. The surface **137** of lever **132** keeps the inner hinged sections in position while the surface **133** is engaging arms **135**.

As this folding operation is being performed the shaping members have come into engagement with the hinged sections and are supplying a mould around which the material is folded. These moulding members have eight hinged plates **138** which are hinged at **139** to a sleeve and at **140** to a collar mounted on a shaft **141**. As the moulding members come into engagement with the carriers **10** the hinged points **139** and **140** are forced toward one another. This movement is resisted by springs **142** surrounding shafts **141**, which cause the plates **138** to withdraw to their original position when the moulding members are withdrawn. The upper plates **138** are acted upon by two springs **143**, best shown in Figures 69—C and 70—C. This causes the upper pair of plates to spread apart at the same time that the lower pair of plates spread apart. As the carriers and shaping members progress in their movement, hinged plates **138** successively assume the positions shown in Figures 72—C to 74—C. At the same time the hinged sections of the carriers **10** are being folded up in the manner already described, as illustrated in the same figures, so that the package material is folded along the scoring lines **126** to form five sides of the package.

As this is occurring the material **4** creeps outward toward the edges of the hinged sections **129** due to the fact that the hinged sections of the carriers **10** are pivoted below the surface of these carriers.

It will be noted from Figure 72—C that the suction ports **144** are closed at this point so that no suction is applied to the two outer hinged sections on each side of the carrier. At **73**—C the section ports **144** have made contact with the passages **145**, so at this point, where the paper need do no further creeping along the two inner hinged sections, a suction is applied to the sections. It will be further noted from Figure 73—C that the suction ports **146** are still closed at this point, but from Figure 74—C it will be seen that at this point the suction ports **146** have come into communication with the channels **147** and apply a suction to the outer hinged sections. When the sides have been completely folded up, as shown in Figure 74—C, the outer halves of each of the two outer strips **3** are projecting beyond the carrier. These portions engage fingers **148** mounted on arms **149**, and are folded down so that the cover, or sixth side of the package, may be secured thereto.

The apparatus indicated at I in Figure 3 folds the strips **3** so that these strips are in position to be cut and secured to the ends of the packages to close the holes **41** which were cut in strips **40** by the apparatus at D—I in Figure 15—D. These are the strips which were applied to the package at Figure 4—A, and were folded up at C in Figure 1 to form the sides of the packages. At this point the packages have been completed, filled, and covered, and are joined together by this continuous strip **3**, forming the inner surface of the edge of the packages.

In Figure 44—I the packages are shown at **100** and the strips may be seen between adjacent packages. The packages have left the carriers **10** at this point, and are moving along the guide **102**. The wheel **103** is revolving with its periphery traveling at the same speed as the packages, and a plurality of sets of blades **104**, **105**, **106** are arranged around the periphery to engage successive packages. These blades are of very thin flexible material. As may be seen from Figures 45—I and 46—I, the pairs of blades **104** and **105** move into position between two packages within the strips **3**, while the pair of blades **106** is outside of the strips **3**. Blades **106** are held in this position by springs **107** (Fig. 46—I). Blades **104** are adjusted to remain in such a position that they will enter the space between two packages at about the midpoint of the space. Having entered the space between the packages the blades **104** are caused to assume a position against the forward end of one package by means of sliding members **108** (Figures 47—I, 48—I, 49—I).

As may be seen from Figure 44—I and Figures 47—I to 49—I, blades **104** have a U-shaped section **109**. As these blades slip between adjacent packages a pair of rollers **110**, carried by members **108** engage cam surfaces **111**, causing the members **108** to slip behind the U-shaped section, and due to the surface **112** on these members, to withdraw the section **109** within a suitable groove **113** in the surface of wheel **103**.

