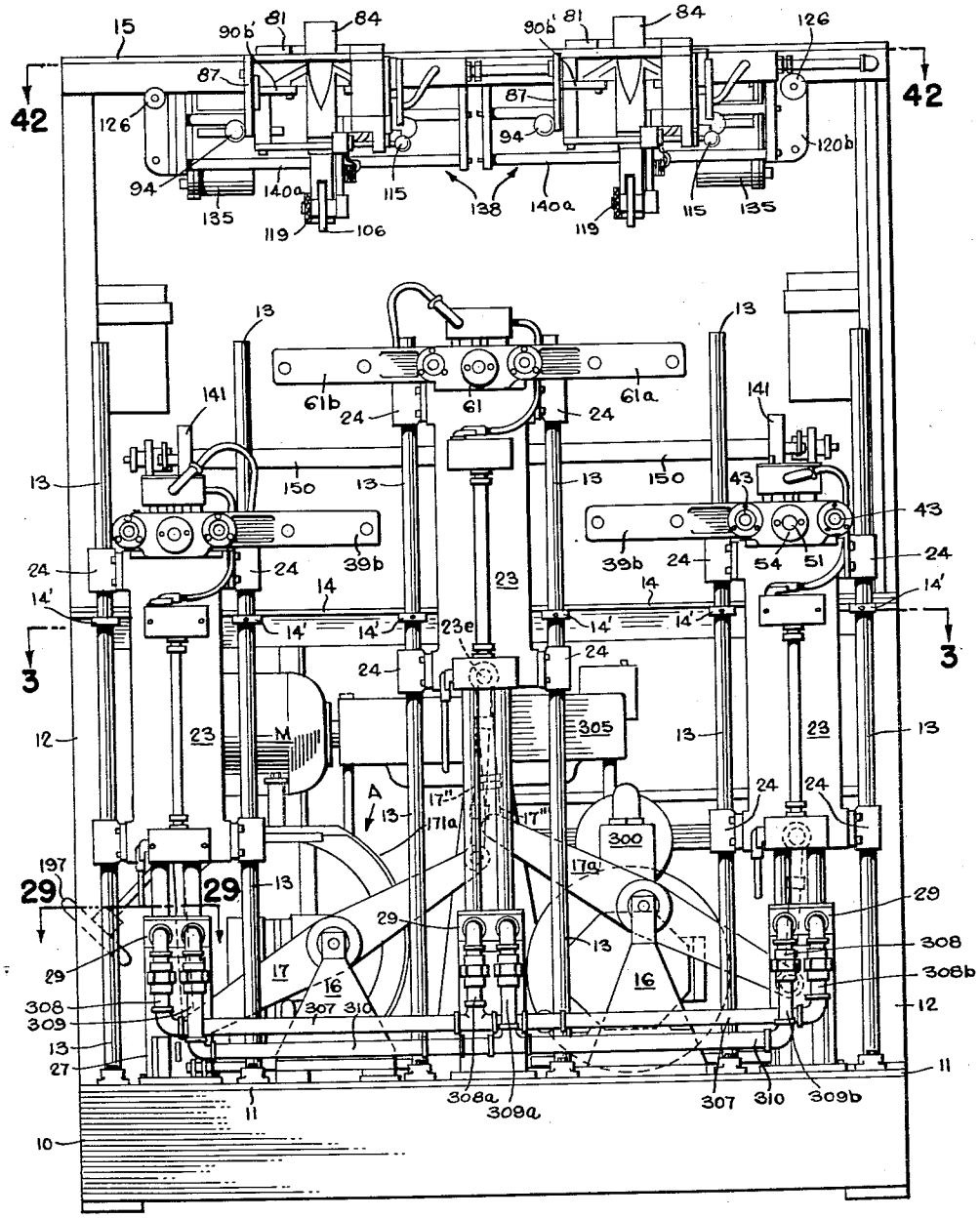
Jan. 9, 1962 C. A. FRANK ETAL 3,015,922

PACKAGING MACHINES

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FIG. 1




*INVENTORS*

CARL A. FRANK
BY ROBERT B. McCLOSKY
JOSEPH A. LYNCH

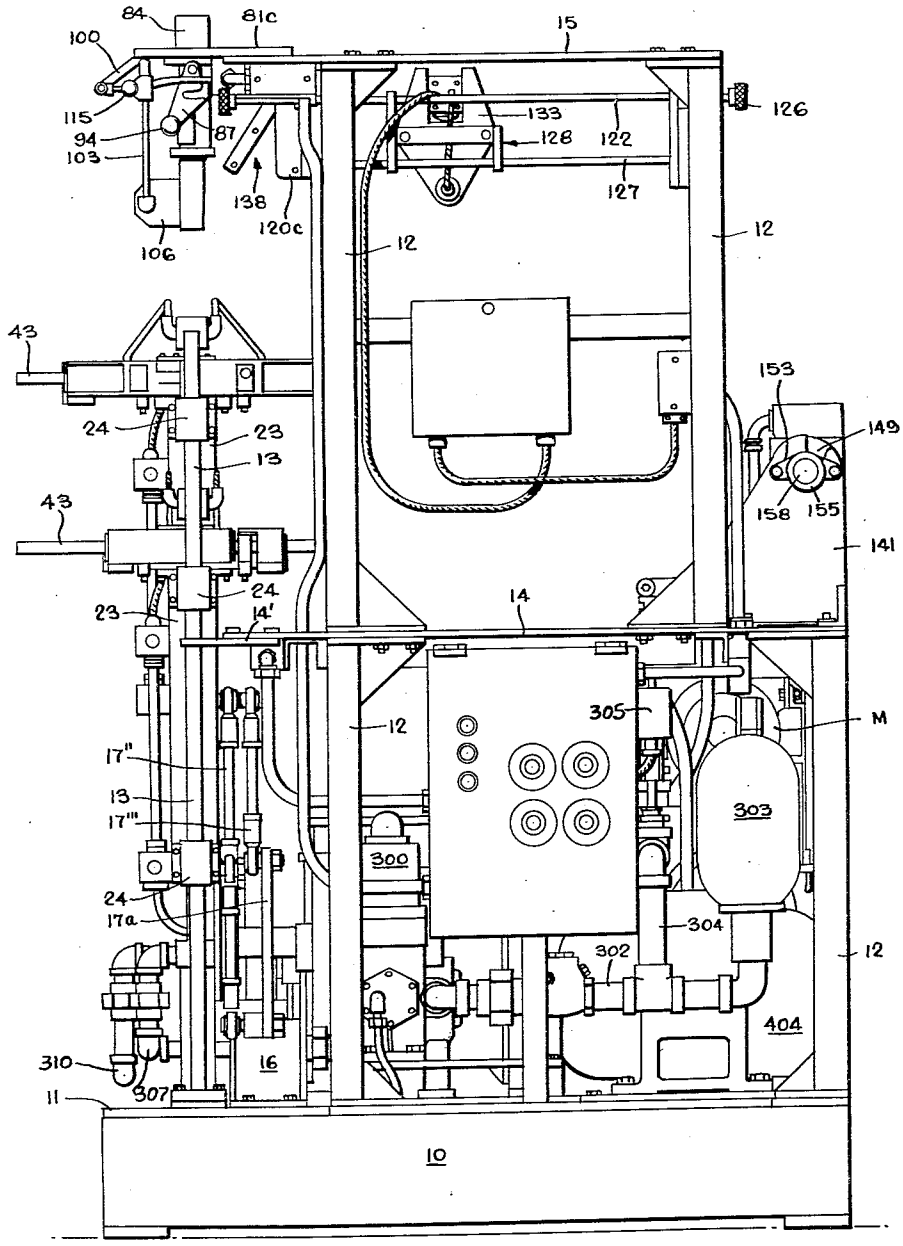
Max Wall
ATTORNEY

Jan. 9, 1962 C. A. FRANK ETAL 3,015,922

PACKAGING MACHINES

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FIG. 2




