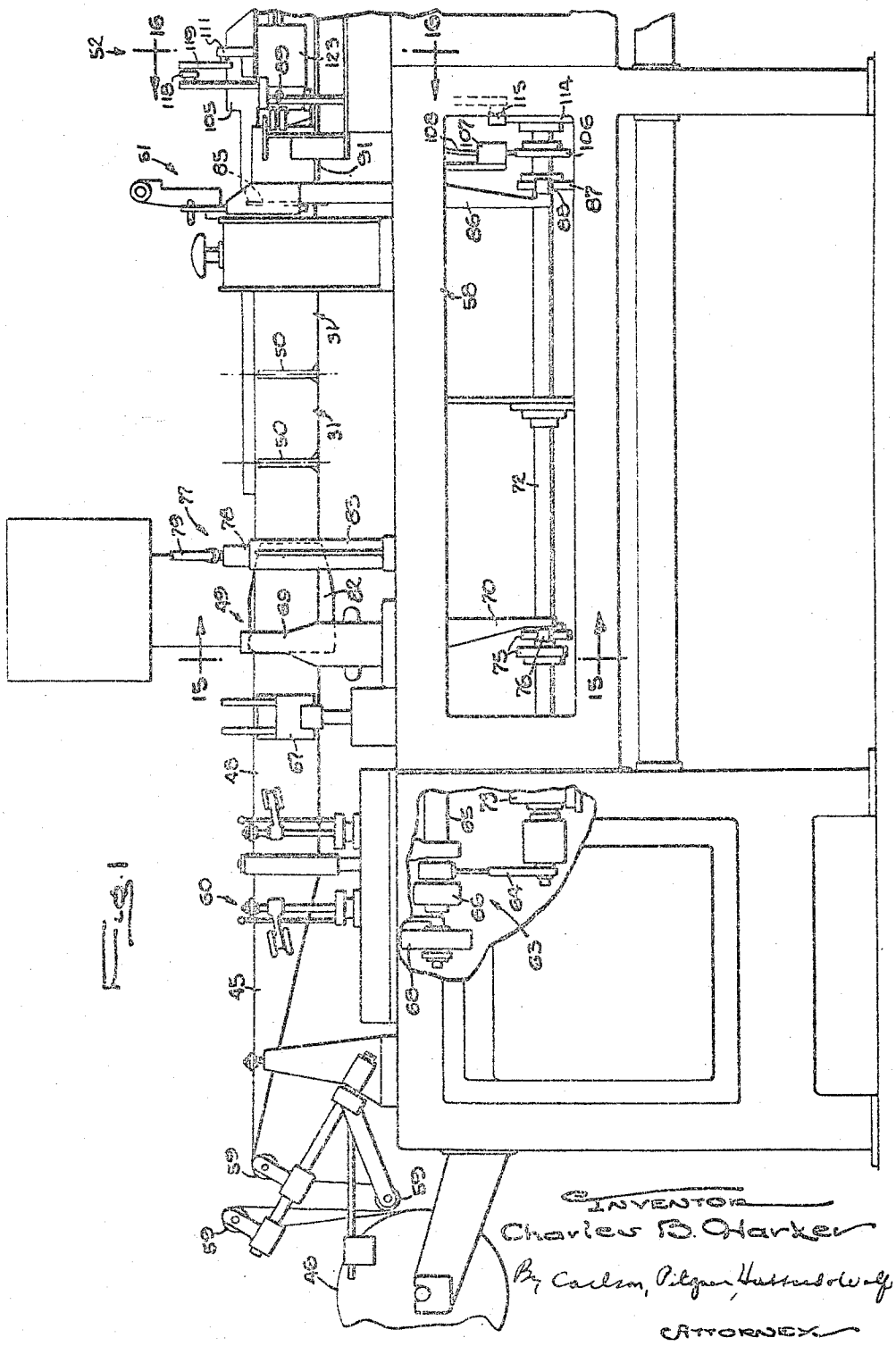
May 12, 1959 C. B. HARKER 2,885,846

MACHINE FOR FORMING, FILLING AND CLOSING BAGS

Filed Nov. 1, 1954 24 Sheets-Sheet 1



INVENTOR
Charles B. Harker
By Carlson, Pilger, Hartman & Wolf
ATTORNEY

May 12, 1959 C. B. HARKER 2,885,846

MACHINE FOR FORMING, FILLING AND CLOSING BAGS

Filed Nov. 1, 1954 24 Sheets-Sheet 2

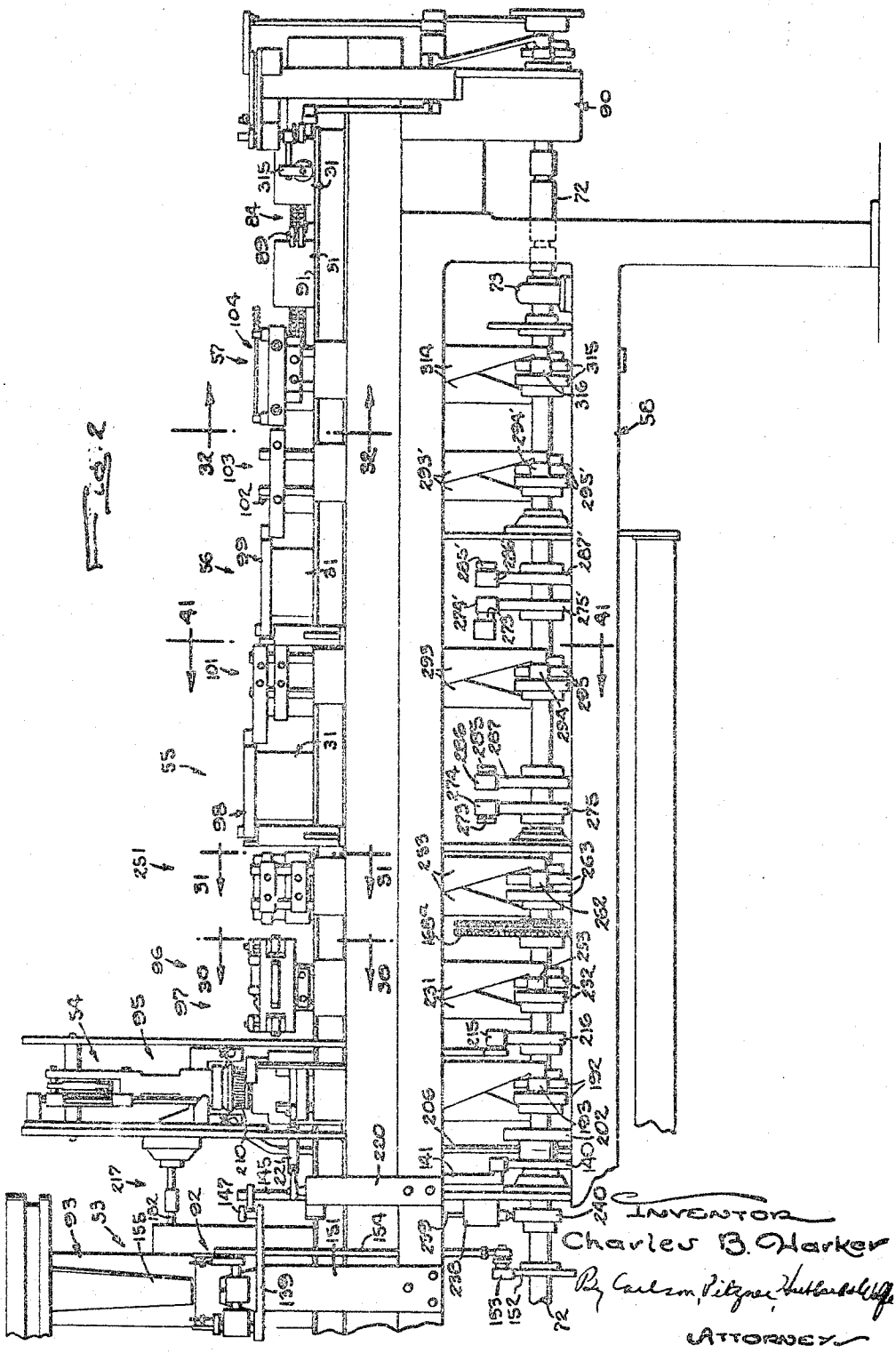


Fig. 2

INVENTOR
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May 12, 1959 C. B. HARKER 2,885,846

MACHINE FOR FORMING, FILLING AND CLOSING BAGS

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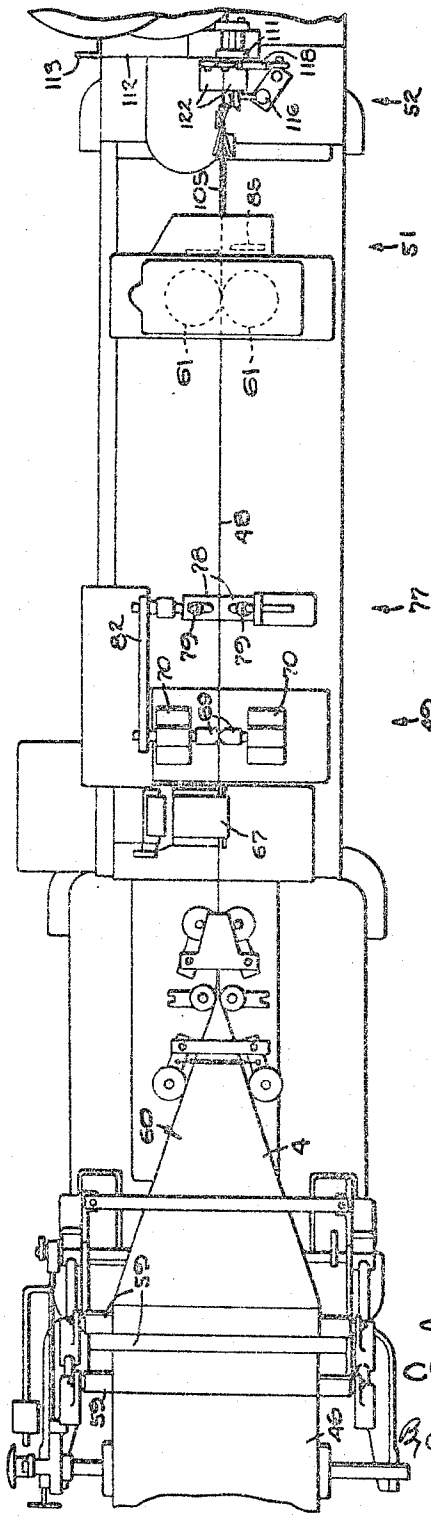
Fig. 3



INVENTOR
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ATTORNEYS

May 12, 1959 C. B. HARKER 2,885,846

MACHINE FOR FORMING, FILLING AND CLOSING BAGS

Filed Nov. 1, 1954 24 Sheets-Sheet 4

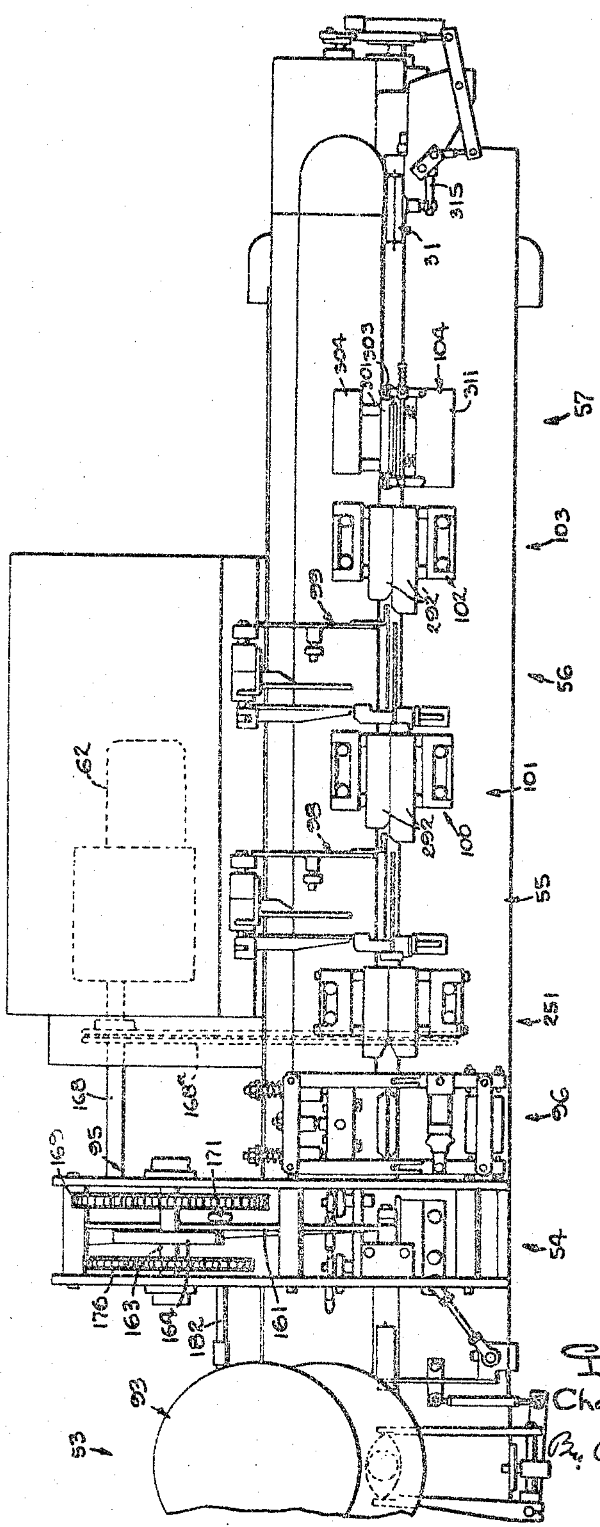

Fig. 4

INVENTOR
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ATTORNEYS

May 12, 1959 C. B. HARKER 2,885,846

MACHINE FOR FORMING, FILLING AND CLOSING BAGS

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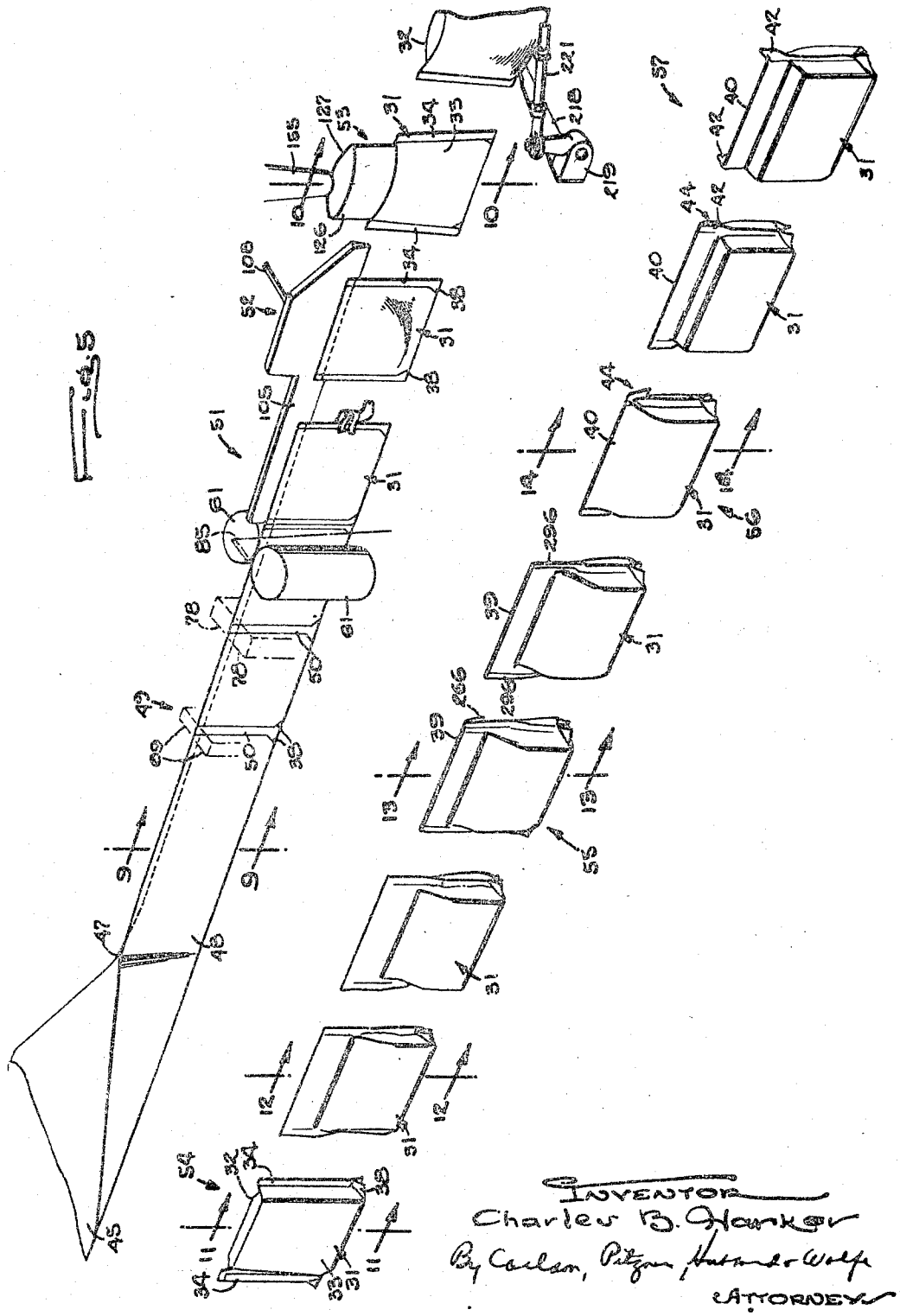

Fig. 5

INVENTOR
Charles B. Harker
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ATTORNEYS