After the blades are all in position the pair of blades **106** are to be moved toward one another to fold the strips **3** inward. This is accomplished by means of levers **114** on which are mounted rollers **115**. Rollers **115** engage second cam surfaces **116** causing blades **106** to move toward one another. As the wheel **103** continues to revolve the packages will of course be drawn closer together as the strips **3** are folded. As the blades **104** are restrained by members **108** they will remain in position, and blades **105** and **106** will be bent over towards blades **104**. As the wheel **103** continues to revolve further, and the packages move on, the blades **104**, **105**, and **106** will slip out from engagement with the packages. Forked springs **117** (Figures 47—I, 49—I) will return members **108** to their original position. Springs **107** will return levers **114** to their original position and they will be prevented from excessive movement by set screws **119** (Figures 50—I and 51—I).

The apparatus illustrated in Figure 56—J cuts the strips between successive packages as desired. The form of finished package (Figure 57) which I have chosen to illustrate comprises two of the packages described above so that the apparatus illustrated in Figure 56—J is adapted to cut the strips joining every second package. In order to cut the strips between the packages evenly a slicing motion must be used. Accordingly, in Figure 56—J a pair of blades **220** is provided which slip between every second package and are actuated in the same manner as the adhesive applying brushes of Figures 52—H to 55—H. That is, as the packages travel along the blades slip in between and travel with the packages until the cutting operation is finished and they have again slipped out from between the packages. In Figure 56—J the packages are shown approaching the blades and the apparatus at I which seals the ends of the packages is indicated diagrammatically at the right of the figure.

In Figure 57 is indicated a finished package consisting of two compartments, each joined together by strips **3** which were not cut between these two, and each with its quota of cigarettes.

In Figure 58 an enlarged cross-section is

shown to indicate the arrangement of the partition sheet supplied at F, Figure 2, between adjacent cigarettes within the package. Here it will be noted that this sheet goes over each cigarette, between two adjacent cigarettes, up again and over the next cigarette. By feeding the cigarettes over and under the "Cellophane" sheet 185 of Figure 2, an arrangement of partitions such as that shown in Figure 59 may be secured in which a partition sheet goes over one cigarette, under the next, over the next, etc.

In Figure 60 is illustrated the form which the package would take if it had been supplied with a longitudinal compartment strip as above described and then filled with cigarettes on each side of this compartment. In this case, of course, the package would be of double width.

In Figure 61 is shown a view of the package of Figure 60 along line 61—61 of that figure, showing the central compartment strip at the center of the figure.

In Figure 62 is illustrated an apparatus for evacuating the package and supplying it with an inert gas, and at the right hand side of the figure is illustrated the auxiliary suction fingers 247 which pull down the side edges of the cover sheet to prevent wrinkling. When this apparatus is used the chain of Figure 3 on which the carriers ride to supply the cover sheet will be lengthened at its center.

It has already been described above that the carriers 10 on which the package is formed are supplied with a continuous suction throughout the entire machine to hold the packages in proper position to coordinate the various operations of forming the package and filling it with material. As shown in Figure 62, the auxiliary suction fingers 247, which are connected to the suction pipe 248, are inserted in position at a point where the surface plate of the cover sheet carrier links and the top surfaces of the packages in the carrier links 10 are just about to meet. These suction fingers have suction slots machined in them (not shown) which are just wide enough to cover the turned in side flaps of the package as shown in Figure 63—S. As the cover sheet carriers and the top surfaces pass the thin ends of the suction fingers, the edges of the cover sheet are drawn down upon the side flaps of the package; thereby ironing out any wrinkling which may take place at this point while the cover sheet is placed in position. A suction manifold 221 is shown in Figure 62 having an outlet pipe 222 through which the suction is pulled in the groove 241. At point 223 this suction is cut off and at point 224 another section of similar nature to the suction apparatus already described supplies a gas to the packages through the pipe 225 and the groove 242.