*INVENTORS*

CARL A. FRANK
ROBERT B. McCLOSKY
JOSEPH A. LYNCH

*BY*

*ATTORNEY*

Jan. 9, 1962 C. A. FRANK ETAL 3,015,922

PACKAGING MACHINES

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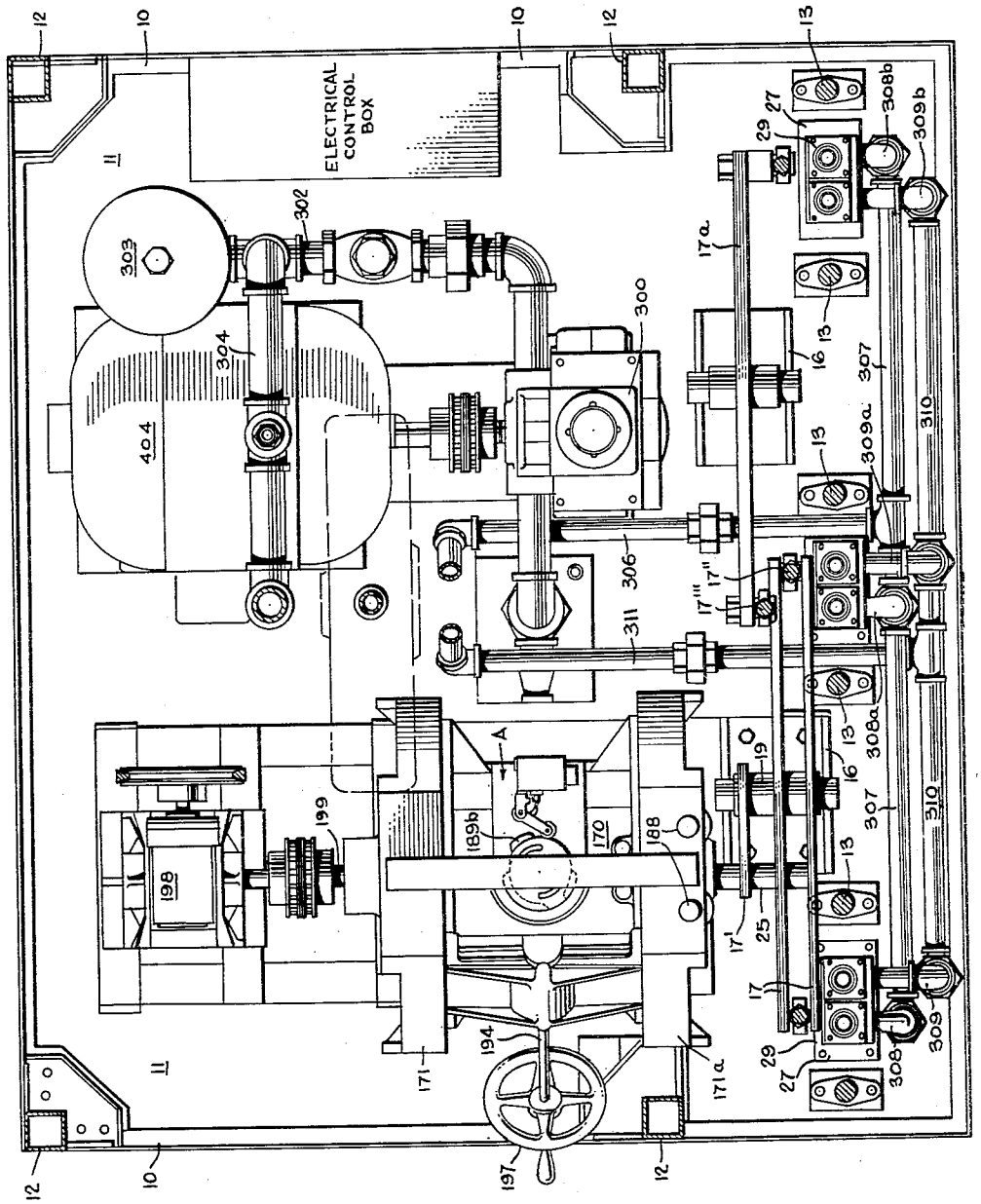



FIG.3

INVENTORS
CARL A. FRANK
ROBERT B. McCLOSKY
JOSEPH A. LYNCH

BY

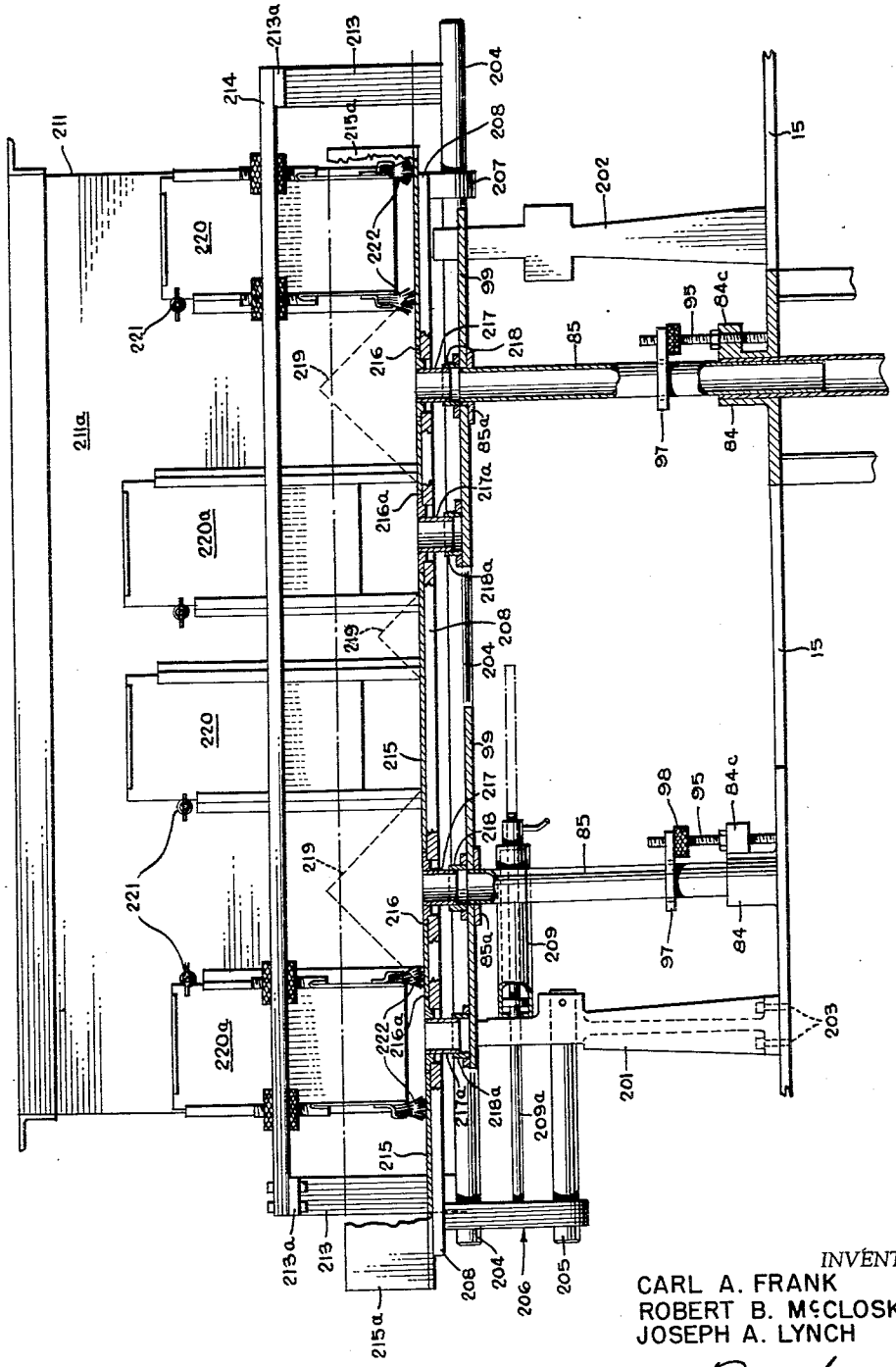
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PACKAGING MACHINES