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MACHINE FOR FORMING, FILLING AND CLOSING BAGS

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Fig. 6

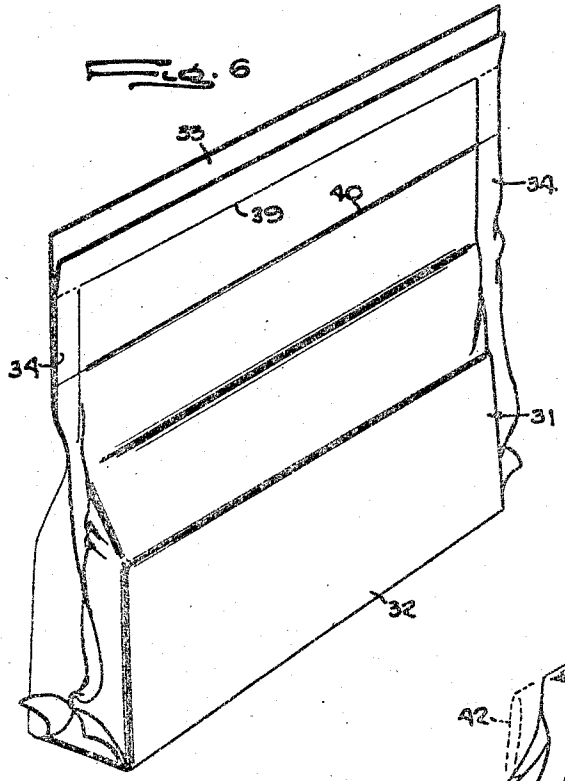


Fig. 7

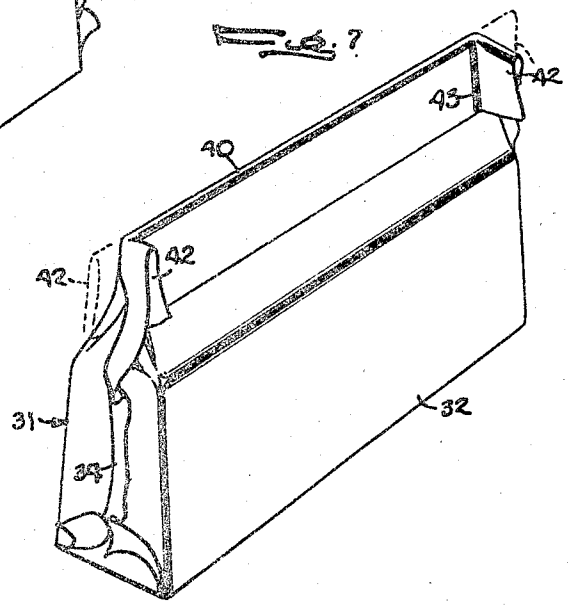
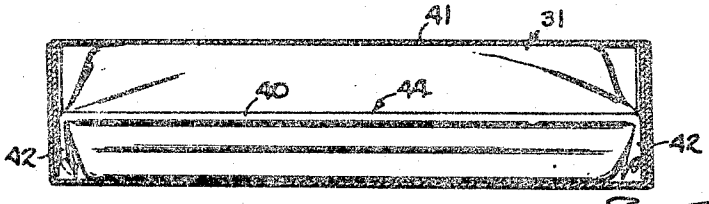


Fig. 8



INVENTOR
Charles B. Harker
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May 12, 1959 C. B. HARKER 2,885,846

MACHINE FOR FORMING, FILLING AND CLOSING BAGS

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Fig. 9

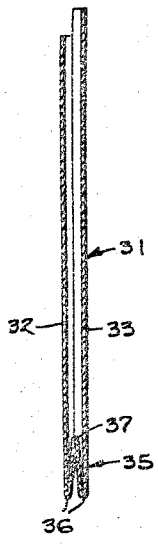


Fig. 10

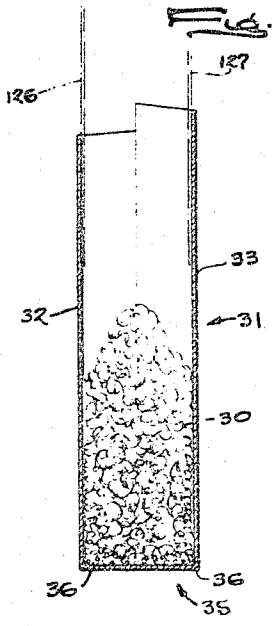


Fig. 11

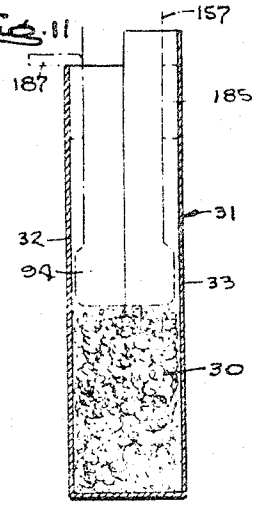


Fig. 12

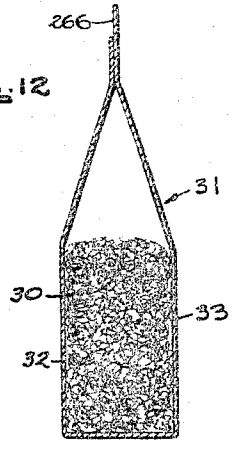


Fig. 13

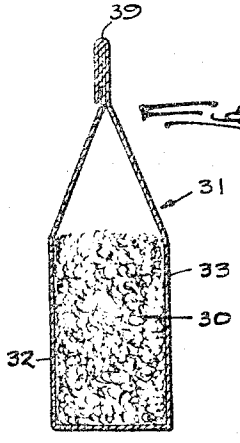
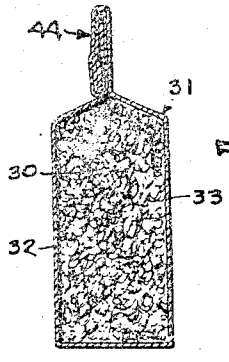


Fig. 14



INVENTOR
Charles B. Harker
By Carlson, Peterson, Hume & Wolfe
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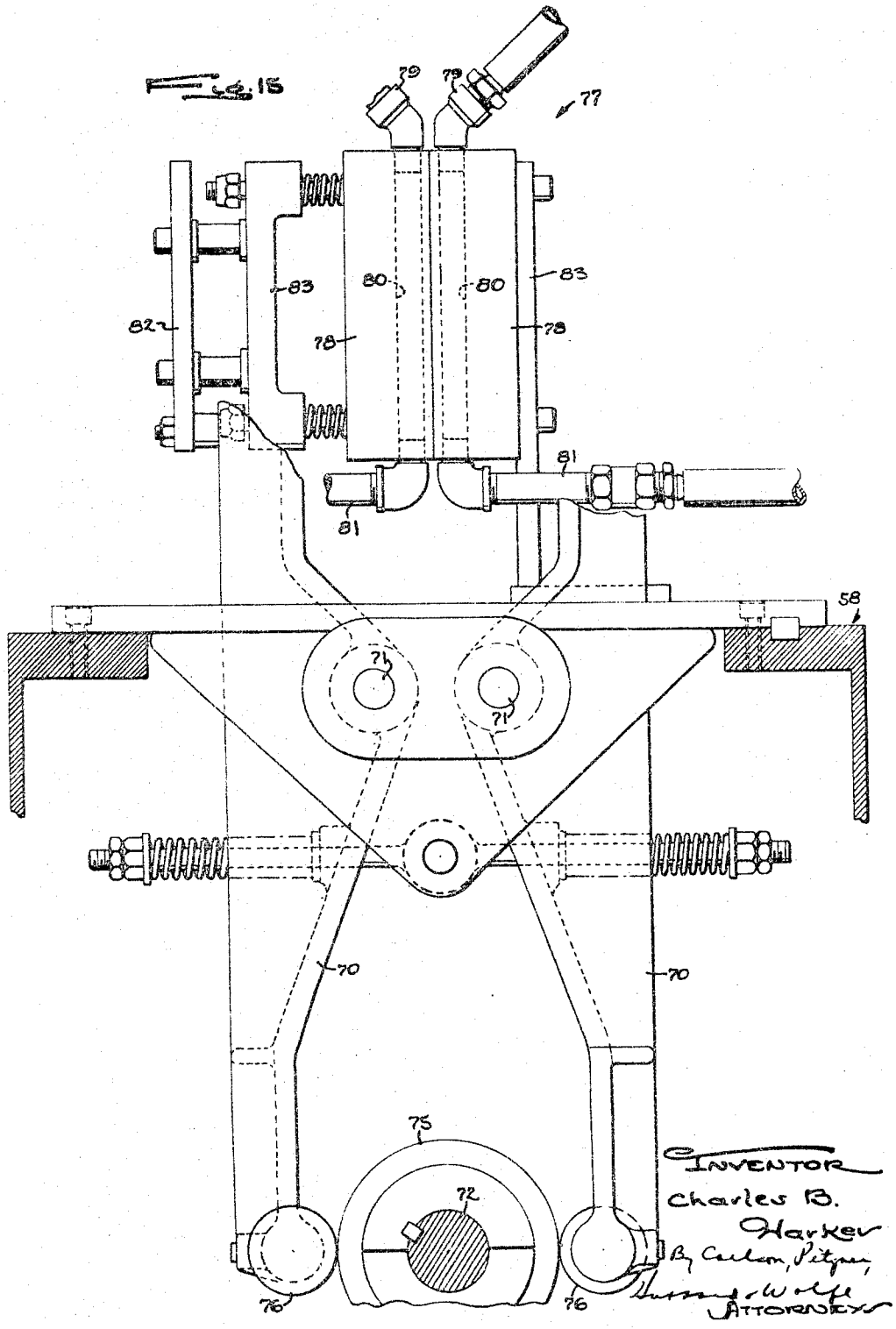
May 12, 1959 C. B. HARKER 2,885,846

MACHINE FOR FORMING, FILLING AND CLOSING BAGS

Filed Nov. 1, 1954 24 Sheets-Sheet 8



INVENTOR
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May 12, 1959 C. B. HARKER 2,885,846

MACHINE FOR FORMING, FILLING AND CLOSING BAGS

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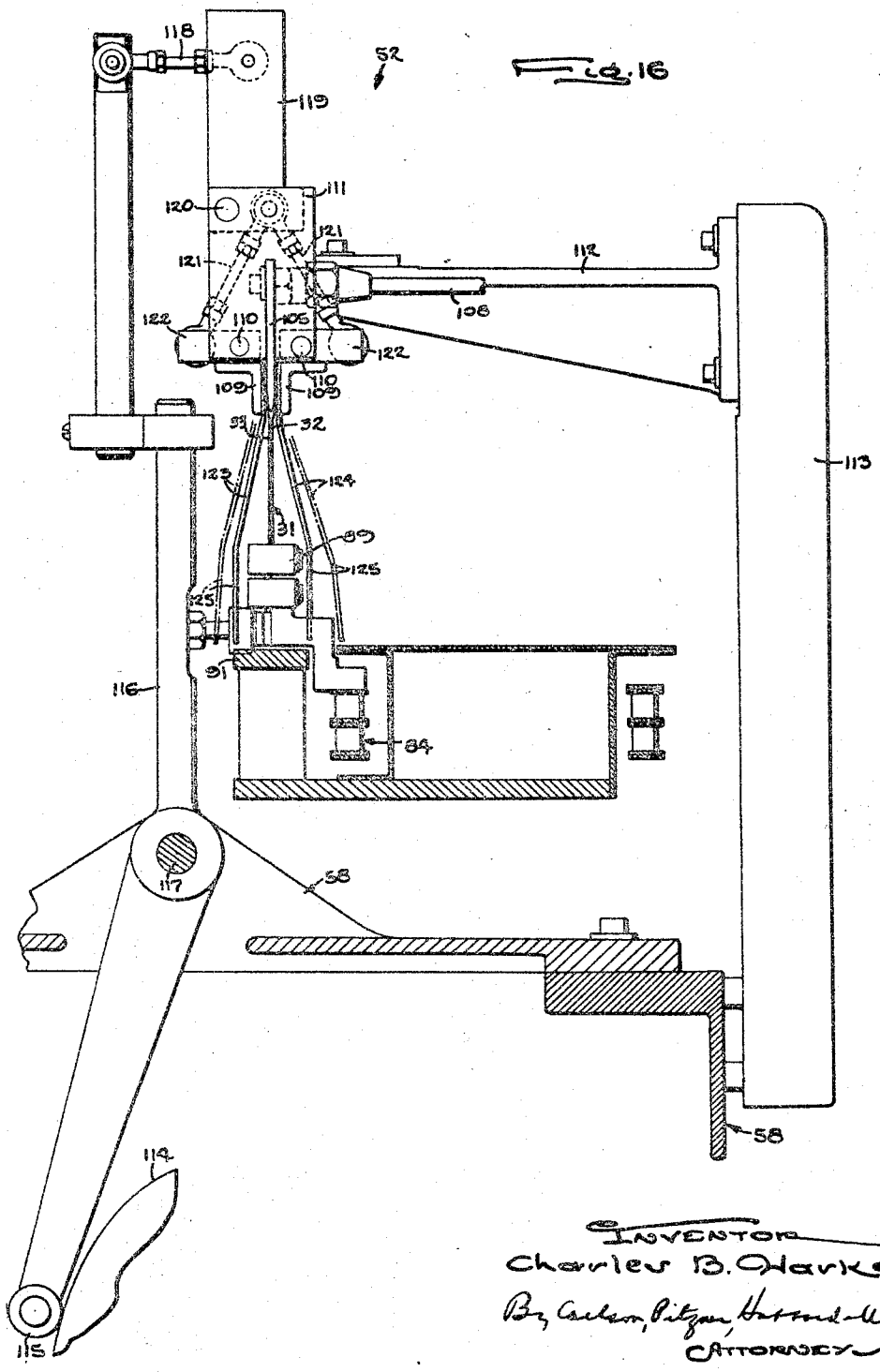

Fig. 16

INVENTOR
Charles B. Harker
By Carlson, Pitzer, Hamond-Wolfe
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May 12, 1959 C. B. HARKER 2,885,846

MACHINE FOR FORMING, FILLING AND CLOSING BAGS

Filed Nov. 1, 1954

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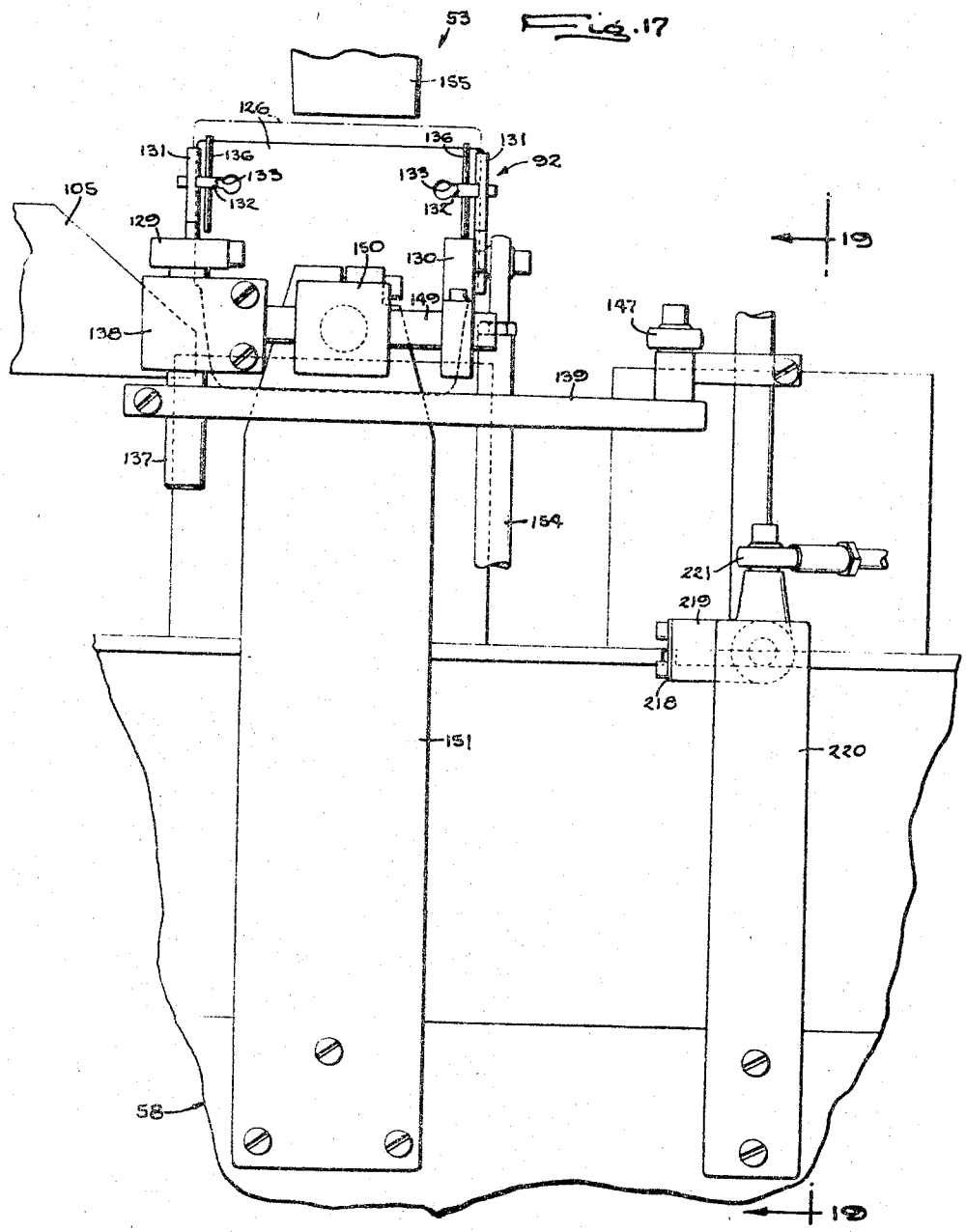
Fig. 17



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May 12, 1959 C. B. HARKER 2,885,846

MACHINE FOR FORMING, FILLING AND CLOSING BAGS

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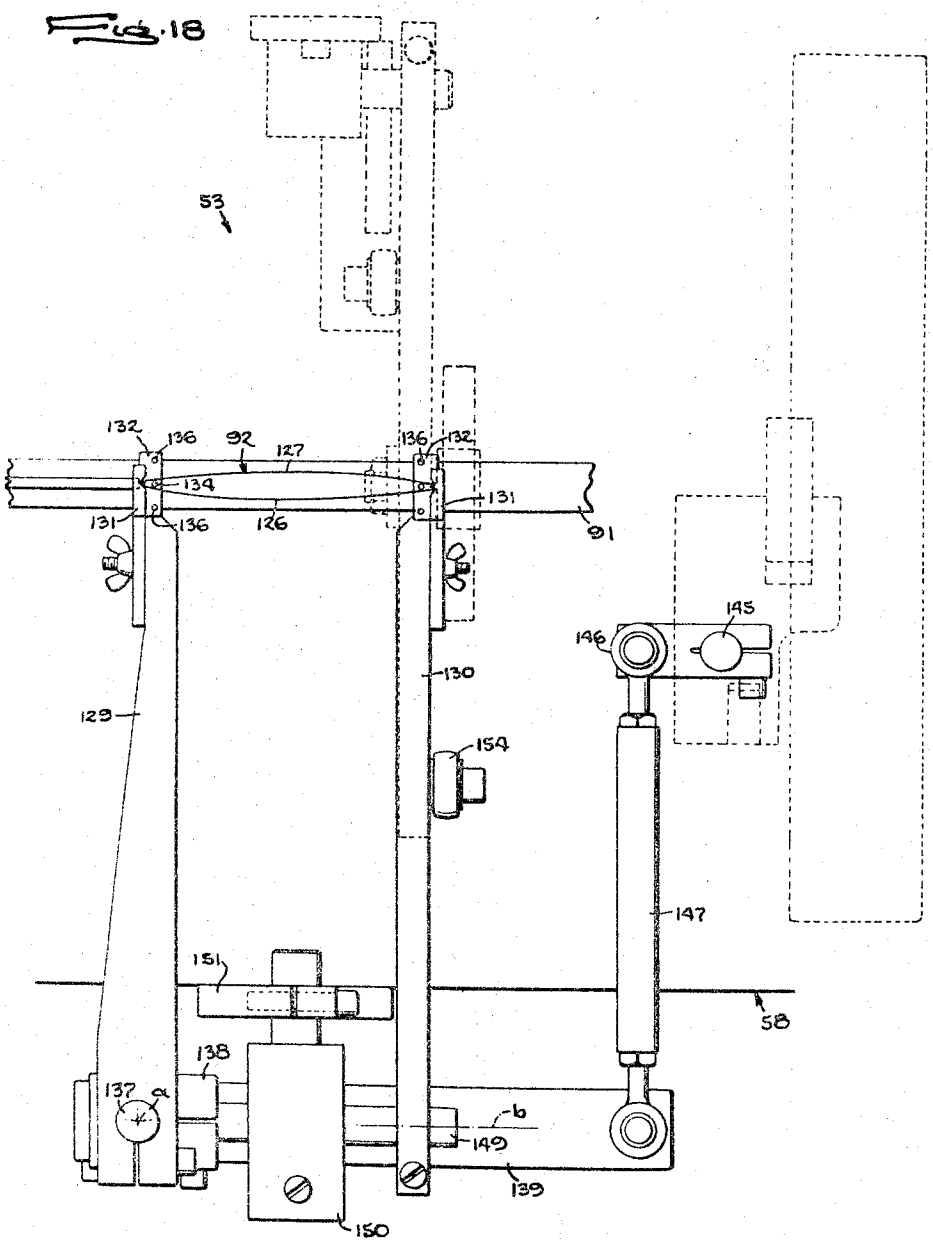
Fig. 18