In this arrangement for evacuating and gasifying the package the cover sheet is supplied by carriers which are provided with a rubber gasket 240 illustrated in Figures 63 and 64. This rubber gasket forms an air-tight compartment by pressing tightly against the top surfaces of the hinged sides 17 and 18 of the carriers 10, thereby enclosing the entire package. At this point, however, it will be recalled that the ends of the package are open to the interior of the air-tight chamber through apertures 41, Figure 15—D. As a suction is pulled on the entire chamber closing the package, the pressure outside and inside the package will be equal so there will be no tendency for the package to collapse. Again, when the chamber reaches the position where it is supplied with the inert gas through pipe 225, the gas will be supplied to the entire chamber and again the pressure will be equalized.

Figures 65 to 74—C illustrate a form of the invention in which a package of hexagonal shape is made. A strip or strips 4, similar to the strips 4 of Figure 1 are secured together and supplied in the same manner with longitudinal reinforcing strips 3 similar to the strips 3 of Figure 1. These strips are then supplied with additional cross strips 40, similar to the cross strips 40 of Figure 15—D by apparatus similar to that illustrated at D, in Figure 1, and further illustrated in Figures 15—D to 20—D. In this case the cross strips 40 are supplied before the package blanks are cut. The package blanks may be cut by any suitable means, such as that illustrated as the cutting member in Figure 1. In this case the material is cut as illustrated in Figure 66, the cuts being along the lines indicated by material which is omitted, and also being along the lines 125. The longitudinal strips 3 are scored down their centers as indicated at 126 (Figures 65 and 66). The material is then folded up along the lines 126 so that the section between each pair of longitudinal strips 3 becomes one side of a hexagonal package. It will be noted that there are five such sections. On being folded up they form five sides of the package, leaving the top open so that the package may be filled with material and the sixth side applied after it is filled. End tabs 127 fold over the ends of the package so formed and are adhered to the tabs 128 which are folded in to form a surface to which the tabs 127 may adhere.

The sides and ends of the package material are folded up by apparatus illustrated in Figures 67—C to 74—C. In this case the shaping members, similar in function to those indicated at E, Figure 1, cooperate with the carriers, similar in function to those indicated at 10, Figure 1, to shape the package.

As the side hinged sections have been folding up as described, the end hinged sections 150 (Fig. 67—C) of the carriers have also been folding up. Prior to the time when these end sections are folded against the ends of the package, however, fingers 151 (Fig. 71—C) fold the end tabs 128 of the package over to form a surface which is to adhere to the end pieces 127. This is accomplished by means of rollers 153 (Fig. 67—C) which engage cam surface 154 and actuate the mechanism illustrated in Fig. 71—C. The rollers actuate racks 155 which rotate pinions 156. Pinions 156 operate through suitable gears to engage the teeth of gears 157 on which the fingers 151 are mounted. Fingers 151 accordingly move upward and fold in the tabs 128. The fingers 151 may be seen indicated partially in dotted lines in Fig. 74—C where the end tabs 128 are shown folded down. These fingers are shaped in the manner illustrated in order to permit the end hinged sections 150 to catch the end tabs 128 before the fingers are entirely withdrawn. The end tabs 128 or the end pieces 127 may be supplied with adhesive by suitable apparatus not shown to cause them to adhere.

Additional rollers 158 (Fig. 67—C) are secured to arms 159 and slide in bearings 160 and 161. These arms terminate in a rack as shown in Fig. 71—C. They are actuated by cam surfaces 162 (Fig. 67—C) which are arranged slightly farther along in the travel of the carriers than the surfaces 154. The arms 159 operate to turn up the end hinged sections 150 and the end pieces

127 thereon. It will thus be seen that these sections are turned up after the fingers 151 have folded down the tabs 128.

A collar 163 (Fig. 71—C) secures a spring 164 between itself and bearing 161 so that the arms 159 are returned to their original position when the rollers 158 leave the cam surfaces 162. Springs 165 (Fig. 71—C) are provided to return the fingers 151 to their normal position. When the arms 159 are actuated by the cam surface 162 the rack at the end of the arm operates a pinion 166 to move lever 167 against depending arms 168 which are hinged to the end sections 150. The end sections are accordingly folded up so that the end tabs 127 come in contact with the tabs 128.