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FIG. 4




INVENTORS
CARL A. FRANK
ROBERT B. McCLOSKY
JOSEPH A. LYNCH

BY

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Jan. 9, 1962 C. A. FRANK ETAL 3,015,922

PACKAGING MACHINES

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FIG. 6

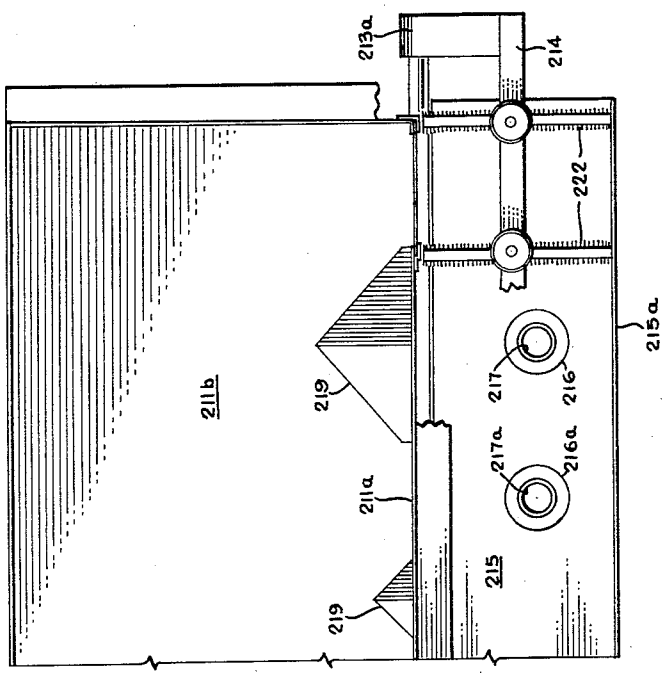
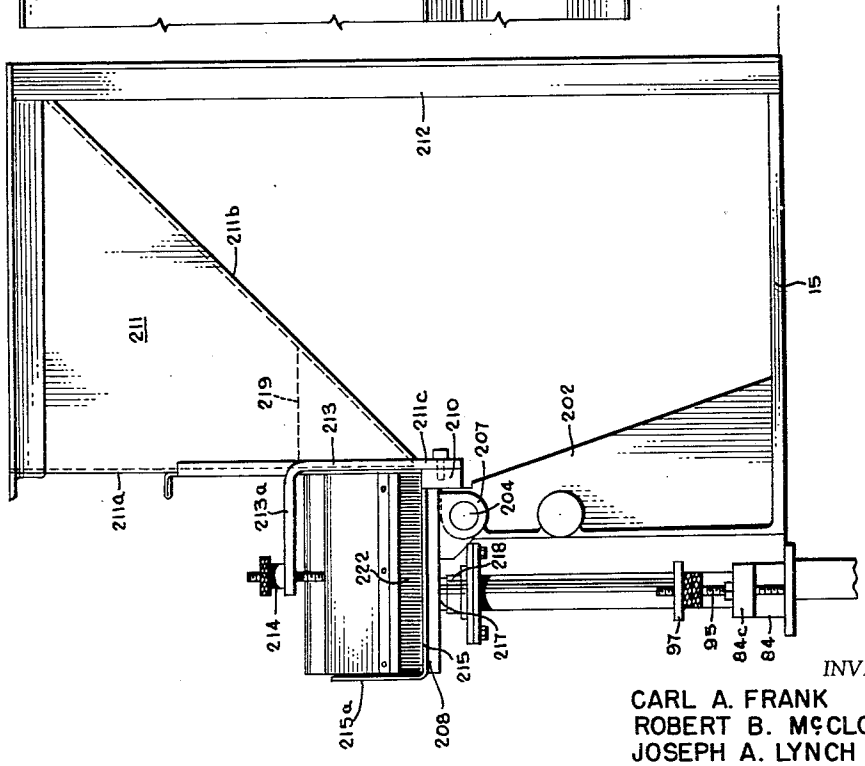