INVENTOR
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By Carlson, Pilger, Hubbard & Wolfe
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May 12, 1959 C. B. HARKER 2,885,846

MACHINE FOR FORMING, FILLING AND CLOSING BAGS

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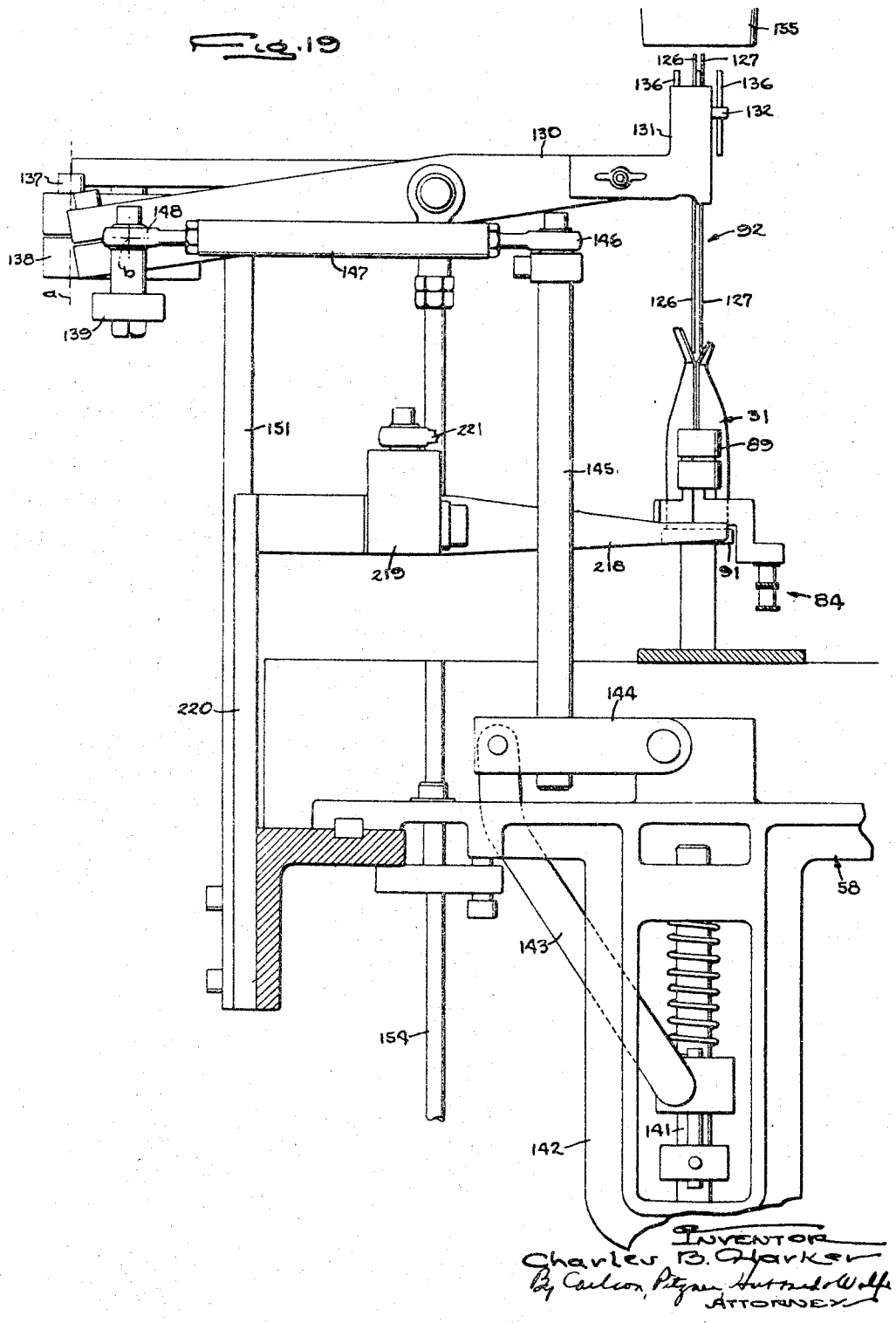
Fig. 19



INVENTOR
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May 12, 1959 C. B. HARKER 2,885,846

MACHINE FOR FORMING, FILLING AND CLOSING BAGS

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Fig. 20

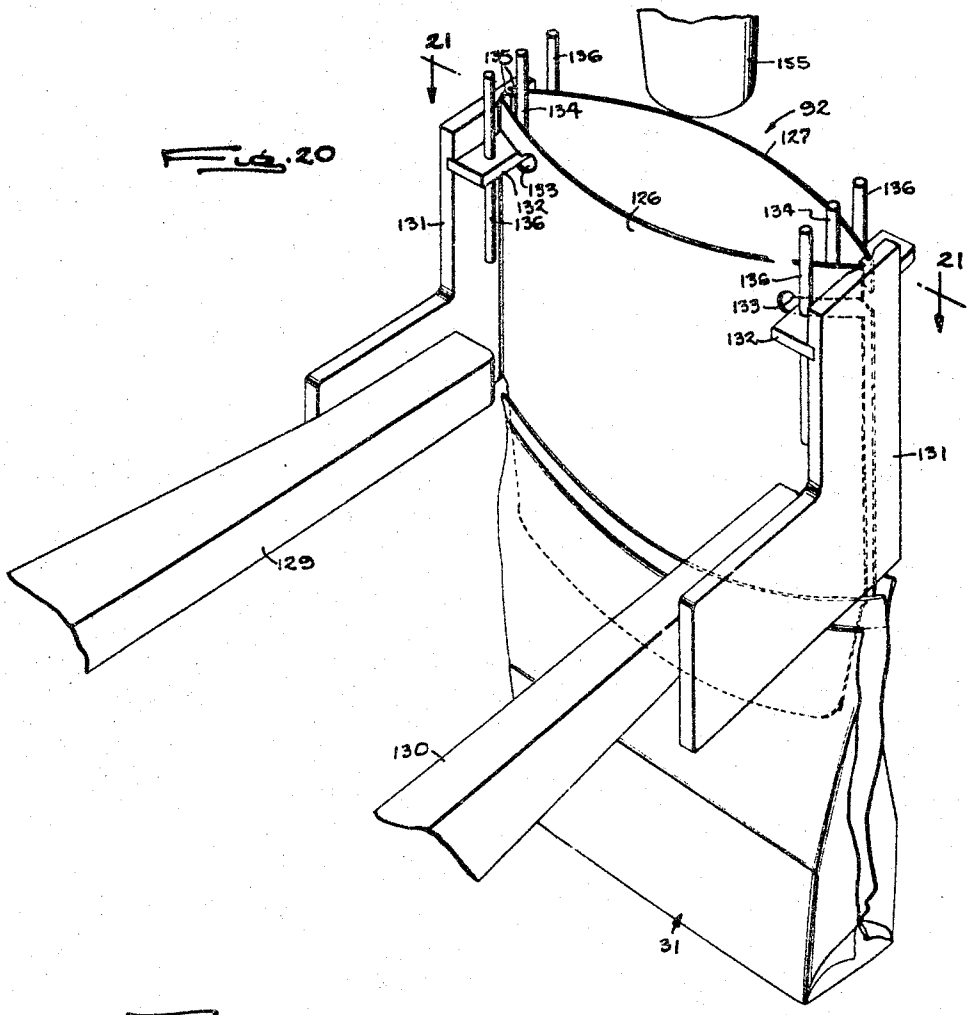
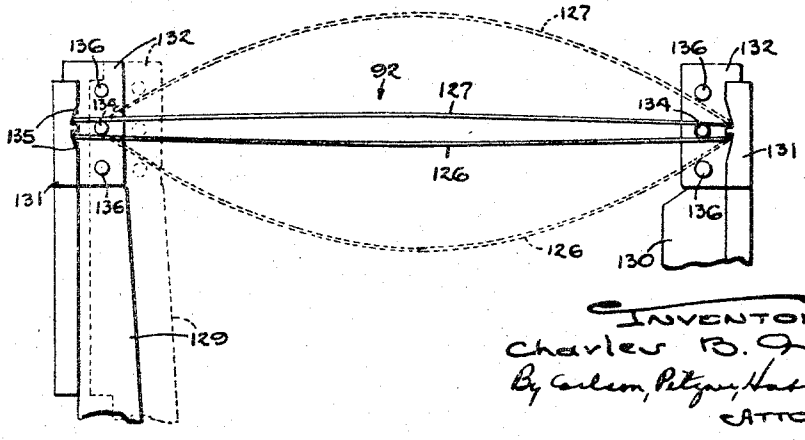


Fig. 21



INVENTOR
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By Carlson, Pitzer, Hassard & Wolfe
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May 12, 1959 C. B. HARKER 2,885,846

MACHINE FOR FORMING, FILLING AND CLOSING BAGS

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Fig. 22

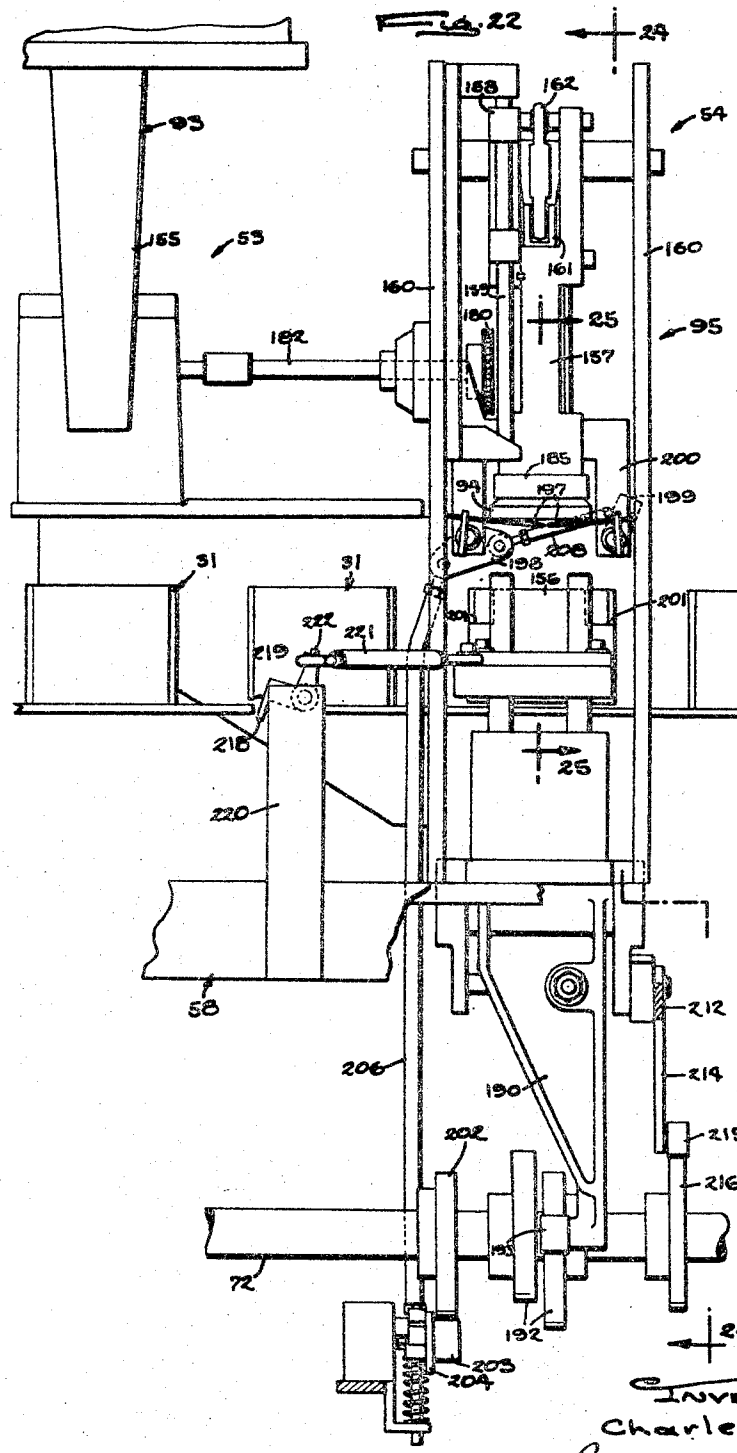
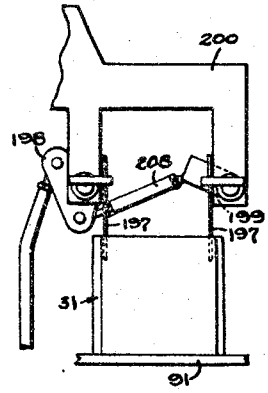


Fig. 23



INVENTOR
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By Carlson, Pelgrim, Hallman & Wolfe
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May 12, 1959 C. B. HARKER 2,885,846

MACHINE FOR FORMING, FILLING AND CLOSING BAGS

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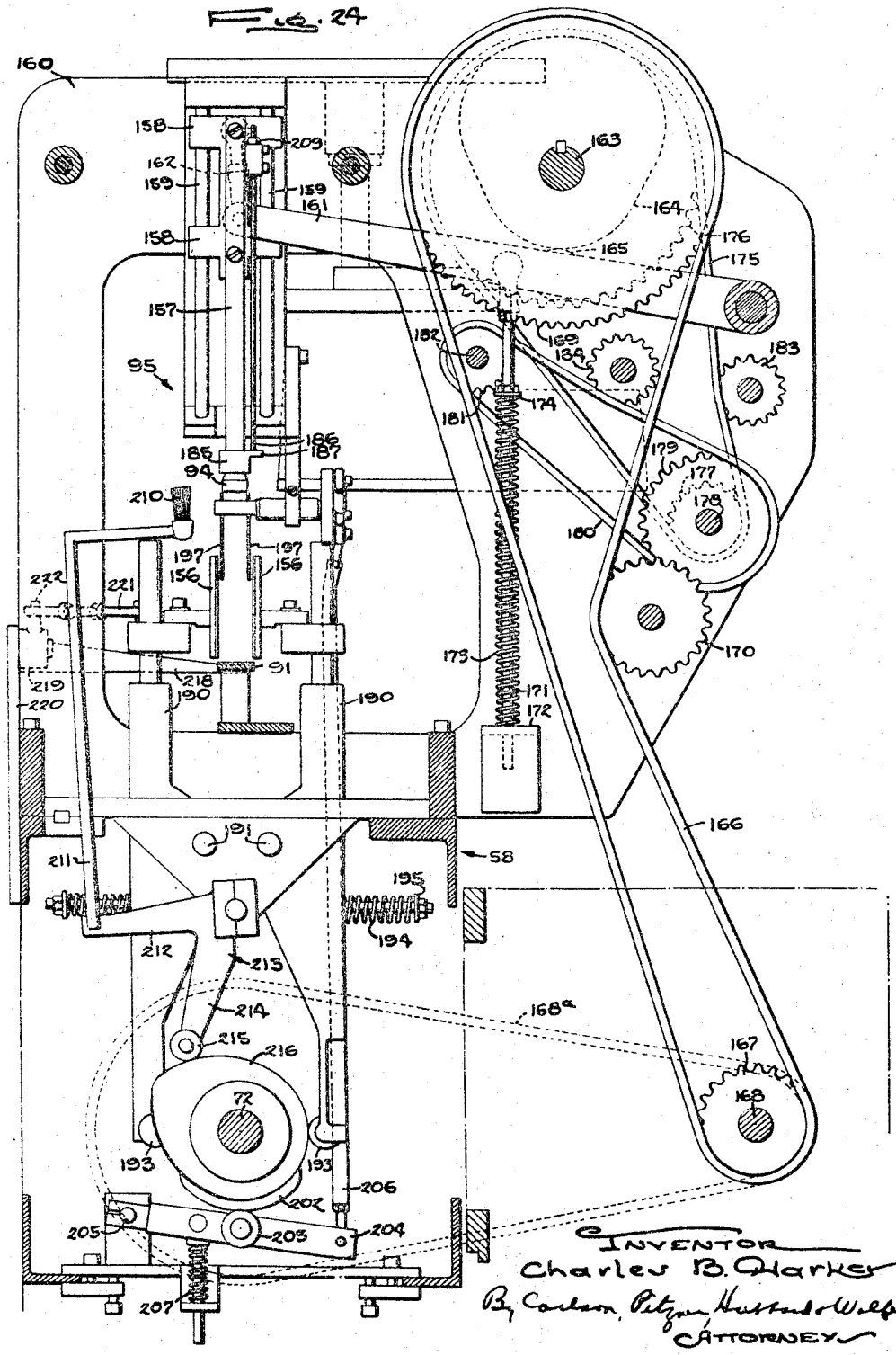
Fig. 24



INVENTOR
Charles B. Harker
By Carlson, Pitzer, Hurlbut & Wolfe
ATTORNEYS

May 12, 1959 C. B. HARKER 2,885,846

MACHINE FOR FORMING, FILLING AND CLOSING BAGS

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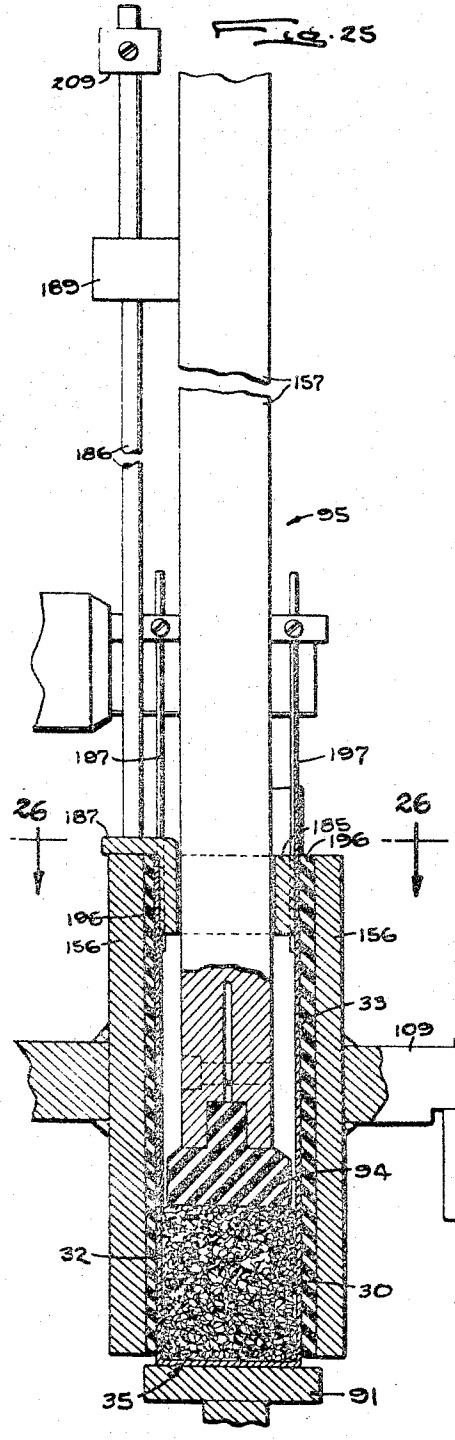
Fig. 25