In Figure 75 there is illustrated diagrammatically the operation that has just been described in connection with Figures 67—C, 69—C, and 73—C, 74—C. Here it will be seen that as the package travels from right to left of the figure the sides are first folded up, the tabs 128 are then folded in, and then the end tabs 127 are folded up over the end tabs 128.

In Figure 76 is shown a continued diagrammatic view of the development of the package after the operations of Figure 75 have been completed and shows the cover sheet being applied to the package and the end tabs of the cover sheet being turned down over the ends of the package.

In Figure 77 is illustrated another arrangement of the sheets of "Cellophane" or other similar material to form a package. In this figure is shown a sheet from which diamond-shaped sections have been cut for decorative, strengthening or other purposes.

In Figures 78–82 are shown apparatus for forming a bottle in accordance with the present invention. The operation of the mechanism shown in these figures is similar to that already described and will be obvious from that description. Here a bottle head 226 which may be made of molded plastic material is supplied to one end of the package instead of covering that end with a flap 127. The hinged section 150a operates in the same manner as end hinged section 150. The bottle heads 226 are automatically placed in position by mechanism not shown. The end tabs 128 are folded down over the shoulder of the bottle head 226 and secured thereto by means of an adhesive which has been supplied to that portion of the bottle head. The padded fingers 151a fold down these tabs in a similar manner in which the fingers 151 fold in the tabs 128. The cover sheet 245 is then supplied as illustrated in Figure 80, and its ends are turned down and secured to the rest of the packages, as shown in Figures 81 and 82.

In Figures 83 and 84 are illustrated a suction mechanism having a rotary or floating valve construction which is a modified form of means for supplying a suction to the individual links of the carrier chains illustrated in Figures 1, 2 and 3. This mechanism is mounted as a unit on the hollow shaft 250. This shaft is stationary and has keyed upon it the suction sector 251. Slidably mounted upon the machined hub portion 252 of the suction sector is the valve ring retaining sector 253. The valve ring 254 is free to be revolved in its grooved seat 255 machined in the periphery of both sectors 251 and 253, which is most clearly shown in Figure 84.

The valve ring is placed in position on the sectors by pressing them toward one another to compress the spiral springs 256 which press against the inner face of the sector 253. These springs are carried on the pins 257 which are anchored in the suction sector 251 as shown in Figure 83. When the inner faces of both sectors meet, and due to the flanges on one side of both sectors having been machined away at 258 and 259, the valve ring 254 can easily be slipped over the sectors and when sector 253 is released, the springs 256 force it into the position illustrated in Figure 83. The force of the springs is not very great, it being just enough to insure the valve ring being properly seated in its grooved seat 255 and to take up any wear that might take place.

The suction sector 251 has machined in its portion of the grooved valve seat, the suction groove 183a, which is connected to the hollow shaft 250 by the by-pass hole 182a. One end of said shaft is plugged as shown in Figure 84, and the other end (not shown) is connected in any suitable manner to the main suction line of the machine. This suction is continuous, and as the valve openings 260 machined in the valve ring pass the shoulder 183b of the groove 183a, the suction is carried up to the suction holes 184 of the carrier links 181 as already described herein. The suction is discontinued when the valve openings 260 pass the shoulder 183c of the suction slot 183a. The suction ring is revolved by the movement of the carrier links. This is accomplished by means of the sprocket teeth 261 machined on the periphery of the ring engaging in the slots 184a machined in the bottom of the carrier link body.

The carrier chain slides in a channel member 192a similar to that illustrated in Figure 2. In this application the channel member is supported off center to allow the suction mechanism to be centered with the channel member. The suction ring 254 enters a slot 262 cut into bottom of the channel member to contact with the carrier links.

In Fig. 85 is shown a view of one of the movable lateral partition supports or fins 188 of the Fig. 35—F. Here are seen the extended arms 189 which are engaged to move the fins up and down in the space provided for their movement.