FIG. 5




INVENTORS
CARL A. FRANK
ROBERT B. McCLOSKY
JOSEPH A. LYNCH

BY

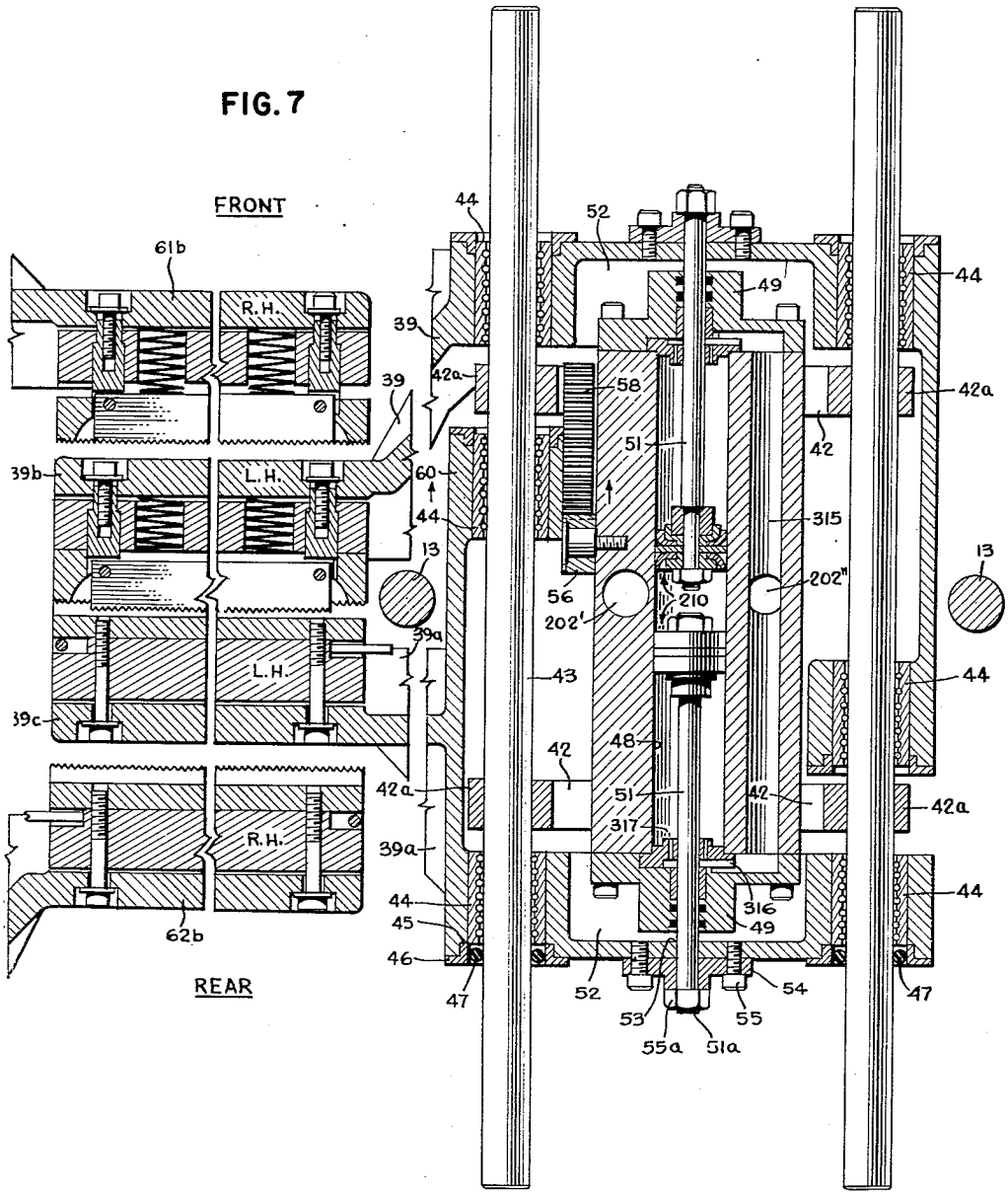
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FIG. 7




INVENTORS

CARL A. FRANK
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JOSEPH A. LYNCH

BY

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PACKAGING MACHINES

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FIG. 8

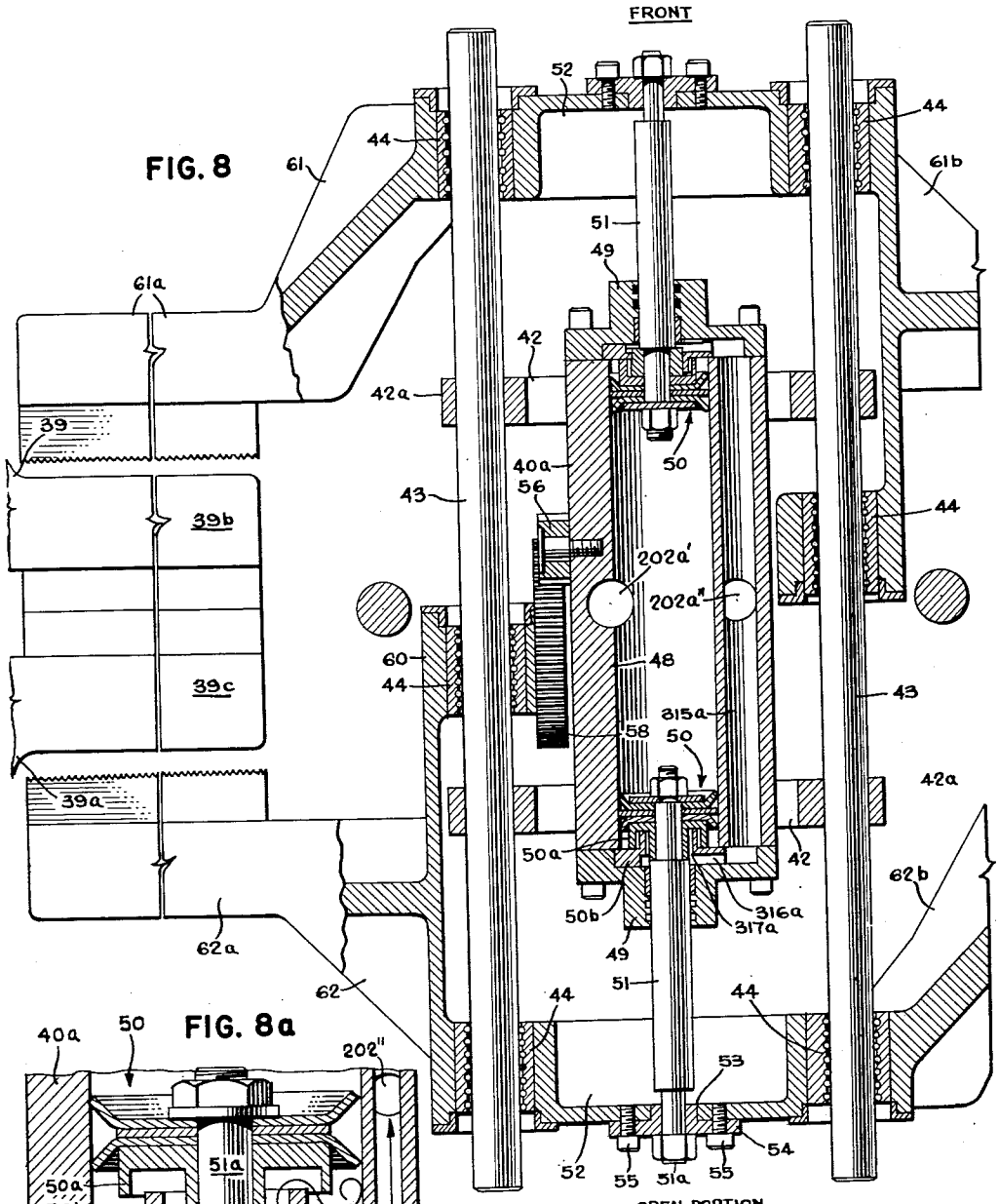
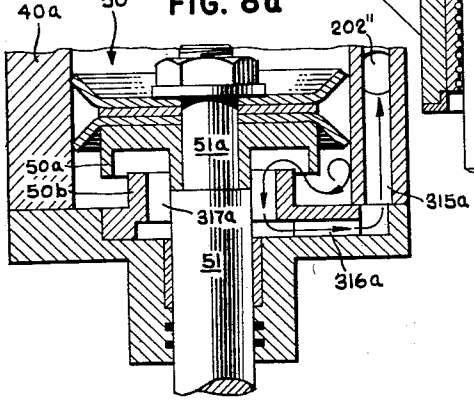