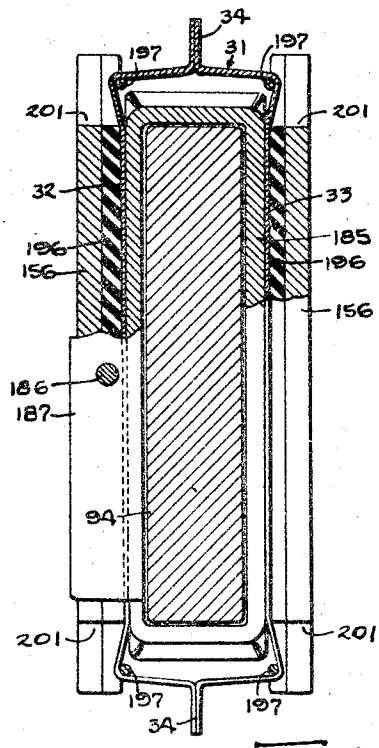


Fig. 26

INVENTOR
Charles B. Harker
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May 12, 1959 C. B. HARKER 2,885,846

MACHINE FOR FORMING, FILLING AND CLOSING BAGS

Filed Nov. 1, 1954 24 Sheets-Sheet 17

Fig. 27

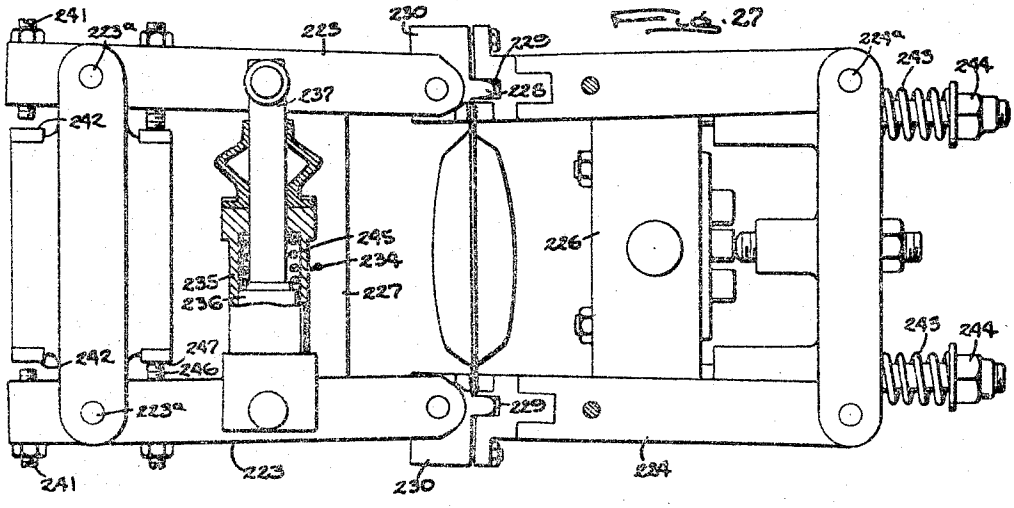
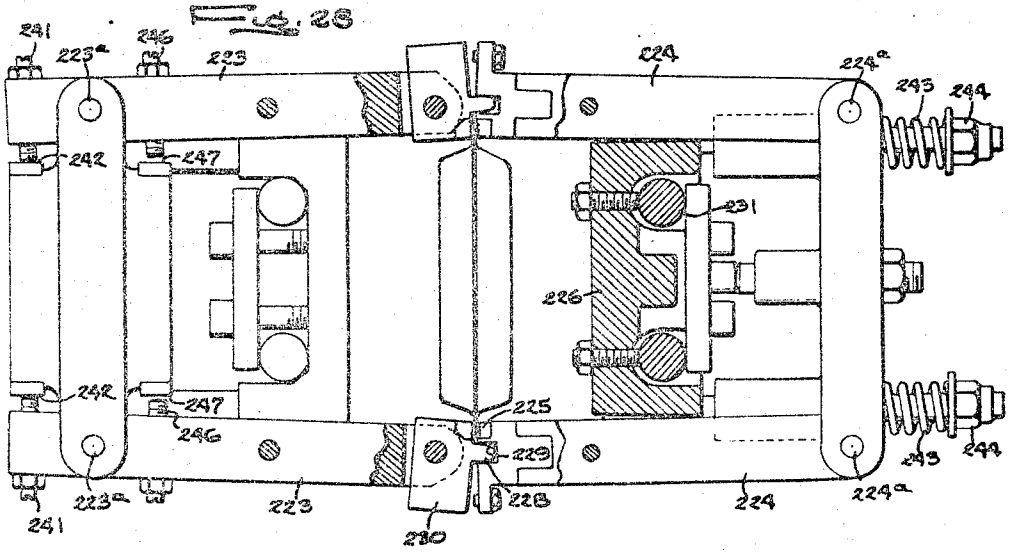


Fig. 28



INVENTOR
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May 12, 1959 C. B. HARKER 2,885,846

MACHINE FOR FORMING, FILLING AND CLOSING BAGS

Filed Nov. 1, 1954 24 Sheets-Sheet 18

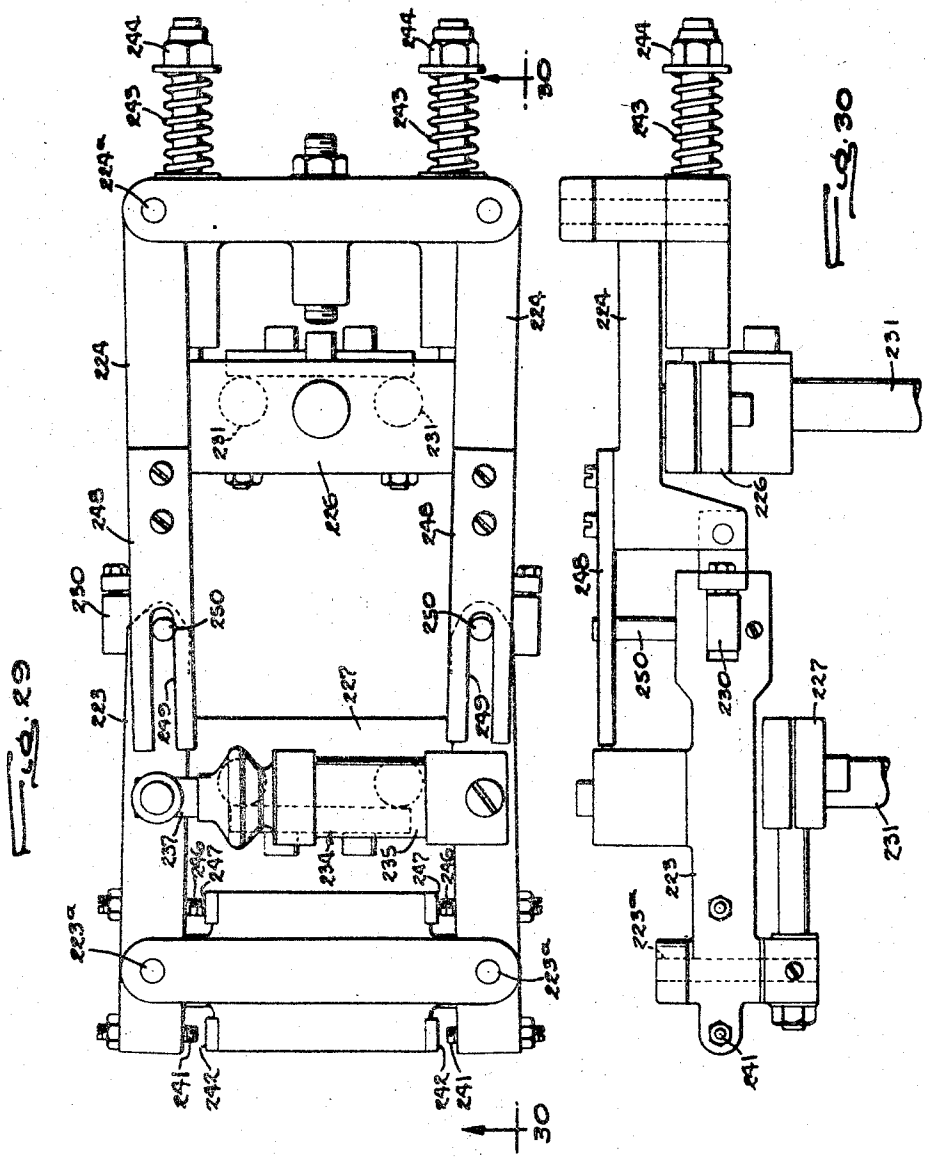

Fig. 29

Fig. 30

INVENTOR
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May 12, 1959 C. B. HARKER 2,885,846

MACHINE FOR FORMING, FILLING AND CLOSING BAGS

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Fig. 31

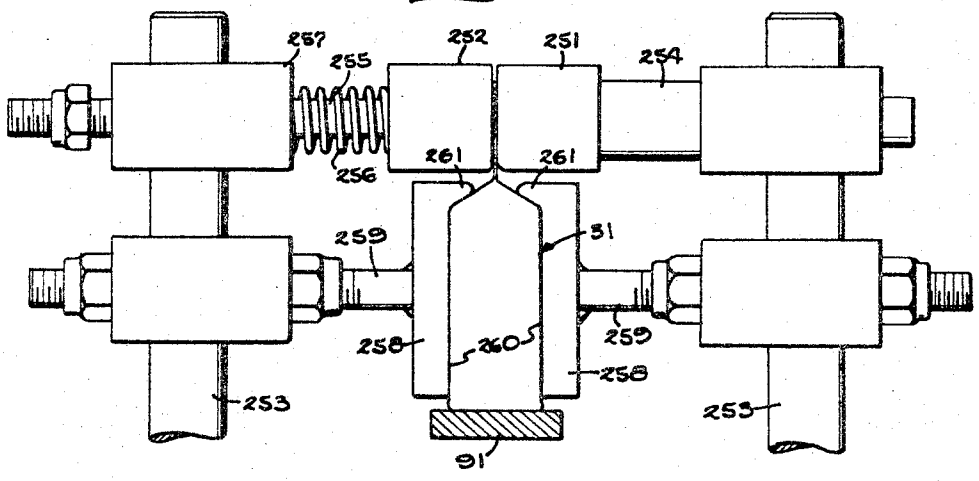
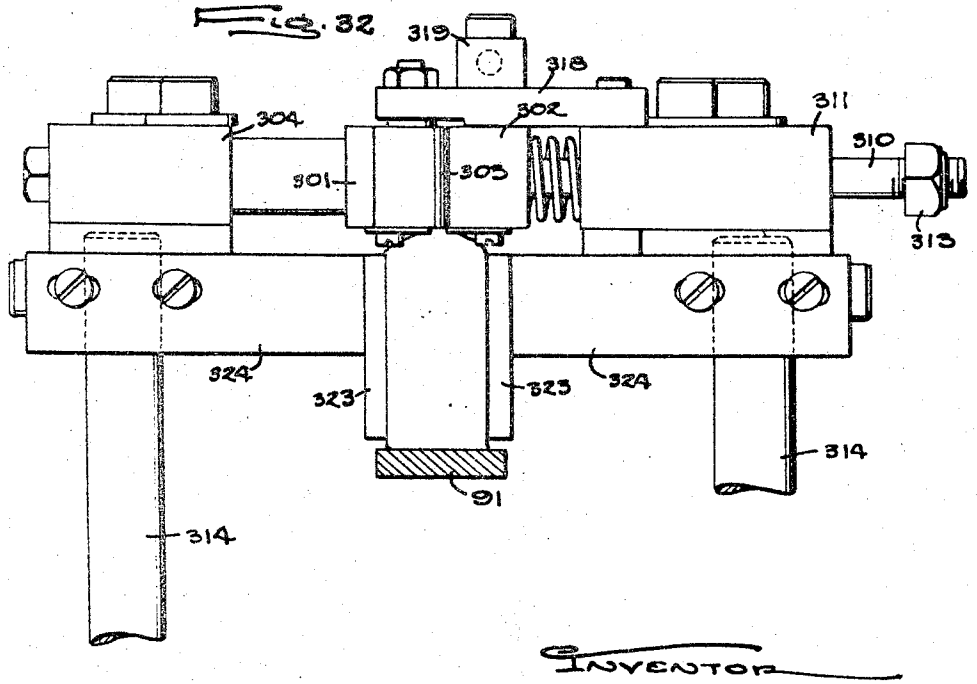


Fig. 32



INVENTOR
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By Carlson, Pitzer, Hubbard & Wolfe
ATTORNEYS

May 12, 1959 C. B. HARKER 2,885,846

MACHINE FOR FORMING, FILLING AND CLOSING BAGS

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Fig. 33

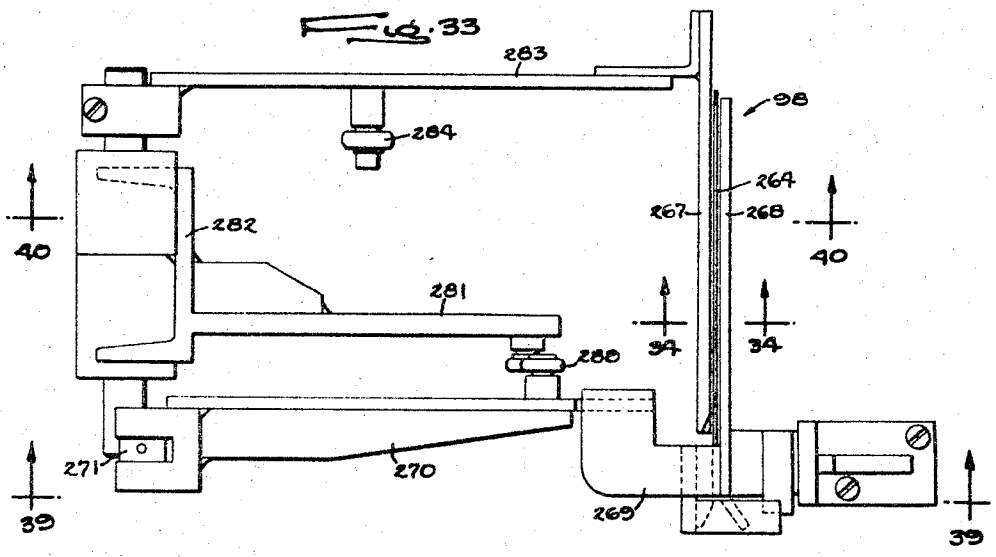


Fig. 34

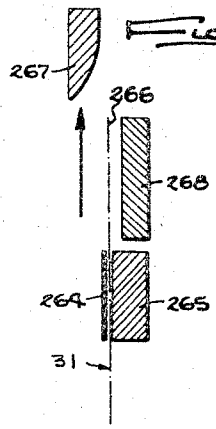


Fig. 35

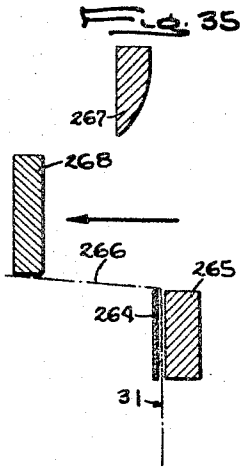


Fig. 36

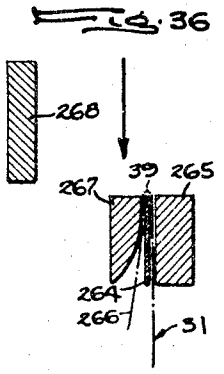


Fig. 37

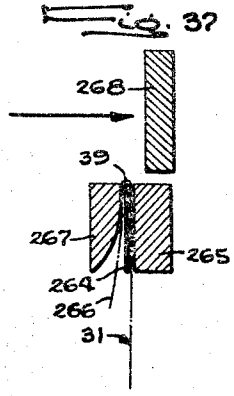
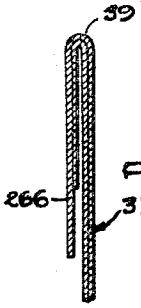


Fig. 38



INVENTOR
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May 12, 1959 C. B. HARKER 2,885,846

MACHINE FOR FORMING, FILLING AND CLOSING BAGS

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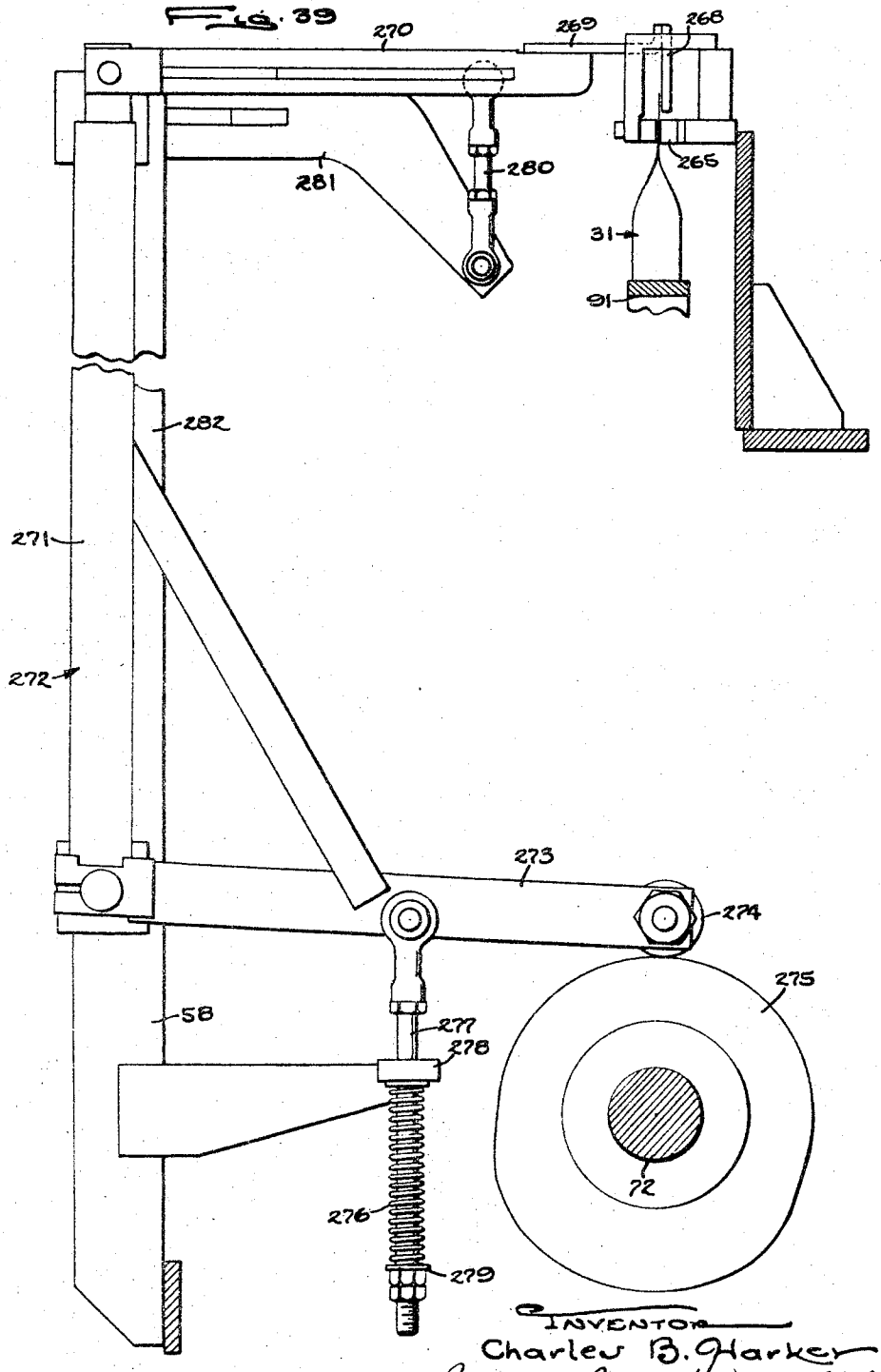
Fig. 39