In Fig. 86 is shown a fin similar to that of Fig. 85 except that it has a portion cut from its upper surface to permit it to straddle a longitudinal partition strip. It is of course for use in a package in which a longitudinal partition strip is used.

In Figs. 87 and 88 are shown a sectional view and a plan view respectively of a modified form of apparatus for applying corner strips to a package. Hinged shaping members 231 engage the package as in apparatus previously described. The corner strips 232 are held in position by suction through suction channels 233 until they are attached to the inner corners of the package. These corner strips may be used in cases where the cross strips 40 are omitted.

Fig. 89 shows diagrammatically one of the packages being formed with the corner strips 232 joined by the side strips 3 previously described.

In Figs. 90 and 91 is illustrated the contour of the channel for the chains illustrated in Figs. 1, 2 and 3 with carrier devices for shaping the package, inserting the contents, and applying the cover sheet.

Choosing the apparatus F of Fig. 2 particularly for description the suction begins to be applied at point 234 of Fig. 91. From point 234 to point 235 where the suction ends the channel will follow the arc of a circle in order to get as good a vac-

uum seat as possible. At point **236** the cigarettes will begin to enter the packets prepared to receive them. From this point to point **237**, where the packet carrying devices separate from the packages, the vertical movement of the packets must be smooth and even. This part of the channel must therefore also be an arc of a circle but this arc will be of larger radius than the arc between points **234** and **235**. It is therefore necessary to shape the channel member in such a manner that the movement from point **235** to point **236** shall be as short and as smooth as possible. The condition for achieving this result most satisfactorily is for the points **235** and **236** to lie on the curve of a logarithmic spiral with a radius of curvature at each of the points **235** and **236** equal to the radius of curvature of the arc it meets at each point. As the radius of curvature of a logarithmic spiral increases at a constant rate this path is the shortest distance between the two junction points which will permit the junction to be made at both points without a bump. The contour of the channel member is completed by following the same curves already explained. That is from point **237** the shape will be the same as that between points **236** and **235**, then it will follow the shape of the curve between points **235** and **234**, then that between points **236** and **235**, then that between points **237** and **236**, then again that between points **236** and **235** where it will join the curve already described at point **234**.

What is claimed is:

1. In combination means for making containers and packaging goods with a sheet of packaging material, means for moving said sheet along a path, means for applying reinforcing and tearing strips to said sheet, means for making transverse incisions in said sheet, means for applying transverse strips to said sheet to strengthen the edges next to said incisions, means for turning up said strengthened parts and the lateral edges of the sheet, means for fastening the same in their upturned position to form a tray shaped container, means for filling said container, means for folding the lateral edges thereover, and means for sealing a top sheet on said container.

2. In combination means for making containers and packaging goods comprising means for moving a tray forming sheet, means for applying reinforcing and tearing strips to said sheets disposed substantially in parallel with its lateral edges, means for making incisions in said sheet to outline the form of the tray, means for applying strengthening strips with turned up tabs for reinforcing the transversely cut edges, means for turning up the lateral sides and the strengthened transverse portions and fastening the same in their upturned position, means for filling said trays and turning the lateral sides over the filled portion, and means for sealing a closing sheet thereover.

3. In combination means for making containers and packaging goods with a moving sheet of packaging material, means for impressing reinforcing and tearing strips on said sheet in substantially parallel relation with each other, a vacuum forming plate, means for coordinating said moving sheet with said plate and impressing incisions in said sheet upon the plate, means for applying cross strips with turned up tabs to said sheet, means for shaping the cut and strengthened sheet into tray shape and adhering the tabs, means for filling the tray with goods to be packaged, and means for closing the lateral edges of said container over the packaged goods and sealing a cover sheet thereover.

4. In combination means for making containers and packaging goods with a moving sheet of packaging material, means for applying reinforcing tearing strips to said sheet in substantially parallel relation with each other, means for shaping the sheet to form a container, means for sealing said container, and means for holding said sheet in position by suction while the same is shaped into a container, filled, and sealed.