FIG. 8a




INVENTORS
CARL A. FRANK
ROBERT B. McCLOSKY
BY JOSEPH A. LYNCH
ATTORNEY

Jan. 9, 1962 C. A. FRANK ETAL 3,015,922

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FIG. 9

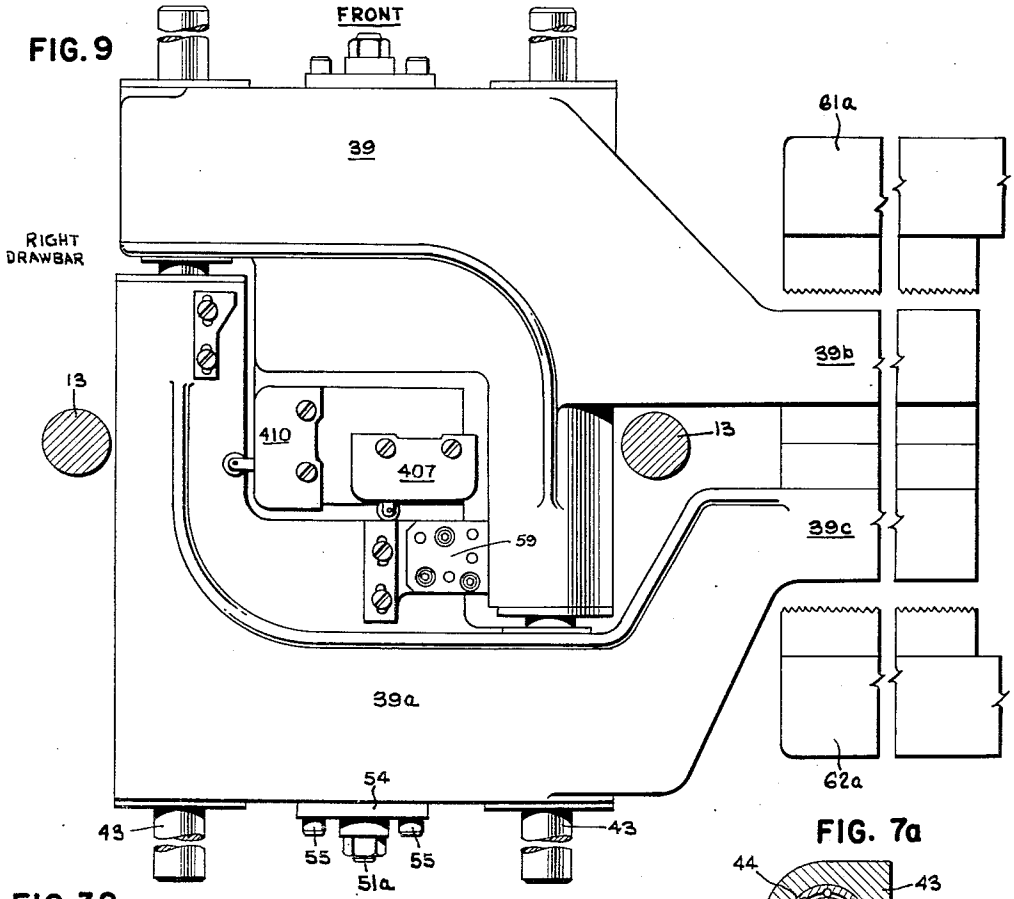



FIG. 7a

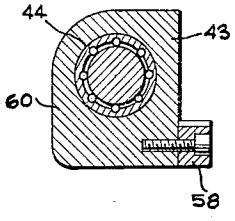



FIG. 32

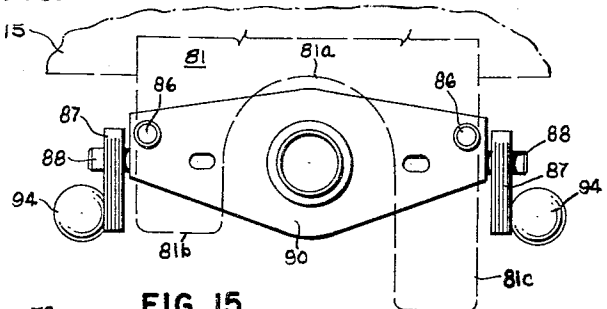



FIG. 15

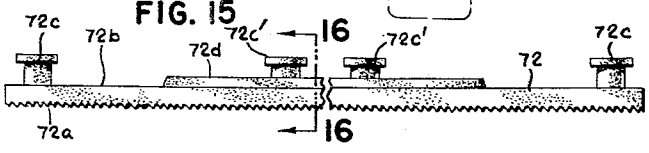
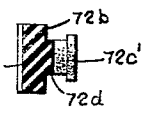



FIG. 16




INVENTORS
CARL A. FRANK
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JOSEPH A. LYNCH