INVENTOR
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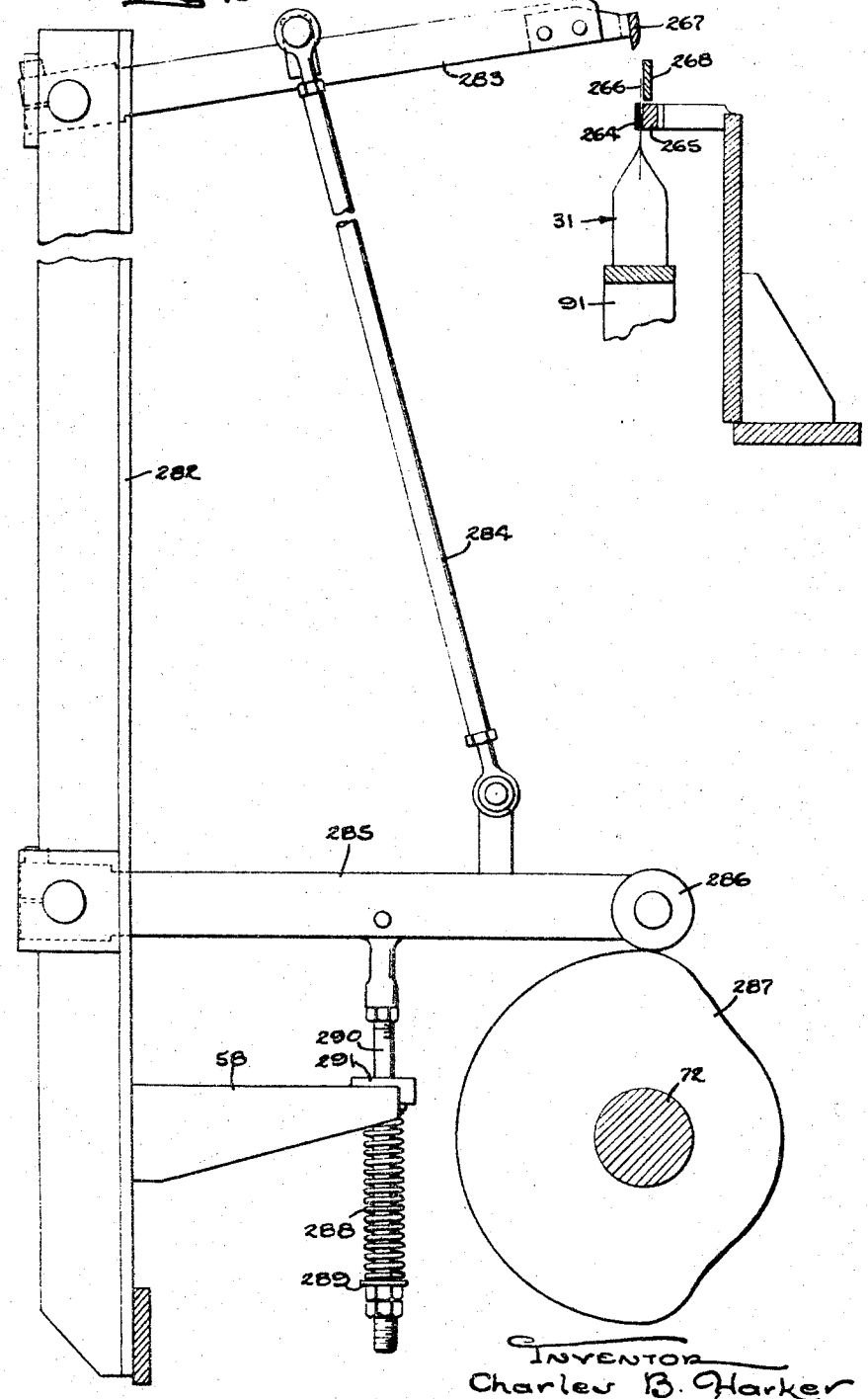
By Carlson, Pitzner, Hubbard & Wolfe
ATTORNEYS

May 12, 1959 C. B. HARKER 2,885,846

MACHINE FOR FORMING, FILLING AND CLOSING BAGS

Filed Nov. 1, 1954 24 Sheets-Sheet 22

Fig. 40



INVENTOR
Charles B. Harker
By Carlson, Patzey, Watson & Welsh
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May 12, 1959 C. B. HARKER 2,885,846

MACHINE FOR FORMING, FILLING AND CLOSING BAGS

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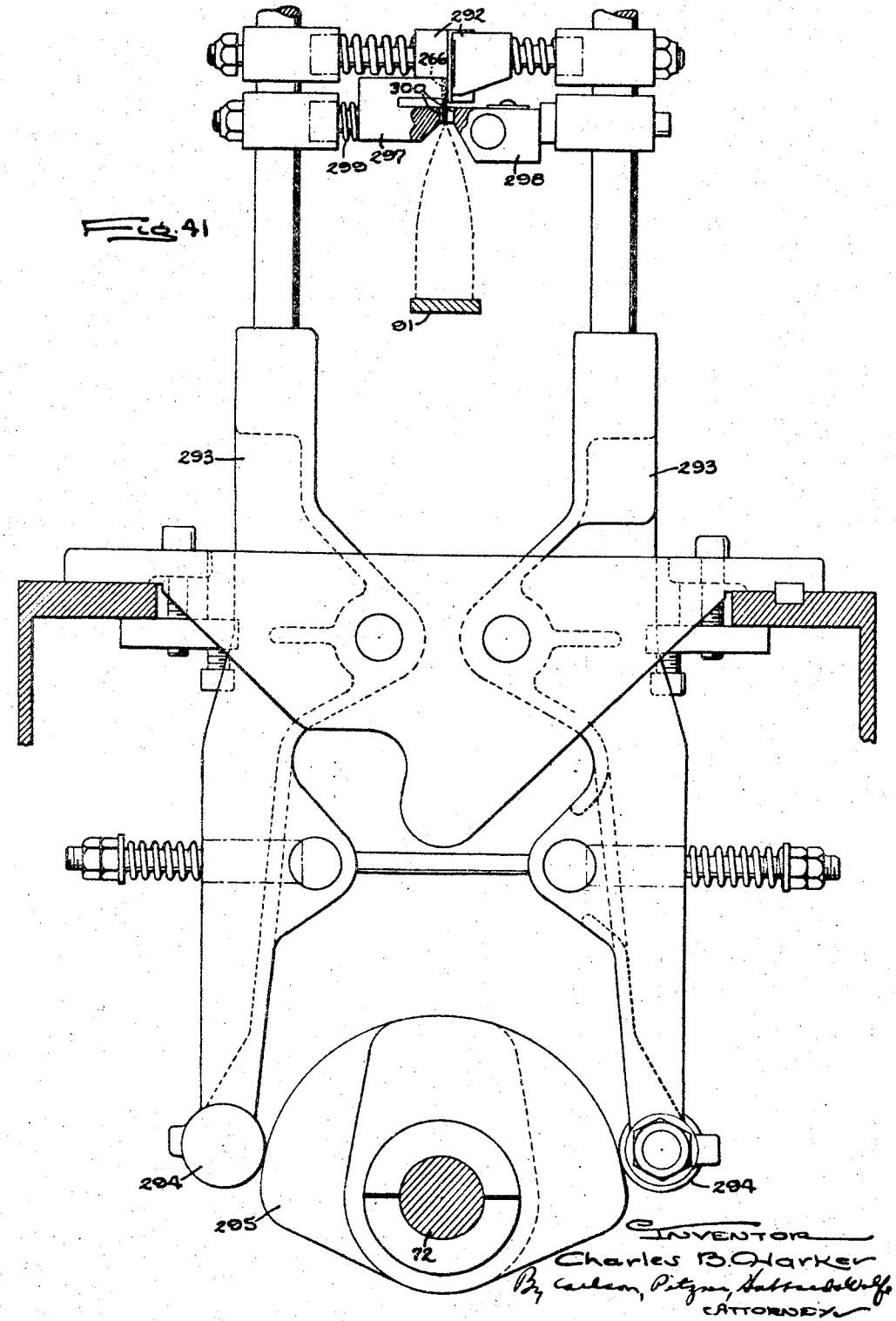
Fig. 41



INVENTOR
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By Carlson, Pitzner, Hubbard & Wolfe
ATTORNEYS

May 12, 1959 C. B. HARKER 2,885,846

MACHINE FOR FORMING, FILLING AND CLOSING BAGS

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Fig. 42

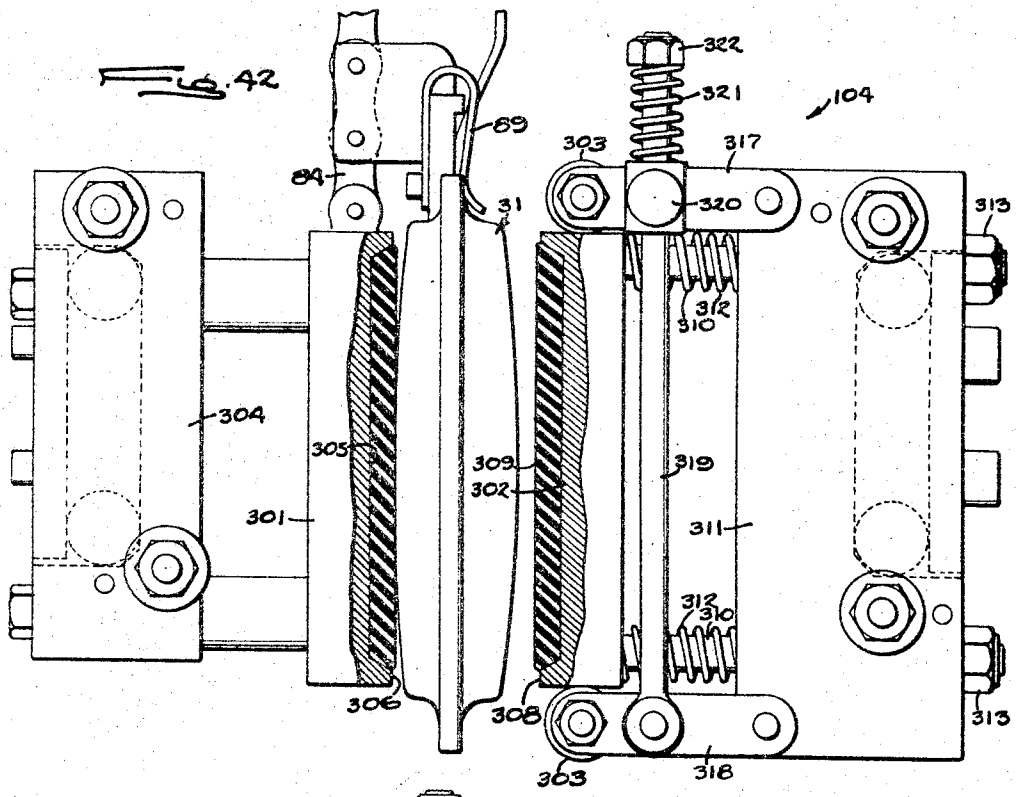
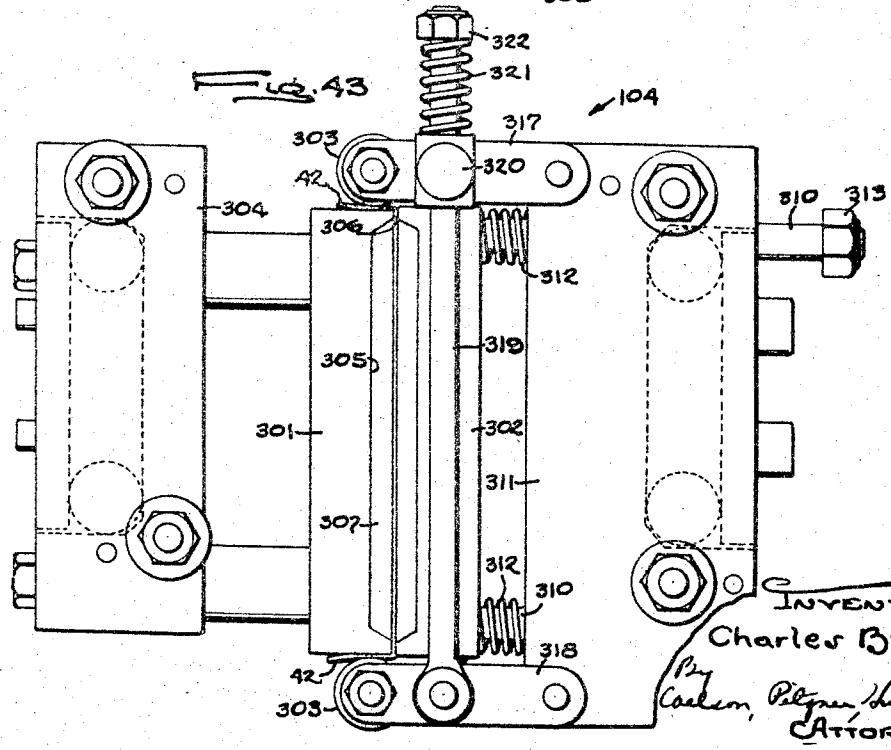


Fig. 43



INVENTOR
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United States Patent Office

2,885,846

Patented May 12, 1959

2,885,846

MACHINE FOR FORMING, FILLING AND CLOSING BAGS

Charles B. Harker, Rockford, Ill., assignor to Bartelt Engineering Company, Rockford, Ill., a corporation of Illinois

Application November 1, 1954, Serial No. 465,885

17 Claims. (Cl. 53—124)

This invention relates to a machine for forming, filling and closing a succession of bags as the latter are advanced step by step along a predetermined path and presented successively to a plurality of stations. More particularly, the invention has reference to a machine for packaging a loose material, such as pipe tobacco, in a bag which is expandible into a substantially squared shape.

The general object of the invention is to provide a new and improved machine of the above character which operates automatically and at high speeds, which produces a compact and neat package and in which the completed bag is comparatively airtight to maintain the quality of the contents but may be opened and closed again easily.

Another object is to provide a novel combination of bag making and packaging mechanisms which form, fill and close the bags rapidly without wrinkling or otherwise marring the appearance of the bag.

A further object is to provide a new and improved mechanism for opening the bag for filling whereby the entire mouth of the bag is held open to permit a large quantity of material to be dropped in a mass into the bag.

A detailed object is to tamp the material being packaged thereby to reduce the overall size of the completed package and to expand the bag to the squared shape automatically as an incident to such tamping.

Another object is to tamp the packaged material and expand the bag to its squared shape and then to stretch the upper portion of the bag and thereby flatten the open end of the bag preparatory to closing the latter.

A further object is to close the bag by folding over the flattened portion at the top of the bag and, more particularly, by folding the flattened portion twice so that the bag is closed by a seal composed of a double fold.

Still another object is to seal the first fold temporarily in place to hold the fold in place while the second fold is made and this without interfering with the opening of the bag in use.

Another object is to prevent unfolding of the closing seal and thereby increase the airtightness of the bag by bending in the ends of the folded seal at a station subsequent to the station at which the final fold is made.

The invention also resides in the novel construction and arrangement of the mechanisms for tamping the material and expanding the bag, for stretching the folding of the bag top and for bending in the ends of the closing seal.

Other objects and advantages of the invention will become apparent from the following detailed description taken in connection with the accompanying drawings, in which:

Figure 1 is a fragmentary side elevation of the forward end of a packaging machine embodying the novel features of the present invention.

Fig. 2 is a fragmentary side elevation of the rear end of the machine and constitutes a continuation of Fig. 1.

Fig. 3 is a plan view of that portion of the machine shown in Fig. 1.

Fig. 4 is a plan view of that portion of the machine shown in Fig. 2.

Fig. 5 is a schematic perspective view showing the manner in which the bag is made, filled and closed.

Fig. 6 is a perspective view of the bag at one stage of the packaging operation.

Fig. 7 is a perspective view of the completed bag.

Fig. 8 is a sectional view of a carton enclosing the bag.

Fig. 9 is an enlarged sectional view taken along the line 9—9 in Fig. 5.

Fig. 10 is an enlarged sectional view taken along the line 10—10 in Fig. 5.

Fig. 11 is an enlarged sectional view taken along the line 11—11 in Fig. 5.

Fig. 12 is an enlarged sectional view taken along the line 12—12 in Fig. 5.

Fig. 13 is an enlarged sectional view taken along the line 13—13 in Fig. 5.

Fig. 14 is an enlarged sectional view taken along the line 14—14 in Fig. 5.

Fig. 15 is an enlarged sectional view taken along the line 15—15 in Fig. 1.

Fig. 16 is an enlarged fragmentary sectional view taken along the line 16—16 in Fig. 1.

Fig. 17 is an enlarged fragmentary side elevation of the mechanism for opening and filling the bag.

Fig. 18 is an enlarged fragmentary plan view of the opening mechanism.

Fig. 19 is a fragmentary sectional view taken along the line 19—19 in Fig. 17.

Fig. 20 is a fragmentary perspective view of the filling and opening mechanisms.

Fig. 21 is a fragmentary sectional view taken along the line 21—21 in Fig. 20.

Fig. 22 is an enlarged fragmentary side elevation of the mechanism for compacting the material in the bag and associated mechanisms.

Fig. 23 is a fragmentary view similar to Fig. 22 but showing the parts in a moved position.

Fig. 24 is a fragmentary sectional view taken along the line 24—24 in Fig. 22.

Fig. 25 is an enlarged sectional view taken along the line 25—25 in Fig. 22 and showing the parts in a moved position.

Fig. 26 is a sectional view taken along the line 26—26 in Fig. 25, parts being broken away and shown in section.

Fig. 27 is a fragmentary plan view of the mechanism for stretching the upper portion of a filled bag, parts being broken away and shown in section.

Fig. 28 is a view similar to Fig. 27 but showing the parts in a different position.

Fig. 29 is a view similar to Fig. 27 but shows the parts in full.

Fig. 30 is an enlarged fragmentary sectional view taken along the line 30—30 in Fig. 2.