5. A combination according to claim 4 comprising means for laminating the cover sheet to the container by suction.

6. In combination means for making containers and packaging goods with a moving tray forming sheet, means for applying reinforcing and tearing strips to said sheet substantially in parallel with the lateral edges thereof, means for forming said sheet into a succession of connected trays, means for filling the trays with goods to be packaged, and means for closing the lateral edges of the trays over the goods and laminating a sealing sheet thereover.

7. A combination in accordance with claim 6 comprising means for holding the trays in position by suction during the operations thereon.

8. In combination means for making containers and packaging goods with a moving tray forming sheet, means for applying reinforcing and tearing strips to said sheet substantially in parallel with the lateral edges thereof, means for forming said sheet into a succession of connected trays, means for filling said trays by inverting over them successive packets of goods, means for folding in the lateral edges of said trays, and means for laminating a sealing sheet thereover.

9. A combination in accordance with claim 8 comprising means for holding said packages and trays in position by suction during the movement thereof.

10. In combination means for packaging cigarettes comprising means for vacuum seating a sheet of cellulose material to form partitioned chambers, means for filling said chambers with cigarettes, means for compressing said cigarettes laterally to form packets, means for assembling said packets of cigarettes in containers, and means for sealing said filled containers.

11. A combination in accordance with claim 10 comprising means for applying a tearing piece to the end of the container to be opened and embedding said tearing piece in the container material, stretching and weakening to score along line to be torn.

12. In combination means for making a package of thin pliable material comprising a succession of perforated plates for carrying sheets of said material, a groove communicating with the perforations in said plates, and means for applying a suction to said groove and perforations whereby said packaging material may be accurately retained in place while moving to successive positions for performing operations thereon.

13. In combination means for forming a plurality of packages joined together by a continuous strip, and means for close connecting said packages by folding said strips inwardly between successive packages and means for causing said folded strips to adhere to the ends of the adjacent packages.

14. In a machine having rotating mechanism which travels through a portion of its rotation through the arc of a circle having a given radius

of curvature and through another portion of its rotation through the arc of a circle having a different radius of curvature, a channel member guiding the travel between said arcuate portions having the shape of a logarithmic spiral whose radius of curvature at the points adjoining the arcuate portions is equal to the radius of curvature of said portions.

15. In a machine for making packages, a curved channel member having a suction groove extending longitudinally thereof, a tube terminating in a groove adapted to communicate with said first groove to apply a suction thereto, a ring having passages for interconnecting said two grooves, and means for resiliently holding said ring in contact with said grooves.

16. In combination means for packaging articles comprising a member having a plurality of grooves therein, a plurality of fins adapted to move vertically and horizontally in said grooves, means for vacuum seating a sheet of cellulose material against said member and between said fins to form partitioned chambers, means for positioning an article in each said chamber, means for lowering successive fins in the grooves as the articles are positioned in the chambers to hold the articles between pairs of fins by friction thereby forming packets of articles, means for assembling said packets of articles in containers, and means for sealing said filled containers.

17. In combination, means for packaging articles comprising a member having a plurality of grooves therein, a plurality of fins adapted to move vertically and horizontally in said grooves, holes in said members between said fins, means for supplying suction to said holes, means for feeding a strip of thin pliable material to said device over said fins whereby the material is folded into position by suction to form partitioned chambers, means for positioning an article in each of said chambers, means for lowering successive fins in the grooves as the articles are positioned in the chambers to hold the articles between pairs of fins by friction thereby forming packets of articles, means for assembling said packets of articles in containers, and means for sealing said filled containers.

18. In combination means for making containers and packaging goods with a moving sheet of packaging material, means for impressing reinforcing and tearing strips on each sheet in substantially parallel relation with each other, a vacuum forming plate, means for coordinating said moving sheet with said plate and impressing incisions in said sheet upon the plate, means for cutting a series of reinforcing cross strips to be applied to said material, means for perforating said cross strips, means for folding up the ends of said cross strips, means for applying said cross strips to said sheet, means for shaping the cut and strengthened sheet into tray shape, a container, means for filling the container with goods to be packaged, and means for closing the lateral edges of said container over the packaged goods and sealing a cover thereover.