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PACKAGING MACHINES

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FIG. 10

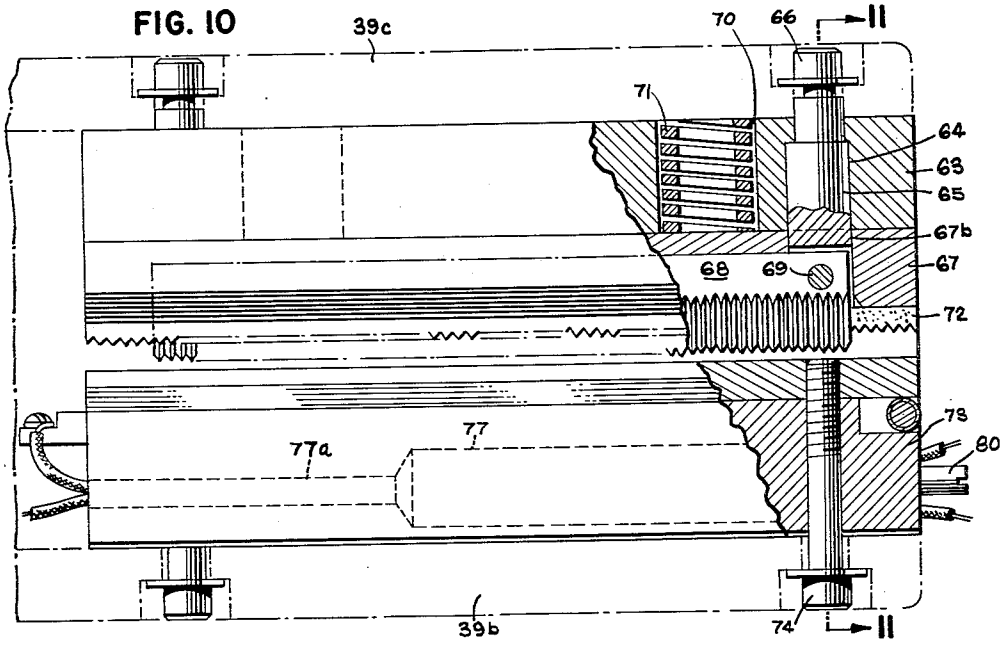



FIG. 11

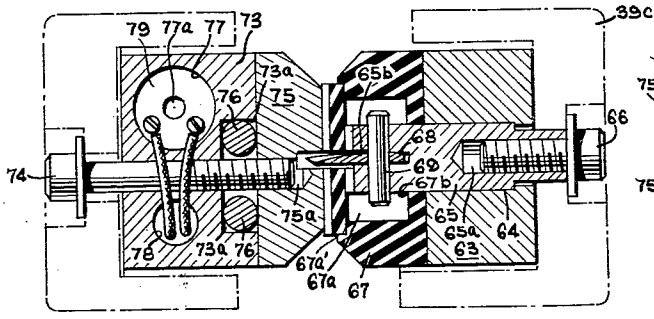
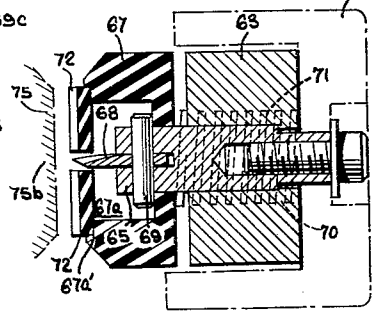



FIG. 12



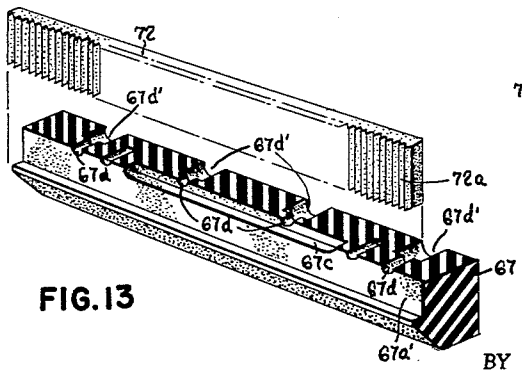




FIG. 13

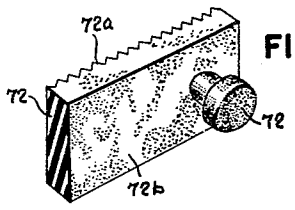



FIG. 14

INVENTORS
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JOSEPH A. LYNCH

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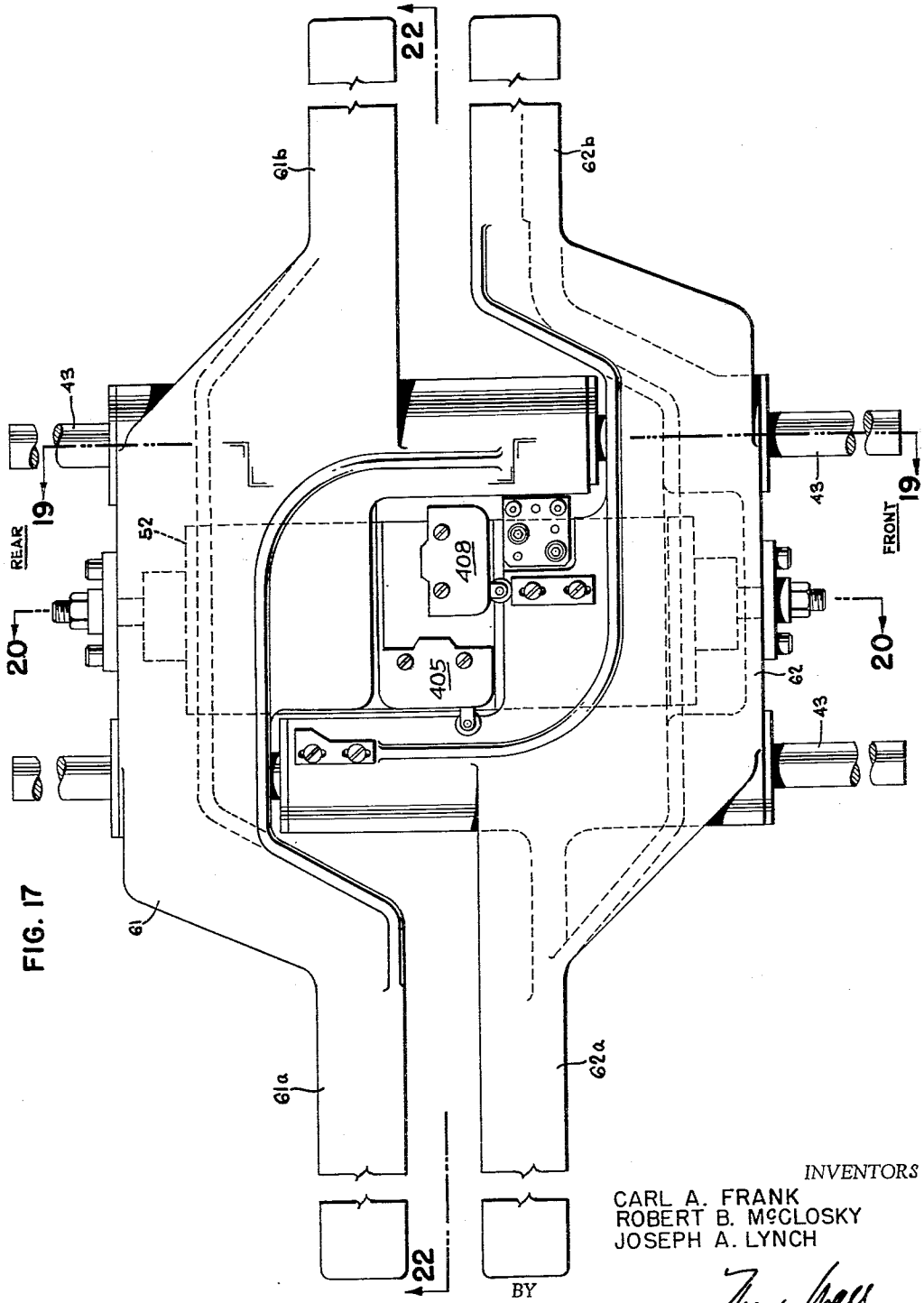



FIG. 17

INVENTORS
CARL A. FRANK
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JOSEPH A. LYNCH