Fig. 31 is an enlarged fragmentary sectional view taken along the line 31—31 in Fig. 2.

Fig. 32 is an enlarged fragmentary sectional view taken along the line 32—32 in Fig. 2.

Fig. 33 is an enlarged fragmentary plan view of the mechanism for folding the bag top.

Fig. 34 is an enlarged sectional view taken along the line 34—34 in Fig. 3.

Figs. 35, 36 and 37 are views similar to Fig. 34 and illustrate the successive steps of the folding mechanism.

Fig. 38 is a fragmentary sectional view of the folded upper portion of the bag.

Fig. 39 is a fragmentary sectional view taken along the line 39—39 in Fig. 33.

Fig. 40 is a fragmentary sectional view taken along the line 40—40 in Fig. 33.

Fig. 41 is an enlarged fragmentary sectional view taken along the line 41—41 in Fig. 2.

Fig. 42 is an enlarged fragmentary plan view of the mechanism for bending in the ends of the folded portion of the bag, parts being broken away and shown in section.

Fig. 43 is a view similar to Fig. 42 but shows the parts in a moved position.

As shown in the drawings for purposes of illustration, the invention is embodied in a machine for packaging a loose granular or shredded material 30, such as pipe tobacco, in a bag or pouch 31 (see Figs. 5 through 14). The latter is expandible to assume a generally square or rectangular shape when opened and filled but is formed in a flat condition from front and back panels 32 and 33 disposed face to face and joined together along their side margins by seals 34. Along their bottom edges, the panels are joined by a bellows-like or gusset fold 35 which is formed by two outer folds 36 and an intermediate reverse fold 37. The side seals 34 extend from a point below the upper edge of the front panel 32, which may be slightly shorter than the back panel 33, to the reverse fold 37. Below the reverse fold, the two halves of each fold 36 are joined together at the edges of the bag by seals 38 (Fig. 5) but the two folds are not joined to each other as shown in Fig. 7. The seals 38 extend downwardly and inwardly from the intersection of the reverse fold and the inner edge of the adjacent side seal 34, that is, they extend diagonally across the lower corners of the bag.

With the foregoing construction, the gusset fold 35 expands when the bag is opened and filled as shown in Fig. 10 and assumes the generally squared shape illustrated in Fig. 11. After the material 30 is deposited in the expanded bag, the top of the bag is closed by a seal which may be made by folding over the upper edge portions of the panels 32 and 33. In the present instance, the panels are folded twice to provide a comparatively air-tight package. The first fold is made along a line 39 (Fig. 6) below the upper edge of the shorter front panel 32 and at the top of the side seals 34, so that portions of both panels are folded over and the second fold is made along a line 40 below the folded over upper edge of the back panel 33 (see Fig. 6).

It will be seen from Figs. 6 and 7 that the upper bag portion, which has been flattened for the folds 39 and 40, is wider than the expanded body portion of the bag. To reduce the overall size of the bag so that the latter may be inserted in a carton 41 (Fig. 8) of minimum size, the triangular portions 42 (Fig. 7) which project beyond the sides of the body portion of the bag at the upper end thereof are bent forwardly along vertical fold lines 43, these lines constituting continuations of the sides of the expanded body portion of the bag. Such bending reduces the maximum length of the bag to that of the body portion and, as a result, the carton need only be long enough to receive this length. When the bag is in the carton 41, the bent over portions 42 are engaged and held in position by the ends of the carton and, since they are held in the bent position, these portions prevent the closure 40 formed by top folds 39 and 40 from unfolding accidentally.

Preferably, the bags 31 are made on an automatic machine such as the one disclosed in Bartelt Patent 2,649,674. For this purpose, the bags are constructed from a flexible sheet of material such as metal foil coated on one side with a heat sealable thermoplastic material. The coated sides of the panels 32 and 33 are disposed on the inside of the bag in face to face relation so that the seals 34 and 38 may be formed by the application of heat and pressure to the outside of the bag at areas corresponding to the areas of these seals. The heat applied is sufficient to soften the thermoplastic material and the opposed areas of softened thermoplastic are fused by the pressure.

In general, the bags are formed on the machine by unwinding a sheet 45 (Figs. 1 and 5) of foil coated on its upper side with the thermoplastic material from a suitable supply roll 46 and by folding the sheet longitudinally into two strips 47 and 48 corresponding to the front and back panels 32 and 33. The fold is made to one side of the center of the sheet 45 so that the strip 48 is wider than the strip 47 to conform to the sizes of the bag panels and, while the fold is being made, the folded edge is tucked in as disclosed in the patent to make the outer and reverse folds 36 and 37, that is, to form the gusset 35. After being folded, the sheet is advanced step by step along a linear path through a succession of stations at which the various bag making, filling and closing operations are performed.

At the first station 49 (Figs. 1, 3 and 5), the two strips are heat sealed together transversely to form a series of bags connected at their side edges and open at the top. The cross seal 50 thus formed is twice as wide as the side seals 34 so that it forms the trailing edge seal of one bag and the leading edge seal of the next bag and this seal 50 also includes the diagonal corner seals 38. After the strips are sealed, the bags are separated at a cut-off station 51 and the severed bags then are opened at a station 52 and are filled with the material to be packaged at a station 53 (Figs. 2, 4 and 5). Next, the material within the bag is compacted at a station 54 after which the bag top is folded over for the first time at a station 55 and then is folded a second time at a subsequent station 56. Finally, the end portions 42 of the closing fold are bent inwardly to form the completed package at a station 57.

The various mechanisms for forming, filling and closing the bags 31 all are mounted on an elongated horizontal frame 58 (Figs. 1 and 2) which supports the supply roll 46 at one end thereof. As the sheet 45 is drawn off the roll, it is threaded over a series of guide rollers 59 and through a former 60. The latter is supported on top of the frame 58 and is of conventional construction to fold the sheet longitudinally and tuck in the gusset fold 35. The sheet is advanced horizontally through the former 60 by a pair of upright feed rollers 61 journaled on the frame 58 beyond the former and on opposite sides of the bag path so as to engage the folded sheet 45 frictionally.

To turn the feed rollers 61 intermittently and thereby impart a step-by-step advance to the folded sheet 45, the rollers are driven by a continuously operating motor 62 (Fig. 4) through an indexing mechanism 63. The latter includes a yieldable crank 64 which connects the motor and a horizontal shaft 65 journaled on the frame and geared to the feed rollers. In one direction, the crank turns the shaft and hence the rollers in the bag advancing direction through a one-way clutch 66 which renders the crank inoperative in the opposite direction. Thus, the sheet 45 alternately advances and dwells. The length of each advance determines this width of the bags 31 and this may be controlled by employing a sensing device such as a photoelectric eye 67 which detects spaced marks on the sheet 45 and operates to energize a brake 68 which stops the shaft 65, such stopping being permitted by yielding of the crank 64. An indexing mechanism suitable for use here is the one disclosed in the application of Kenneth R. Johnson, Serial No. 261,226, filed December 12, 1951, now U. S. Patent No. 2,738,187 to which reference may be had for details of construction.

During each dwell of the strips 47 and 48, heated sealing shoes 69 (Fig. 1) disposed at the station 49 are swung in against opposite sides of the strips and form the seal 50. The shoes are supported on the upper ends of upright levers 70 (Figs. 1 and 15) which are fulcrumed intermediate their ends on the frame 58 as indicated at 71 to swing the shoes together and apart. Such swinging is obtained through the medium of an elongated horizontal camshaft 72 journaled on the frame 58 in spaced bearings 73 and driven continuously by the motor 62 through a

chain 169a (Fig. 4). Cams 75 fast on the camshaft engage follower rollers 76 on the lower ends of the levers 70 and, during dwelling of the strips, the cams turn the levers to swing the shoes 61 in and form the seal 50.

To strengthen the seal 50, the latter may be cooled at the station 77 (Fig. 1) immediately following the sealing station 49. Such cooling reduces the temperature of the thermoplastic to a point where it has set firmly and will resist strain. For this purpose, a second pair of shoes 78 (Figs. 1 and 15) are disposed at the station 77 and swing in against the seal during a dwell period. Instead of being heated, the shoes 78 are cooled by water entering the shoes through pipes 79 (Fig. 15), flowing through passages 80 in the shoes and leaving through pipes 81. The shoes 78 may also be supported by the levers 70 through the medium of a horizontal bar 82 (Fig. 1) rigid with and projecting laterally from the levers and a vertical bracket 83 rigid with the bars and carrying the shoes.

After each advance of the strips 47 and 48, the leading bag 31 is severed from the strips at the station 51 and is picked up by a conveyor 84 (Fig. 2) which advances the bag along a continuation of the bag forming path to the successive stations where the material 30 is packaged in the bag. The bag is severed by a knife 85 which swings forward during a dwell of the bag strips and cuts the seal 50 intermediate its edges. Like the shoes 61, the knife is supported on a vertical lever 86 which is turned by a cam 87 secured to the shaft 72 and engaging a follower roller 88 on the lower end of the lever.

The conveyor 84 for continuing the advance of the bags is in the form of an endless chain having a run along the packaging path and carrying a plurality of rearwardly opening spaced grippers 89 (Fig. 2) which engage the leading edges of the bags. At each end of the path, the conveyor extends around a sprocket wheel (not shown) journaled on the frame 58 and driven intermittently from the camshaft 72 through a Geneva mechanism 90. The conveyor is driven through steps longer than the width of a bag so that the bags carried by the conveyor are spaced apart as shown in Fig. 2 and the bottoms of the bags are supported by and slide along an elongated guide rail 91 paralleling the chain.

To transfer a bag 31 from the strips 47 and 48 to the conveyor 84, the leading bag on the strips is delivered by the feed rollers 61 to a cut-off station 51 (Figs. 1 and 3) where it first is engaged by a gripper 89 and then is severed from the strips. For this purpose, an empty gripper is opened and dwelling at the station 51 and then the feed rollers push the leading bag into the station so that the leading edge of this bag is between the jaws of the gripper. While both the strips and the conveyor are dwelling, the gripper is closed and the knife 85 swings in to cut the strips.

The present invention contemplates the provision of novel mechanisms arranged in a particular manner to package the material 30 in the bags 31 whereby the resulting package is compact and neat in appearance and is relatively airtight to preserve the quality of the packaged material. These mechanisms are disposed along the path of the chain 84 and operate automatically and at high speeds successively to open and fill the bag, to tamp the material and thereby expand the bag to its squared shape, to stretch and thereby flatten the upper portion of the bag and to close the top of the bag by closure 44. Thus, the bags are advanced step by step by the conveyor to the filling station 53 where the bag panels 32 and 33 are separated by a bag opening mechanism 92 and a charge of material is deposited in the bag by a filling mechanism 93. From the filling station, each bag is advanced to the station 94 where the plunger 94 (Fig. 25) of a tamping mechanism 95 compresses the material and expands the bag and then to a station 96 (Fig. 2) where a mechanism 97 stretches the upper portion of the bag so that the bag panels lie flat against each other preparatory to closing the bag.

As discussed earlier, the top of the bag may be closed by folding the bag panels 32 and 33 over and preferably two folds 39 and 40 are made. The first such fold is made by a mechanism 98 (Fig. 1) disposed at the station 55 beyond the stretching station 96 while the second fold is made at the station 56 by a similar mechanism 99. To retain control of the top of the bag and insure that the first fold 39 remains in place while the second fold 40 is made, a mechanism 100 disposed at a station 101 between the folding stations 55 and 56 creases the first fold and forms a comparatively temporary seal to hold the folded part down and prevent the latter from unfolding. Preferably, a second creasing mechanism 102 is disposed at a station 103 beyond the station 56 to crease the second fold 40. From the second creasing station 103, the bag is advanced to the final operating station 57 where the projecting edge portions 42 are bent forwardly by a mechanism 104 to shorten the bag and prevent the top of the bag from unfolding.

In the present instance, the conveyor 84 first delivers the bag to the station 52 (Figs. 1 and 16) in advance of the filling station 53. At the station 52, the bag is partially opened before being fully opened by the mechanism 92 at the next station. This partial opening of the bag may be effected by a means such as that disclosed in my copending application Serial No. 293,778, filed June 16, 1952, now U.S. Patent No. 2,745,583. In general, such a means comprises an elongated horizontal splitter bar 105 which is stationarily supported on the frame 58 and which is straddled by the upper ends of the panels 32 and 33 above the seals 34 dwelling at the station 52. The bar 105 is hollow and is formed with a plurality of orifices opening downwardly into the interior of the bag. While the bag is dwelling, a cam 106 (Fig. 1) on the camshaft 72 opens a valve 107 which is in a line 108 (Fig. 16) leading to the interior of the bar and connects the bar with a suitable source of air under pressure. As a result, air is discharged into the bag and this air separates the bag panels 32 and 33 and also fully expands the gusset 35 at the bottom of the bag.

Means is provided to hold the upper ends of the bag panels 32 and 33 against the bar 105 as the air is introduced into the bag so as to prevent wrinkling of the panels. Herein, this means comprises two elongated horizontal angle bars 109 (Fig. 16) extending along opposite sides of the air splitter bar 105 and mounted to move in toward the bar and clamp the panel ends against the latter as the bag is dwelling. Each angle bar is pivotally mounted at 110 on a stationary plate 111 which is supported by a laterally projecting arm 112 on an upright post 113, the pivots 110 supporting the angle bars for swinging toward and away from the splitter bar 105. The angle bars are swung about their pivots by a cam 114 secured to the shaft 72 and engaging a follower roller 115 on the lower end of an upright lever 116. The latter is fulcrumed at 117 intermediate its ends on the frame 58 and its upper end is connected by means of a swivelled link 118 to the upper end of a shorter vertical lever 119. At its lower end, the lever 119 is fulcrumed by a pivot 120 on the plate 111. Two links 121 are swivelled to the lever 119 immediately to one side of the pivot 120 and diverge downwardly. The lower ends of the links 121 are swivelled to the respective angle bars 109 through plates 122 fast on the bars.

With the foregoing arrangement, the cam 114, during dwelling of the bag 31, swings the lever 116 so that its upper end moves to the right as viewed in Fig. 16. This causes the lever 119 also to swing to the right moving the upper ends of the links 121 down. Such downward movement causes the angle bars 109 to swing in toward the splitter bar 105 and clamp the upper ends of the bag panels 32 and 33 against the splitter bar. With the panels thus held and with the bag still open, the cam 106 opens the valve 107 thus admitting air under pressure into the bag.

The air entering the bag 31 separates the panels 32 and 33 and expands the gusset fold 35. This squares out the bottom portion of the bag. To shape the bag more perfectly preparatory to the filling step, forming plates 123 and 124 may be disposed at the station 52 on opposite sides of the bag so that the bag panels expand against these plates. The latter, in order to provide clearance for the conveyor 84 and the bag during each advance are mounted to move back to inoperative positions (shown in broken lines in Fig. 16) while the conveyor moves and then to shift to the operative positions after the bag comes to rest. This may be achieved conveniently by supporting the plates from the angle bars 109 so that the plates swing with the bars. For this purpose, the upper ends of the plates are welded to the inner surfaces of the angle bars. Below the bars, the plates diverge and then become vertical as indicated at 125 and these parts cause the bottom portion of the bag to assume a square shape.

After the bag is partially opened at the station 52, it is advanced to the station 53 where, during dwelling of the bag, the upper ends of the panels 32 and 33 are spread apart and a charge of material 30 is deposited in the bag. The mechanism 92 for opening the bag mouth is constructed in a novel manner so as to insure proper and positive separation of the bag panels to permit a large quantity of material to be introduced into the bag 31 rapidly. To these ends, the mechanism includes parts 126 and 127 (Figs. 17 through 21) which are straddled by the upper ends of the panels 32 and 33 automatically as the bag enters the filling station 53, which when straddled are separated to spread the panels and which extend across substantially the full width of the bag so as to separate the panels from one edge of the bag to the other. Preferably, the parts 126 and 127 are mounted to be lowered into the bag so that the bag panels are spread all the way to their lower ends.

Herein, the parts 126 and 127 are constructed in such a way that, when they are separated, they form a spout substantially the same size as the bag so that the material 30 may be dropped into the bag in one large charge without danger of the material falling on the outside of the bag. This is achieved by forming the parts 126 and 127 as resiliently flexible plates which are bowed to cooperate in forming a generally oval-shaped spout. The plates may be made of comparatively thin sheet metal which normally are flat and are disposed face to face as shown in Figs. 18 and 19. By pressing against the side edges of the plates so as to move one edge of each plate toward the other edge, the plates bow outwardly and form an oval spout as illustrated in Fig. 20 to guide the material 30 into the bag.

The lower ends of the plates 126 and 127 are alined with the splitter bar 105 and are substantially level with the bottom edge of the latter so that the plates, in effect, form a continuation of the bar. Thus, as the bag comes to rest at the station 53, the upper end portions of the bag panels straddle the plates, the same as they straddled the splitter bar. The plates are slightly narrower than the internal width of the bag, that is, the distance between the inner edges of the side seals 34. This permits the plates to be lowered into the bag before they are bowed to open the bag as illustrated in Figs. 5 and 20. The lower ends of the plates may be tapered as indicated at 128 in Fig. 17 to facilitate entry of the plates between the side seals.

To support the plates 126 and 127 for bowing, the latter are carried between the free ends of horizontal arms 129 and 130 which project in over the bag at the filling station 53. Riveted to the ends of the arms are upright brackets 131 and horizontal bars 132 project laterally toward each other from the opposing sides of the brackets adjacent the upper ends thereof. Notches 133 are cut in the side edges of the plates 126 and 127 and receive the bars 132 thereby to support the plates on the arms 129 and 130.

The plates 126 and 127 are disposed on opposite sides of vertical pins 134 which are secured to and are centrally located relative to the bar 132. Beyond the pins, the plates are bent toward each other to project their edges into two closely spaced vertical grooves 135 formed in each of the brackets 131. Thus, the grooves 135 and the pins 134 hold the plates bowed slightly. When the arms 129 and 130 are moved relatively together, the plates bow further until fully open as shown in Figs. 20 and 21. The extent of the bowing is limited by pins 136 extending vertically through the bars 132 and disposed on the outsides of the plates 126 and 127.

Relative movement of the arms 129 and 130 is obtained by mounting the arm 129 to swing back and forth about a vertical axis *a* (Figs. 18 and 19) defined by an upright pin 137 pressed into the inner end of the arm 129 and journaled in a bearing 138. The lower end of the pin is rigidly connected to one end of a horizontal lever 139 so that the pin also defines the fulcrum of the lever. The lever 139 and hence the arm 129 are turned about the axis *a* by a cam 140 (Fig. 1) fast on the camshaft 72. Through a follower 140[a] the cam causes a vertical rod 141, which is slidable in a bracket 142 (Fig. 19) on the frame 58, to move down. A link 143 which is pivotally connected at one end to the rod 141 and at the other end to a horizontal lever 144 fulcrumed on the frame translates the downward movement of the rod into swinging of the lever. The lever 144 is connected to the lever 139 by a vertical bar 145 whose lower end is pinned to the lever 144. The upper end of the bar 145 is connected by a swivel joint 146 to one end of a horizontal link 147 whose other end is connected by a swivel joint 148 to the lever 139. Downward swinging of the lever 144 results in the bar 145 tipping to the left as viewed in Fig. 19 and thus the link 147 also moves to the left. This swings the lever 139 about the axis *a* moving the arm 129 toward the arm 130 and bowing the plates 126 and 127.