19. In combination means for making containers and packaging goods with a moving sheet of packaging material, means for impressing reinforcing and tearing strips on said sheet in substantially parallel relation with each other, a vacuum forming plate having hinged vacuum forming sides and ends, means for coordinating said moving sheet with said plate and impressing incisions in said sheet upon the plate, means for applying cross strips with turned up tabs to said sheet, means for turning up the hinged sides and ends of said plate to shape said cut and strengthened sheet into tray shape, means for adhering the tabs, means for filling the tray with goods to be packaged, and means for closing the lateral edges of said tray over the goods and sealing a cover thereover.

20. In combination means for making containers and packaging goods with a moving sheet of packaging material, a plate having hinged forming sides and ends, means for applying a vacuum to said plate and through the hinges to said sides and ends for coordinating said moving sheet with said plate, means for impressing incisions in said sheet upon the plate, means for turning up the hinged sides and ends of said plate to shape said incised sheet into tray shaped containers, means for filling the containers with goods to be packaged, and means for closing the lateral edges of said container over the goods and sealing a cover thereover.

21. In combination means for making containers and packaging goods with a moving sheet of packaging material, means for impressing reinforcing and tearing strips on said sheet in substantially parallel relation with each other, a vacuum forming plate having hinged vacuum forming sides and ends, means for coordinating said moving sheet with said plates and impressing incisions in said sheet upon said plate, means for cutting a series of reinforcing cross strips to be applied to said material, means for perforating said cross strips, means for folding up the ends of said cross strips, means for applying said cross strips to said sheet, means for turning up the hinged sides and ends of said forming plate to shape said cut and strengthened sheet into a tray shaped container, means for adhering said folded ends, means for filling the container with goods to be packaged, and means for closing the lateral edges of said container over the goods and sealing a cover thereover to form a package.

22. In combination means for making containers and packaging goods with a moving sheet of packaging material, means for impressing reinforcing and tearing strips on said sheet in substantially parallel relation with each other, a succession of vacuum forming plates, means for coordinating said moving sheet with said plates and for incising said sheet between said plates, means for applying cross strips with turned up tabs to the edges of said incisions, means for lowering templates successively against the portions of the sheet between incisions, means for turning up the sides of said sheet and the ends of said sheet portions against the edges of said successive templates to form a succession of tray shapes with said tabs adhered, means for successively filling the tray with goods to be packaged, and means for closing the lateral edges of each sheet portion over the packaged goods and sealing a cover thereover.

23. In combination means for making containers and packaging goods with a moving sheet of packaging material, means for impressing reinforcing and tearing strips on said sheet in substantially parallel relation with each other, a succession of vacuum forming plates each having hinged vacuum forming sides and ends, means for coordinating the movements of said sheet with movements of said plates, means for impressing incisions in said sheet between successive plates, means for applying cross strips with turned up tabs to the edges of said incisions,

means for lowering templates successively on the vacuum forming plates, means for turning up the hinged sides and ends of said vacuum forming plates against the edges of said templates to shape successive sheet portions into trap shapes and to adhere said tabs for forming a series of trays joined by the non-incised edges of said sheet and by said reinforcing strips, means for successively filling said trays with goods to be packaged, and means for successively closing the lateral edges of said trays over the goods and sealing cover sheets thereover to form a succession of packages.

24. In combination means for making containers and packaging goods with a moving sheet of packaging material, means for impressing reinforcing and tearing strips on said sheet in substantially parallel relation with each other, a vacuum forming plate, means for coordinating said moving sheet with said plate and impressing incisions in said sheet upon the plate, means for applying cross strips with turned up tabs to said sheet, means for shaping the cut and strengthened sheet into tray shape and adhering the folded ends, a plurality of arms having suction channels therein, means for applying partition strips to said arms, means for pulling a suction on said suction channels in said arms to cause said partition strips to adhere to said arms, means for engaging the tray with said arms to apply said partition strips thereto to subdivide said tray, means for filling the subdivisions of the tray with goods to be packaged, and means for closing the lateral edges of said tray over the goods and sealing a cover sheet thereover.