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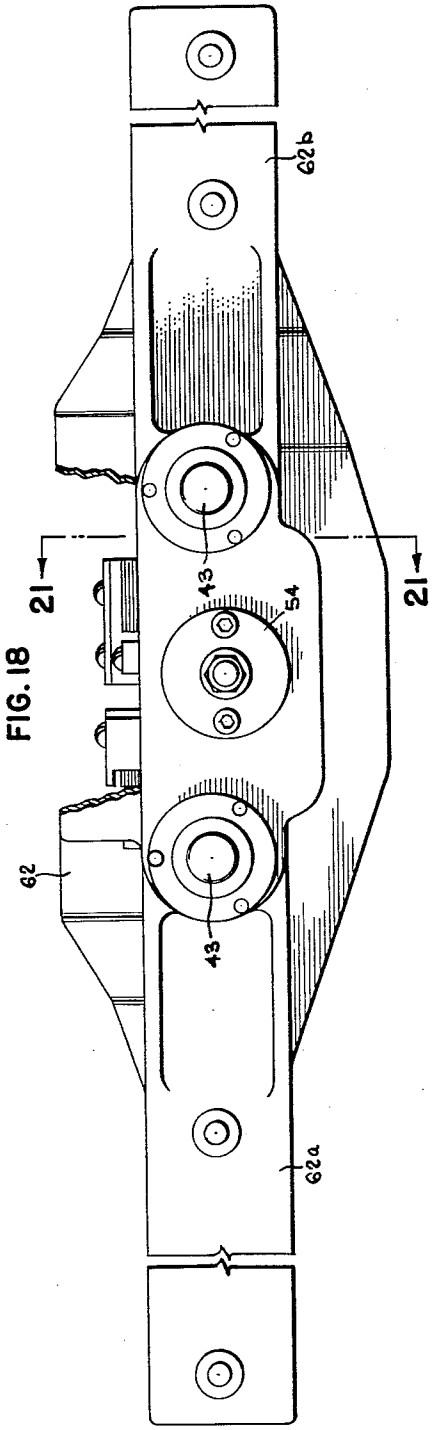



FIG. 18

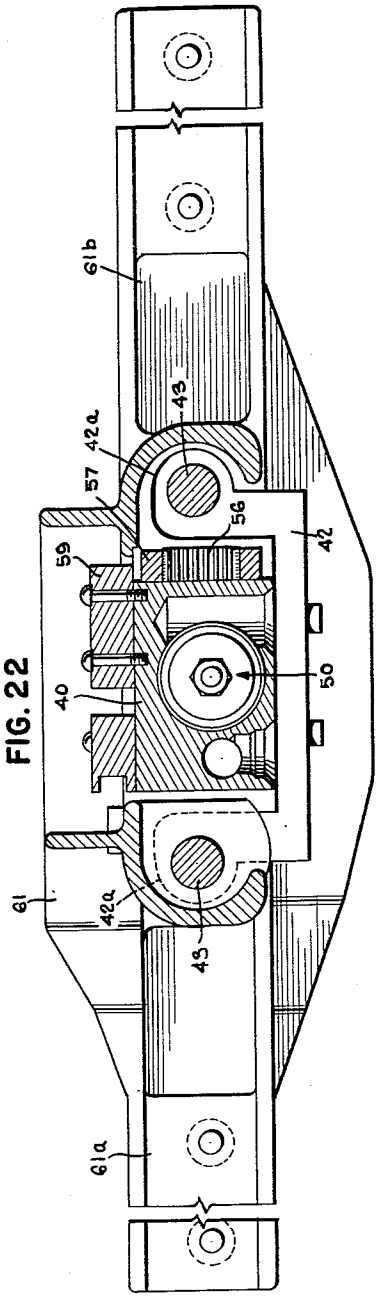



FIG. 22

INVENTORS

CARL A. FRANK
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JOSEPH A. LYNCH

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PACKAGING MACHINES

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FIG. 19

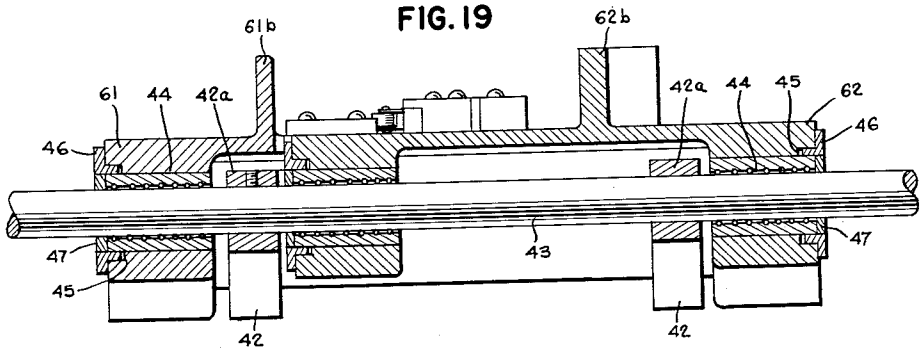



FIG. 20

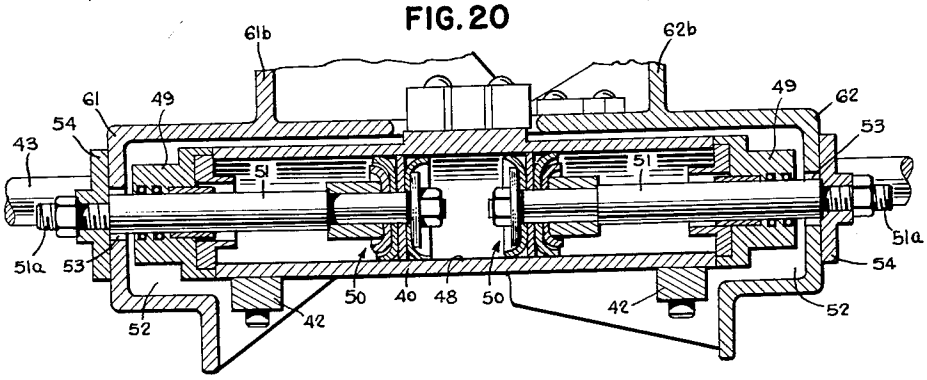
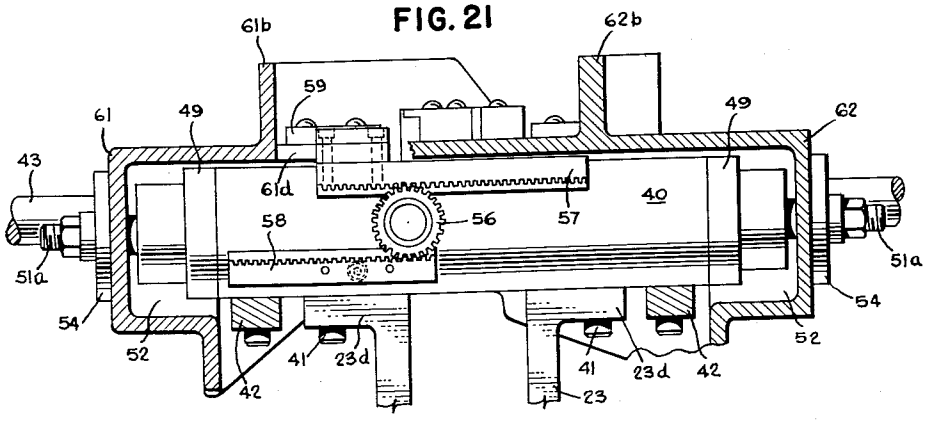