Before the cam 140 bows the plates 126 and 127, the latter are lowered into the bag which is dwelling at the filling station 53. To this end, the arms 129 and 130 also are mounted to swing up and down about a horizontal axis *b* (Fig. 18). This axis intersects the axis *a* and is defined by a horizontal pin 149 pressed into both the bearing 138 and the arm 130. Intermediate its ends, the pin 149 is journaled in a bearing 150 which is fixed to the upper end of a vertical post 151 upstanding from the frame 58. With this arrangement, the plates 126 and 127, the arms 129 and 130 and the lever 139 turn bodily together about the axis *b*. In any angular position, the arm 129 still may be turned about the axis *a*, this being permitted by the swivel connections 146 and 148. The up and down movement of the arms is obtained by a cam 152 (Fig. 2) secured to the shaft 72 and engaging a follower roller 153 on the end of a vertical link 154 (Fig. 19) whose upper end is swivelled to the arm 130 intermediate the ends thereof.

To summarize the operation of the opening and filling mechanisms 92 and 93, a partially opened bag 31 is advanced to and comes to rest at the station 53. As the bag arrives at this station, the upper edge portions of the panels 32 and 33 are transferred from the splitter bar 105 to the plates 126 and 127 so that they now straddle the plates. When the bag is dwelling, the plates are disposed wholly between the inner edges of the side seals 34. The cam 152 then causes the arms 129 and 130 to swing down lowering the plates into the bag. Next, the cam 140 swings the arm 129 toward the arm 130 bowing the plates and opening the mouth of the bag. With the bag open and still dwelling, the filling mechanism 93 discharges the material 30 through its spout 155. The material drops between the bowed plates and into the bag. Finally, the cam 140 swings the arm 129 back to straighten the plates and the cam 152 lifts the two arms raising the plates out of the filled bag. The filling mechanism 93 may be of any of the many types well known in the art and suitable for dispensing the partic-

ular material being packaged and, as will appear later, is operated in the proper timed relation to the other mechanisms.

From the station 53, the filled bag is advanced two steps to the station 54 where the material 30 is compressed or compacted by tamping mechanism 95. The plunger 94 of the latter is rectangular in horizontal cross section and is sized and shaped to correspond to the size and shape of the bag when expanded. Thus, when the plunger enters the bag, it compacts the material and expands the bag to a squared shape as illustrated in Fig. 11. Such shaping of the bag is facilitated by the guide rail 91 which supports the bag at the bottom and vertically disposed plates 156 (Figs. 22 through 25) supported by the frame 58 and projecting upwardly from the guide rail on opposite sides of the bag. The plates 156 prevent the front and back panels 32 and 33 from bulging and rupturing during the tamping operation and cooperate with the guide rail 91 to constitute, in effect, a box-like form in which the bag is expanded to the desired square shape. As a result of the tamping, the material 30 is compressed and is disposed wholly below the folded portions of the completed bag as illustrated in Fig. 14.

In the present instance, the plunger 94 is in the form of a plastic block which is rectangular in shape and slightly smaller than the bag 31 in the expanded condition. The block is secured on the lower end of an elongated upright slide 157 whose lower end is smaller than but is the same shape as the block. The upper end of the slide is supported for shifting up and down by ears 158 projecting laterally from the upper end portion of the slide and sliding on vertical guide rods 159. The guide rods are supported on a comparatively large O-shaped bracket 160 which is rigidly secured to the frame 58.

In order to move the plunger 94 up and down at the proper times, a generally horizontal arm 161 (Fig. 24) is fulcrumed at one end on the bracket 160 and, at the other end, it is connected to the slide 157 by a link 162 pivoted at opposite ends to the slide and the free end of the arm 161. Adjacent the lever 161, a shaft 163 is journaled on the bracket 160 and supports a cam 164 which engages a follower roller 165 carried by the lever. Thus, a rise on the cam depresses the lever 161 and slides the plunger 94 down into the bag 31. The shaft 163 and hence the cam 164 are turned in timed relation with the advance of the bags by the motor 62 through a chain 166 which extends around a sprocket wheel 167 on a shaft 168, and a sprocket wheel 169 on the shaft 163, a third sprocket wheel 170 being journaled on the bracket 160 and engaging the chain to tension the latter. An upright link 171 is swivelled at its upper end to the lever 161 while its lower end slides in an ear 172 on the bracket 160 and a compression spring 173 acting between the ear and an abutment 174 on the link urges the link upwardly and thereby biases the plunger 94 toward the retracted position.

Herein, the dispensing mechanism 93 is driven from the shaft 163 and, for this purpose, a chain 175 extends around a second sprocket wheel 176 on the shaft 163 and a small sprocket wheel 177 fast on a shaft 178 which is journaled on the bracket 160. A larger sprocket wheel 179 on the shaft is connected by a chain 180 to a sprocket wheel 181 which is keyed to a shaft 182. The latter constitutes the drive shaft for the dispensing mechanism. Idler sprocket wheels 183 and 184 are journaled on the bracket 160 and tension the chains 175 and 180 respectively.

Means are provided to hold the front and back panels 32 and 33 of the bag 31 taut during the tamping operation to prevent these panels from being wrinkled as the plunger 94 compresses the material 30. Preferably, this means also serves to maintain the squared shape of the bag and to prevent rupturing of the bag panels during tamping. Herein, this means includes the plates 156 which, in addition to preventing the panels from bulging outwardly as the material is tamped, cooperate with a member 185 (Figs. 22 through 26) to grip the upper edges of the panels and hold the latter while the plunger 94 engages the packaged material. The member 185 may, as illustrated in the drawings, be a rectangular ring disposed within the bag and the plates 156 are moved in to clamp the upper edge portions of the bag panels against the ring.

In the present instance, the ring 185 encircles and slides freely on the lower end portion of the slide 157 to enter the bag with the latter. A rod 186 rigid with an outturned flange 187 on the upper end of the ring projects up alongside the slide and through a lug 189 on the slide. The plates 156 are supported by brackets 109 (Fig. 24) on the upper ends of upright levers 190 which are fulcrumed intermediate their ends at 191 on the frame 58 and are swung toward and away from each other by cams 192 fast on the shaft 72 and engaging followers 193 on the lower ends of the levers, the plates normally being urged apart by compression springs 194 acting between stationary abutments 195 on the frame and the lower portions of the levers. The inner sides of the plates 156 are covered by yieldable rubber pads 196 (Figs. 25 and 26) which engage the bag panels.

The cams 192 and 164 are shaped to swing the plates 156 together and slide the plunger 94 down after the bag comes to rest at the station 54. Before the ring 185 has fully entered the bag, the plates are swung in far enough so that one plate is under the flange 187 and is engaged by the latter. This engagement stops the ring in position to grip the upper portions of the bag panels 32 and 33 and such gripping occurs as the plates continue to swing in and press the panels against the ring. After the ring is stopped and while the bag is clamped between the ring and the plates, the plunger 94 continues down and compresses the material 30.

To insure the proper entry of the ring 185 into the bag, fingers 197 swing down into the open mouth of the bag and spread the latter to a squared shape. Herein, there are four wire fingers mounted in pairs on two levers 198 and 199 which are fulcrumed at opposite edges of the bag on a vertical plate 200 depending from the bracket 160. The fingers of each pair are spaced apart a distance greater than the width of the ring 185 and the distance between each pair when the fingers are swung down to the vertical position shown in Fig. 22 is greater than the length of the ring. Notches 201 are cut in the corners of the plates 156 to provide clearance for the fingers 197 when the latter are in the down position.

A cam 202 (Figs. 22 and 24) on the shaft 72 engages a follower 203 carried on a horizontal lever 204 between the ends thereof. The lever is fulcrumed at one end as indicated at 205 on the frame 58 and the other end is pivotally joined to the lower end of an upright link 206. The lever 198 is a bell crank lever and one arm of this lever is pivoted to the upper end of the link so that the lever and hence the fingers 197 carried thereby are swung by the cam 202 through the medium of the lever 204 and the link 206. A compression spring 207 acting between the frame 58 and the lever 204 holds the follower 203 in engagement with the cam 202. The other arm of the bell crank lever 198 is pivotally connected to the free end of the lever 199 by a link 208 so that the two pairs of fingers 116 swing in unison but in opposite directions.

In the operation of the tamping mechanism 95, the plunger 94 is in its upper position, the plates 156 are back and the fingers 197 are swung up as shown in Fig. 23 when a bag enters the station 54. After the bag comes to rest, the cam 164 lowers the plunger 94 and, at the same time the cams 193 rock the plates 156 toward the bag. Before the ring 185 is carried into the bag by the plunger 94, the cam 202 swings the fingers 197 down to the vertical position shown in Figs. 22 and 25 so that the fingers engage the corners of the bag on the inside thereof and

spread the bag mouth to a squared shape for the entry of the ring 185. After the ring enters the bag, the flange 187 engages the upper end of one of the plates 156 which at this time are just coming into engagement with the bag panels. Thus, the ring is held at the mouth of the bag and the latter is clamped between the ring and the plates.

While the upper portion of the bag is held between the ring 185 and the plates 156, the plunger 94 continues its downward stroke and compresses the material 30. During such compression, the bottom of the bag is pressed down against the guide rail 91 stretching the bag panels 32 and 33 to prevent the latter from wrinkling and expanding the gusset fold 35 to flatten the bottom of the bag. At the same time, the plates 156 prevent the bag panels from bulging and thus the tamping expands the bag into a squared shape. Upon the return stroke of the plunger, the fingers 197 are swung up passing on opposite sides of the ring 185. As the plunger rises, the lug 189 picks up an abutment 209 on the rod 186 lifting the ring 185 out of the bag which then is ready to be indexed to the next station.

To remove any material which may cling to the bottom of the plunger 94, an upwardly facing brush 210 wipes the plunger each time the latter reaches the retracted position. The brush is supported for such movement by an inverted L-shaped bar 211 which is rigid with and projects upwardly from the outer end of one arm 212 of a bell crank lever 213. The latter is fulcrumed on the frame 58 and its other arm 214 supports a follower roller 215 riding on a cam 216 which is secured to the shaft 72 and is shaped to swing the lever and hence the brush after the plunger has been withdrawn.

Preferably, the material 30 is settled in the bag 31 preparatory to being compacted by the tamping mechanism 95 and this is achieved by joggling the bag or tapping the bottom of the bag while the latter dwells at the station 217 (Fig. 2) immediately preceding the compacting station 54. This tapping may be performed by a horizontal arm 218 (Figs. 19, 22 and 24) projecting in under the bag at the station 217 and secured to a block 219. The block is pivoted on a bracket 220 upstanding from and rigid with the frame 58 to swing about an axis extending transversely of the bag path. When turned back and forth about this axis, the block 219 swings the arm 218 up and down to tap the bottom of the bag.

During each dwell of the bags, the arm is turned up and then back down and this is achieved by utilizing the motion of one of the plates 156. For this purpose, a horizontal link 221 is swivelled at one end to one of the levers 190 and at the other end to a lug 222 upstanding from the block 219. Thus, as the lever 190 swings the plate 156 forward, it also turns the block clockwise as viewed in Fig. 22 and this swings the arm 218 up. When the lever is moved back, the block is turned in the opposite direction lowering the arm 218.

After the material 30 is tamped, the bag 31 is indexed to the station 96 where the upper bag portion, which at this time is open as shown in Figs. 11 and 25, is stretched by the mechanism 97 to flatten the tops of the panels 32 and 33 against each other. Herein, the stretching mechanism comprises two pairs of fingers 223 and 224 (Figs. 27 through 30) which are disposed on opposite sides of the bag dwelling at the station 97 and which grip the edges of the bag between the serrated ends 225 thereof. The fingers engage the side seals 34 adjacent their upper ends and then are flexed to stretch the top of the bag. The fingers 224 are horizontally disposed, projecting in toward the top of the bag, and are pivotally mounted at their outer ends on a bracket 226 as indicated at 224^a to swing toward and away from each other about horizontally spaced vertical axes.

On the opposite side of the bag at the station 96, the fingers 223 are similarly pivotally mounted near their outer ends on a bracket 227 as indicated at 223^a and project in toward the fingers 224, one finger of each pair being alined with a finger of the other pair so that each side seal 34 of the open bag is disposed between the opposed ends of a finger 223 and a finger 224. Lugs 228 projecting forwardly from the ends of the fingers 223 outside of the side seals 34 are received in notches 229 in the ends of the fingers 224 to connect the pairs of fingers for swinging in unison about their respective axes. The lugs are formed on members 230 pivotally mounted on the ends of the fingers 223 so that the members turn to maintain the lugs alined with the notches as the fingers 223 and 224 swing. With the two sets of fingers connected, both sets flex together.

The brackets 226 and 227 are mounted on the upper ends of upright levers 231 (Fig. 2) which are fulcrumed intermediate their ends on the frame 58 to swing the pairs of fingers in toward the bag 31 and back out. Such swinging is achieved by means of cams 232 fast on the camshaft 72 and engaging followers 233 carried on the lower ends of the levers 231. During the advance of the conveyor 84, the brackets are swung back to permit the bag 31 to enter between the fingers 223 and 224 and then, after the bag comes to rest at the station 96, the cams 232 swing the fingers into engagement with the side seals 34.

To swing the fingers 223 and 224 out about their vertical axes after they engage the side seals 34 of the bag 31 and thereby stretch the upper end of the bag, an air motor 234 (Figs. 27 and 29) is disposed between the fingers 223 with its cylinder 235 pivotally connected to one finger of this pair and its piston 236 similarly connected to the other finger of the pair through the piston rod 237. Air under pressure from a suitable source (not shown) is admitted to the head end of the cylinder through a valve 238 (Fig. 2), which is interposed in a line 239 connecting the cylinder and the air source and is actuated by a cam 240 on the camshaft. This air slides the piston out swinging the fingers 223 out to a flexed position determined by a pair of stops 241 threaded through the rear ends of the fingers 223 and engaging abutments 242 on the bracket 227. Since the fingers 223 are connected to the fingers 224 by the lugs 228 and notches 229, the fingers 224 similarly are flexed. As a result, the two sets of fingers are flexed in unison and move the side seals, which are gripped between the fingers, apart thus stretching the bag top. The fingers grip the seals with the proper amount of pressure by slidably mounting the bracket 226 on the corresponding lever 231 and springs 243 act between the bracket and bolts 244 threaded into the lever so that the fingers 224 are yieldably urged into engagement with the fingers 225. A compression spring 245 (Fig. 27) encircling the piston rod 237 acts between the piston 236 and the rod end of the cylinder 235 and returns the fingers to the original position after the valve 238 is closed. This position is determined by stops 246 and abutments 247 similar to the stops 241 and abutments 242.

To insure that the fingers 224 swing together and apart with the fingers 223, plates 248 bolted to the fingers 224 project toward the fingers 223 and are formed with forwardly opening slots 249 (Fig. 29). The latter receive pins 250 upstanding from the fingers 223. The pins and slots perform the same function as and supplement the action of the lugs 228 and notches 229. When the levers 231 swing in toward the bag, the pins are received in the slots as are the lugs in the notches.

After the top of the bag is stretched, the bag is advanced to the next station 251 where the bag is shaped preparatory to closing the bag top. Such shaping consists in flattening the stretched top portion of the bag and squaring the lower portion which holds the material 30. The top portion is flattened between two horizontal bars 251 and 252 (Fig. 31) which are disposed on opposite sides of the bag and are supported on the upper ends of vertical levers 253. The bar 251 is mounted rigidly on the end of a rod 254 projecting inwardly from its lever

while the bar 252 slides on a rod 255 projecting from the other lever. A compression spring 256 encircling the rod 255 acts between the bar 252 and an abutment 257 on the lever and urges the bar toward the end of the rod. Thus, the bar 252 is resiliently supported and yields as the two bars flatten the bag top.

Formed plates 258 are disposed beneath the bars 251 and 252 and are rigidly supported on the levers 253 by means of inwardly projecting rods 259. The plates are flat opposite the material 30 as indicated at 260, and, above the material, flanges 261 project in and square the bag around the material. The levers are fulcrumed intermediate their ends on the frame 58 and, at their lower ends, they carry follower rollers 262 riding on cams 263 which are keyed to the camshaft 72. During each dwell period of the bags, the cams swing the levers together moving the bars 251 and 252 and the plates 258 in against the bag to shape the bag as shown in Fig. 31.

From the station 251, the bag is indexed to the next station 55 and here the first fold 39 is made at the top of the bag by the mechanism 98. As the bag moves to the station 55, it enters between two vertical plates 264 and 265 (Figs. 33 through 40) which are spaced close together and whose upper edges terminate at the line of the fold 39. With the bag beween the plates 264 and 265, the portions of the panels 32 and 33 to be folded over (these portions being shown schematically at 266 in Figs. 21 through 25) are bent over and down by two bars 267 and 268 which are arranged and moved in a novel manner and which constitute the folding mechanism 98.

Initially, the bar 268 is behind and opposite the portion 266 of the bag while the bar 267 is above and on the opposite side of the bag as shown in Fig. 34. When the bag comes to rest at the station 55, the bar 268 is moved horizontally toward the bag in the direction indicated by the arrow in Fig. 35 and passes beneath the bar 267 bending the bag portion 266 through a right angle and holding this portion of the bag in the bent position. Next, the bar 267 is moved down to a position alongside the plate 264 and, during this movement, it engages and bends the bag portion 266 through a second right angle as shown in Fig. 36. Then the bar 268 is shifted horizontally back to its original position (Fig. 37) and the bag is advanced to the next station 101, the bag portion 266 being held down between the bar 267 and the plate 264 during this advance. After the bag is indexed, the bar 267 is moved back up to its original position shown in Fig. 34.

It will be observed that the top portion 266 is folded over through the simple reciprocation of the bars 267 and 268. Such reciprocation is obtained easily from the camshaft 72. Thus, the bar 268 is supported by a bracket 269 fast on the outer end of an arm 270 (Figs. 33 and 39) which is pivotally connected at its inner end to the free end of the upright arm 271 of a bell crank lever 272. The latter is fulcrumed on the frame 58 and carries at the outer end of its horizontal arm 273 a follower 274 engaging a cam 275 on the camshaft 72. The follower is held in engagement with the cam by a compression spring 276 which encircles a rod 277 pivotally connected to the arm 273 and sliding in a collar 278 on the frame 58 and which acts between the collar and an abutment 279 on the rod. A link 280 is pivotally joined at one end to the arm 270 and at the other end to a stationary bracket 281 which is secured to a post 282 upstanding from the frame. Thus, the arms 270 and 271 and the link 280 constitute a parallelogram linkage which causes the bar 268 to move horizontally back and forth as the bell crank lever 272 is swung about its fulcrum by the cam 275.

To reciprocate the bar 267, the latter is mounted on the outer end of a generally horizontal arm 283 (Figs. 33 and 40) pivotally connected at its inner end to the upper end of the post 282. An elongated generally vertical link 284 is pivotally joined at its upper end to an intermediate portion of the arm 283 and at its lower end to a second horizontal arm 285 disposed below the arm 283 and similarly pivoted to the post 282. At its outer end, the arm 285 carries a follower 286 engaging a cam 287 on the shaft 72 and, as in the case of the follower 274, the follower 286 is held against the cam 287 by a compression spring 288 acting between an abutment 289 on a rod 290 and a collar 291 through which the rod slides, the rod being pivotally connected at its upper end to the arm 285. Thus the cam 287 swings the bar 267 up and down so that the cams 275 and 287 cooperate to shift the two bars 267 and 268 and fold the top portion 266 of the bag in the manner described above and shown in Figs. 34 through 37.