25. In combination means for making containers and packaging goods with a moving sheet of packaging material, means for impressing reinforcing and tearing strips on said sheet in substantially parallel relationship with each other, a vacuum forming plate, means for coordinating said moving sheet with said plate and impressing incisions in said sheet upon the plate, means for cutting a series of reinforcing cross strips to be applied to said material, means for perforating said cross strips, means for folding up the ends of said cross strips, means for applying said cross strips to said sheet, means for shaping the cut and strengthened sheet into a tray shaped container and adhering the folded ends, a plurality of arms having suction channels therein, means for applying partition strips to said arms, means for pulling a suction on said suction channels in said arms to cause said partition strips to adhere to said arms, means for engaging the container with said arms to apply said partition strips thereto to subdivide said container, means for filling the subdivisions of the container with goods to be packaged, and means for closing the lateral edges of said container over the goods and sealing a cover sheet thereover.

26. In combination means for making containers and packaging goods with a moving sheet of packaging material; a vacuum forming plate, means for coordinating said moving sheet with said plate; means for impressing incisions in said sheet while upon said plate; means, including shaping plates mounted on arms hinged together to permit movement of the plates outwardly to position with the edges thereof flush with the forming plate edges, for shaping the incised sheet into tray shapes; means for filling the trays with goods to be packaged; and means for closing the lateral edges of said trays over the goods and sealing a cover thereover.

27. In combination means for making containers and packaging goods with a moving sheet of packaging material, a vacuum forming plate, means for coordinating said moving sheet with said plate, means for impressing incisions in said sheet while upon said plate, means for shaping the incised sheet into tray shaped containers, said means including hinged shaping plates insertable in said containers, suction means for carrying reinforcing corners on said plate corners to insert said reinforcements into said tray shaped containers, means for filling the reinforced containers with goods to be packaged, and means for closing the lateral edges of said containers and sealing a cover thereover.

28. In combination means for making containers and packaging goods with a moving sheet of packaging material, comprising a vacuum forming plate, means for coordinating said moving sheet with said plate, means for impressing incisions in said sheet while upon said plate, means for shaping the incised sheet into tray shapes, said means including hinged shaping plates insertable in said trays, means for applying suction to the corners of said plates, said means including passages in the hinges, means for carrying reinforcing corners on said plate corners for inserting said reinforcing corners into said tray shapes, means for filling the reinforced trays with goods to be packaged, and means for closing the lateral edges of said trays and sealing cover sheets thereover.

29. In combination means for making containers and packaging goods with a moving sheet of packaging material, means for impressing reinforcing and tearing strips on said sheet in substantially parallel relation with each other, means for impressing incisions in said sheet and for perforating said sheet adjacent said incisions, means for applying cross strips to said sheet adjacent said incisions, said cross strips having perforations therein corresponding to those in said sheet, vacuum means for turning up the sides and ends of said sheet to form a tray shaped container, means for filling said container with goods to be packaged, means for forming an air tight chamber about said package, said chamber having vacuum channels communicating with said perforations whereby said completed package may be evacuated, and means to apply a gas to said vacuum channels to fill said packages.

30. In a packaging machine having mechanism which travels through a closed path guided by a channel member, a portion of which is an arc of a circle having a given radius of curvature and another portion of which is an arc of a circle having a different radius of curvature and a third portion of which guides the travel between said arcuate portions and has the shape of a logarithmic spiral whose radius of curvature at the points adjoining the arcuate portions is equal to the radii of curvature of said portions, a suction groove extending longitudinally of the channel member, a tube terminating in a groove adapted to communicate with said first groove to apply suction thereto, a ring having passages for interconnecting said two grooves, and means for resiliently holding said ring in contact with said grooves.

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