From the folding station 55, the bag 31 is advanced to the station 101 where the fold 39 is creased by the mechanism 100. The latter comprises two horizontal pressure bars 292 (Figs. 2 and 41) disposed on opposite sides of the bag alongside the fold. The pressure bars are secured to the upper ends of upright levers 293 which are fulcrumed intermediate their ends on the frame 58 and carry at their lower ends followers 294 riding on cams 295. The cams are fast on the camshaft 72 and swing the pressure bars against the top of the bag during a period of dwell. The bars squeeze the folded bag portion 266 against the front panel 32 thus flattening or creasing the fold 39. In this way, the bag portion is prevented from unfolding while the second fold 40 is made.

If desired, a more positive means may be employed to hold the folded bag portion 266 down during the second folding operation. This means may be in the form of comparatively weak seals 296 (Fig. 5), that is, seals which will hold the fold in place but break easily when the bag top is unfolded. Such a seal may be formed by heat sealing the projecting upper edge portion of the back panel 33 to the front panel 32 after the first fold is made. Thus, the thermoplastic surface of the back panel is joined to the thermally inert surface of the front panel and this results in a rather weak seal.

To make the seals 296, sealing bars 297 and 298 (Fig. 41) are disposed at the station 101 and are supported on the levers 293 so as to form the seals at the same time that the bars 292 crease the fold 39. One of the bars is resiliently supported on its lever by means of a spring 299 to yield when the sealing bars press the bag between them. The forward ends 300 of the sealing bars are heated to soften the thermoplastic and are reduced in size to make the seal 296 short. The bars engage the bag only at areas over the side seals 34 so that the spot seals 296 are superimposed on the side seals.

After the fold 39 is flattened and the spot seals 296 are made at the station 101, the bag is indexed one step to the station 56 where the second fold 40 is made. This fold is formed by the mechanism 99 which is identical in construction to the folding mechanism 98, corresponding parts being indicated by primed reference characters, except that the bars 267′ and 268′ and the plates holding the bag are lower than the corresponding parts of the first folding mechanism to be disposed properly relative to the line of the second fold 40. The latter, like the fold 39, is creased or flattened at the next station 103 by pressure bars 292′ similar to the bars 292. At the station 103, however, the bag top merely is creased and not heat sealed.

From the second creasing station 103, the bag is indexed to the last operating station 57 on the next advance of the conveyor 84. At the station 103, the triangular side portions 42 at the upper part of the bag are bent forwardly at right angles to the body of the bag as shown in Fig. 7. This bending is effected by the mechanism 104 which is disposed at the station 103 and

comprises plungers 301 and 302 (Figs. 32, 42 and 43) engaging the bag at the bending lines 43 and members 303 riding along the ends of the plungers and bending the edge portions over against these ends. Herein, the plunger 301 is an elongated horizontal bar facing the front of the bag and supported on a bracket 304. The face of the bar is recessed intermediate its ends as indicated at 305 to form surfaces 306 at each end of the bar and these surfaces engage the top portion of the bag inside the lines 43 of bending. Rubber pads 307 are inserted in the recesses 305 and resiliently grip the intermediate portion of the bag top.

The plunger 302 is disposed in back of the bag and is similarly recessed to provide surfaces 308 opposing the surfaces 306, a rubber pad 309 also being disposed between the surfaces 308. Bolts 310 pinned to and projecting rearwardly from the back of the plunger 302 extend through holes in a bracket 311 so that the plunger may slide relative to the bracket. Normally, the plunger is urged forwardly by compression springs 312 encircling the bolts 310 and acting between the plunger and the bracket to the position shown in Fig. 42 and determined by stops 313 which are in the form of nuts threaded on the ends of the bolts and abutting against the back of the bracket 311. The brackets 304 and 311 are secured to the upper ends of vertical levers 314 (Figs. 2 and 32) which, like the levers 293, are fulcrumed on the frame 58 and are swung by cams 315 mounted on the shaft 72 and engaging followers 316 on the lower ends of the levers. The cams hold the plungers apart as shown in Fig. 42 while the bag enters the station 57 and then, during dwelling of the bag, swing the plungers together into engagement with the bag.

While the plungers 301 and 302 are engaging the bag 31, the members 303 ride forward along the ends of the plunger 302 and bend the edge portions 42 of the bag against the ends of the plunger 301. In the present instance, these members are rollers journaled respectively on the outer ends of arms 317 and 318 which are disposed alongside the ends of the plunger 302 and are pivotally mounted at their other ends on the bracket 311. A rod 319 is pivoted at one end to the arm 318 intermediate the ends thereof and slidably projects through a pivot 320 on the arm 317. A compression spring 321 encircling the end portion of the rod and acting between the arm 317 and an abutment 322 on the end of the rod urges the rollers against the ends of the plunger 302.

With the foregoing arrangement of the mechanism 164, the brackets 304 and 311 are swung together moving the plungers 301 and 302 against the bag. After such engagement, the bracket 311 continues to move inwardly, this being permitted by yielding of the springs 312. From this continued movement of the bracket 311, the rollers 303 ride forward on the ends of the plunger 302 and cross over to the ends of the plunger 301 as illustrated in Fig. 43. This bends the edge portions 42 of the bag 31 forward giving the latter the shape shown in Fig. 7. A final shaping of the bag may be effected at the station 57 by flat horizontal plates 323 (Fig. 32) which are secured to the ends of arms 324 projecting inwardly from the levers 314. The plates engage and square the body portion of the bag. The completed bag then is advanced to the end of the machine where it is removed from the conveyor 84 by a suitable device 315 after opening of the gripper 89 and then the bag is inserted in the box 41.

It will be observed that the various mechanisms automatically open and fill the bag 31, tamp the material 30, fold and crease the top of the bag, shape the latter and bend in the edge portions 42 of the bag. As a result, the packages may be made neatly and rapidly on high speed machinery. The completed bag is comparatively air tight and still is easily opened since it is closed by the folds 39 and 40. Thus, the bag, when used to package pipe tobacco, conveniently serves as a pouch which keeps the tobacco fresh, provides easy access to the tobacco and is small enough to carry in a pocket.

This application is a continuation-in-part of my copending application Serial No. 413,749, filed March 3, 1954, now abandoned.

I claim as my invention:

1. A packaging machine comprising means for supporting an upwardly opening bag and advancing the same step by step along a predetermined path through a succession of dwell stations, mechanism disposed at one of said stations and operable while the bag is dwelling to open the latter partially, mechanism at a second station operable to complete the opening of the bag and deposit a quantity of material in the same, a member located beyond said second station and actuated periodically to strike the bag and thereby settle the material in the bag, a plunger disposed beyond said member and operable during a dwell period to enter said bag and compact the material therein, mechanism disposed at a station beyond said plunger and engageable with the top portion of the bag to stretch and thereby flatten the same, molding elements disposed at a subsequent station and engageable with said bag to mold the bag into a predetermined shape, and means disposed beyond said elements and operable to close the top of the bag.

2. A packaging machine comprising means for supporting an upwardly opening bag and advancing the same step by step along a predetermined path through a succession of dwell stations, mechanism disposed at one of said stations and operable to deposit a quantity of material in the bag, a plunger located at a second station and operable to enter said bag and compact the material therein, elements disposed beyond said second station and engageable with the upper portion of said bag to stretch and flatten the same, members disposed at a station beyond said elements engageable with the bag to mold the bag body to a predetermined shape, mechanisms disposed beyond said last-mentioned station and operable sequentially to fold down the top of the bag, crease the resulting fold, fold the top portion down again and crease the second fold, and means disposed at a subsequent station and operable to bend the ends of the folded bag portion inwardly and at generally right angles to the folded portion.

3. A packaging machine comprising means for supporting an upwardly opening bag and advancing the same step by step along a predetermined path through a succession of dwell stations, mechanism disposed at one of said stations and operable to deposit a quantity of material in the bag, a plunger located at a second station and operable to enter said bag and compact the material therein, elements disposed beyond said second station and engageable with the upper portion of said bag to stretch and flatten the same, members disposed at a station beyond said elements engageable with the bag to mold the bag body to a predetermined shape, mechanism disposed at a subsequent station and operable to fold down the top portion of the bag and thereby close the latter, and means located beyond said last-mentioned station and having parts movable during a dwell period to bend in the ends of the folded portion of the bag.

4. The combination of, mechanism for supporting and partially filling an upwardly opening bag and advancing the same edgewise and step by step along a predetermined path through a succession of dwell stations, said bag having a bellows-like bottom expandable into a substantially squared shape, means at one of said stations providing rigid supports for the bottom of the bag and for limiting the separation of the side walls of the bag, a plunger projectable into the open end of the bag at such station to compact the bag contents and expand the bag walls against said supports, releasable means gripping the upper end portions of said side walls to hold the same against wrinkling during entry of said plunger, mechanism at a subsequent one of said stations operable

to grip opposite margins of the bag and place the top portion of the bag under edgewise tension, and means acting on the bag while dwelling at a subsequent one of said stations to seal and close the flattened portion of the bag top.

5. The combination of, mechanism for supporting and partially filling an upwardly opening bag and advancing the same edgewise and step by step along a predetermined path through a succession of dwell stations, means at one of said stations providing rigid supports for the bottom of the bag and for limiting the separation of the side walls of the bag, a plunger projectable into the open end of the bag at such station to compact the bag contents and expand the bag walls against said supports, releasable means gripping the upper end portions of said side walls to hold the same against wrinkling during entry of said plunger, mechanism at a subsequent one of said stations operable to place the top portion of the bag under edgewise tension, and means acting on the bag while dwelling at a subsequent one of said stations to seal and close the flattened portion of the bag top.

6. The combination of, mechanism for supporting an upwardly opening bag and advancing the same step by step along a predetermined path through a succession of dwell stations, said bag originally being flat and having a bellows-like bottom expandable to permit the bag when opened to assume a substantially squared shape, mechanism at one of said stations for opening the bag and expanding the bag bottom, means disposed beyond said last-named mechanism for partially filling the opened bag, a plunger projectable into the open end of the bag at a second one of said stations to compact the bag contents and expand the bag walls to a squared shape, releasable means gripping the upper end portions of said side walls to hold the same against wrinkling during entry of said plunger, mechanism at a subsequent one of said stations operable to stretch the top portion of the bag and thereby flatten the same, and means acting on the bag while dwelling at a subsequent one of said stations to seal and close the flattened portion of the bag top.

7. The combination of, mechanism for forming and partially filling an upwardly opening bag and advancing the same edgewise and step by step along a predetermined path through a succession of dwell stations, a plunger projectable into the open end of the bag at one of said stations to compact the bag contents, mechanism at a subsequent one of said stations operable to grip opposite margins of the bag and place the top portion of the bag under edgewise tension, means operable on the bag dwelling at a subsequent one of said stations to fold the flattened top portion of the bag outwardly and downwardly against a side wall of the bag, means operable on the folded end portion of the bag at a subsequent one of said stations to bend the same outwardly and downwardly against a wall of the bag and form a double fold and seal, means operable to flatten said double fold at a subsequent one of said stations, and means operable at a subsequent one of said stations to bend the outer end portions of said fold at an angle to the plane of the fold whereby to prevent unfolding of the seal.

8. The combination of, mechanism for supporting and partially filling an upwardly opening bag and advancing the same edgewise and step by step along a predetermined path through a succession of dwell stations, mechanism at a subsequent one of said stations operable to stretch the top portion of the bag and flatten the same, means operable on the bag dwelling at a subsequent one of said stations to fold the flattened portion of the bag outwardly and downwardly against a side wall of the bag, elements disposed at a station beyond said last-mentioned station and operable to crease the said folded portion and simultaneously form a temporary seal to hold said portion against said side wall, and means operable on the folded end portion of the bag at a subsequent one of said stations to bend the same outwardly and downwardly against a wall of the bag and form a double fold and seal.

9. The combination of, mechanism for supporting and partially filling an upwardly opening bag and advancing the same step by step along a predetermined path through a succession of dwell stations, mechanism at one of said stations operable to flatten the top portion of the bag, means operable on the bag dwelling at a subsequent one of said stations to fold the top flattened portion of the bag outwardly and downwardly against a side wall of the bag, means operable on the folded end portion of the bag at a subsequent one of said stations to bend the same outwardly and downwardly against a wall of the bag and form a double fold, and elements disposed between said last two stations and operable to form a weak seal holding said folded end portion against said side wall during the second folding operation.

10. The combination of, mechanism for supporting and partially filling an upwardly opening bag and advancing the same step by step along a predetermined path through a succession of dwell stations, said bag being expandable into a substantially squared shape, mechanism disposed at one of said stations for compacting the contents of the bag, said compacting mechanism comprising a rigid support for the bottom of the bag, a plunger projectable into said bag to compress said contents and having a squared shape to expand the bag during such compressing, a ring of the same shape as but smaller than said bag, means supporting said ring for movement with said plunger into the bag but yieldable to permit relative movement between the ring and the plunger, means positively limiting the movement of said ring and holding the ring inside the bag at the open end thereof, rigid members disposed on opposite sides of the bag and movable into engagement with the walls of the bag to provide lateral support for the bag and to clamp the upper end of the bag against said ring and thereby hold the bag walls taut during compacting by said plunger, and fingers projectable into said bag before entry of said ring and engageable with the corners of the bag to expand the open end thereof to a squared shape preparatory to entry of the ring.

11. The combination of, mechanism for supporting and partially filling an upwardly opening bag and advancing the same step by step along a predetermined path through a succession of dwell stations, said bag being expandable into a predetermined shape, mechanism disposed at one of said stations for compacting the contents of the bag, said compacting mechanism comprising a rigid support for the bottom of the bag, a plunger projectable into said bag to compress said contents and formed to said predetermined shape to expand the bag during such compressing, an element movable into said bag to a position adjacent the open end of the bag, rigid members disposed on opposite sides of the bag and movable into engagement with the walls of the bag to provide lateral support for the bag and to clamp the upper end of the bag against said element and thereby hold the bag walls taut during compacting by said plunger, and means operable before entry of said element to expand said open end to said predetermined shape.

12. The combination of, mechanism for supporting and partially filling an upwardly opening bag and advancing the same step by step along a predetermined path through a succession of dwell stations, said bag being expandable into a substantially squared shape, mechanism disposed at one of said stations for compacting the contents of the bag, said compacting mechanism comprising a rigid support for the bottom of the bag, a plunger projectable into said bag to compress said contents and having a squared shape to expand the bag during such compressing, a ring of the same shape as but smaller than said bag, means supporting said ring for

movement with said plunger into the bag but yieldable to permit relative movement between the ring and the plunger, means positively limiting the movement of said ring and holding the ring inside the bag at the open end thereof, and rigid members disposed on opposite sides of the bag and movable into engagement with the walls of the bag to provide lateral support for the bag and to clamp the upper end of the bag against said ring and thereby hold the bag walls taut during compacting by said plunger.

13. The combination of, mechanism for supporting and partially filling an upwardly opening bag and advancing the same step by step along a predetermined path through a succession of dwell stations, said bag being expandable into a predetermined shape, mechanism disposed at one of said stations for compacting the contents of the bag, said compacting mechanism comprising a rigid support for the bottom of the bag, a plunger projectable into said bag to compress said contents and formed to said predetermined shape to expand the bag during such compressing, an element movable into said bag to a position adjacent the open end of the bag, and rigid members disposed on opposite sides of the bag and movable into engagement with the walls of the bag to provide lateral support for the bag and to clamp the upper end of the bag against said element and thereby hold the bag walls taut during compacting by said plunger.

14. The combination of, mechanism for supporting and partially filling an upwardly opening bag and advancing the same step by step along a predetermined path through a succession of dwell stations, means disposed at certain ones of said stations and operable to flatten the upper end portion of the bag and to close said bag end, and mechanism disposed at a subsequent station for bending the ends of said upper end portion at an angle to the front and back walls of said bag along generally vertical lines spaced inwardly from the edges of the bag, said mechanism comprising first and second members disposed on opposite sides of the bag and movable toward and away from the bag, a first horizontal bar rigidly mounted on said first member to engage one side of said upper end portion between said lines, a second and similar bar for engaging the other side of said end portion, means yieldably supporting said second bar on said second member to permit continued movement of the member after the bar engages said end portion, and elements mounted on said second member and engaging the ends of said second bar to cross the plane of said bag and bend said ends against the ends of said first bar upon such continued movement of said second member.

15. The combination of, mechanism for supporting and partially filling an upwardly opening bag and advancing the same step by step along a preedtermined path through a succession of dwell stations, means disposed at certain ones of said stations and operable to flatten the upper end portion of the bag and to close said bag end, and mechanism disposed at a subsequent station for bending the ends of said upper end portion at an angle to the front and back walls of said bag along generally vertical lines spaced inwardly from the edges of the bag, said mechanism comprising two members disposed on opposite sides of said bag and operable to engage said upper end portion between said lines, and elements movable across said path along the ends of said members to bend said ends against the ends of one of the members.

16. The combination of, mechanism for supporting and partially filling an upwardly opening bag and advancing the same step by step along a predetermined path through a succession of dwell stations, mechanism operable at one of said stations to flatten the top portion of the bag, means operable on the bag at a subsequent one of said stations to fold the top flattened portion of the bag outwardly and downwardly against a side wall of the bag, said folding means comprising a first member movable horizontally from a first position on one side of said path to a second position on the other side of the path to engage the upper end portion of the bag along a transverse fold line and bend such portion into a generally horizontal plane, the distance between said positions being less than the height of said end portion whereby said member remains in engagement with the end portion upon reaching the second position, a second member movable up and down in an upright plane adjacent said path and engageable on its downstroke with said horizontally projecting end portion to bend the latter downwardly against said side wall, and a timing device controlling the movements of both of said members and operable first to move said first member horizontally to said second position and then to move said second member down while the first member still is in the second position whereby the first member holds the upper end portion of the bag in position for engagement by the second member.

17. The combination of, mechanism for supporting and partially filling an upwardly opening bag and advancing the same step by step along a predetermined path through a succession of dwell stations, mechanism operable at one of said stations to flatten the top portion of the bag, means operable on the bag at a subsequent one of said stations to fold the top flattened portion of the bag outwardly and downwardly against a side wall of the bag, said folding means comprising one member movable back and forth across across said path to engage the upper end portion of the bag along a transverse fold line and bend such portion into a generally horizontal plane, a second member movable up and down in an upright plane adjacent said path and engageable on its downstroke with said horizontally projecting end portion to bend the latter downwardly against an outer face of the bag, means disposed at a third station for operating on the folded portion of the bag, and a timing device controlling the movements of said members and the operation of the mechanism for advancing the bags and operable after said second member has completed its downstroke but before the member is moved back up to cause the bags to advance whereby the folded portion of the bag is held down by the second member as the bag is advanced to said third station.

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2,168,241	Robinson	Aug. 1, 1939
2,179,685	Chalmers	Nov. 14, 1939