FIG. 21




INVENTORS
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JOSEPH A. LYNCH

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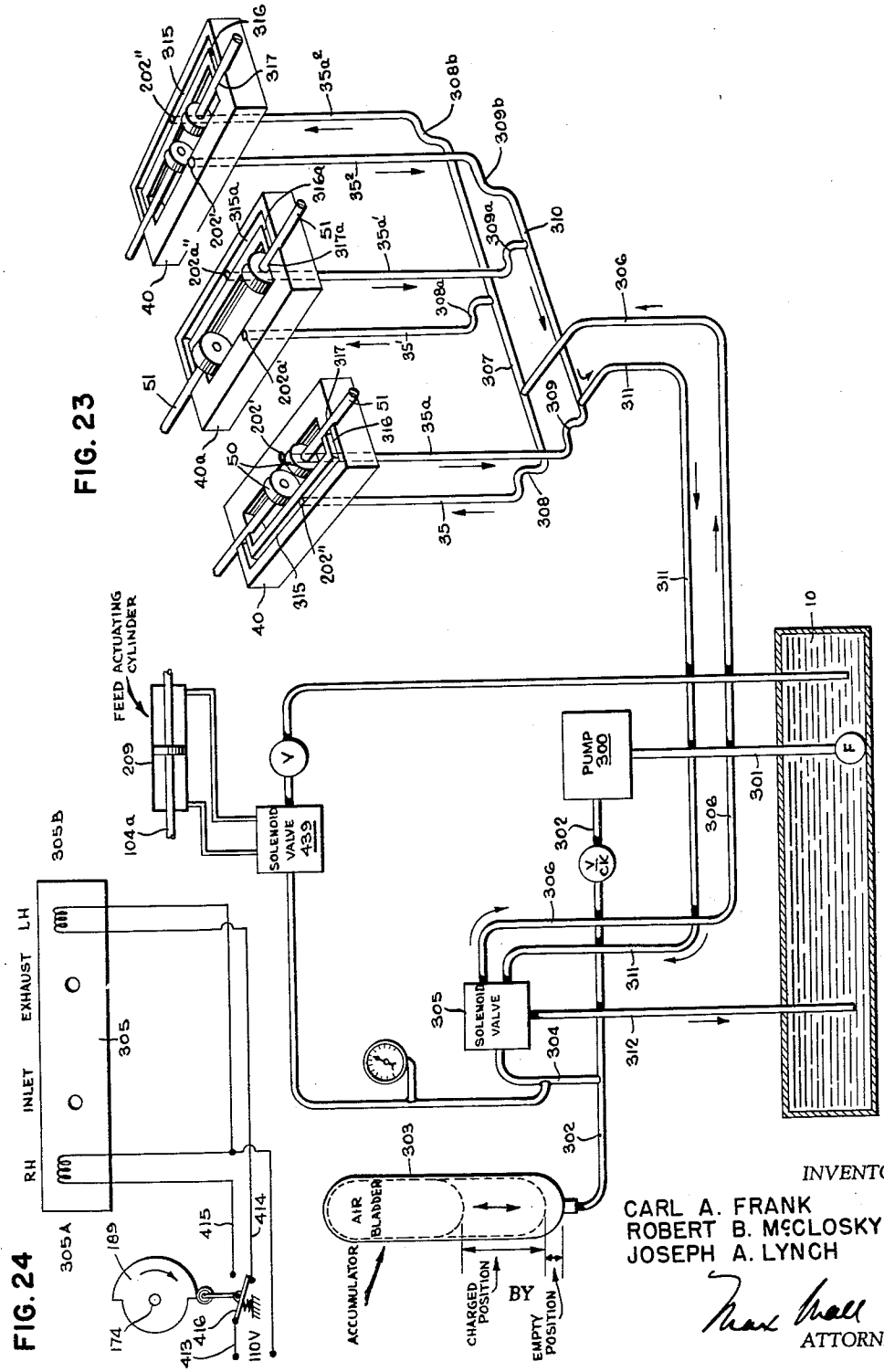



FIG. 23

FIG. 24

INVENTORS

CARL A. FRANK
ROBERT B. McCLOSKY
JOSEPH A. LYNCH

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PACKAGING MACHINES

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FIG. 25

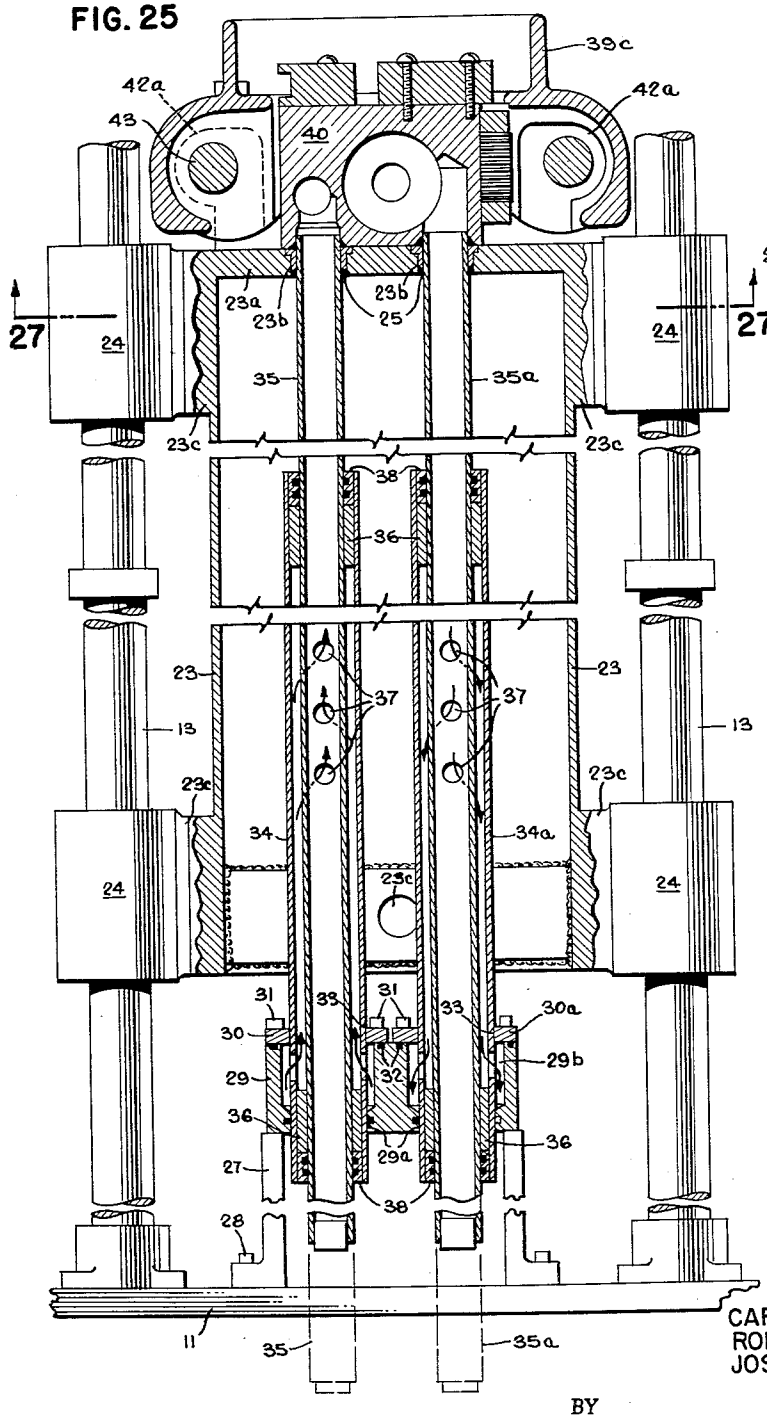
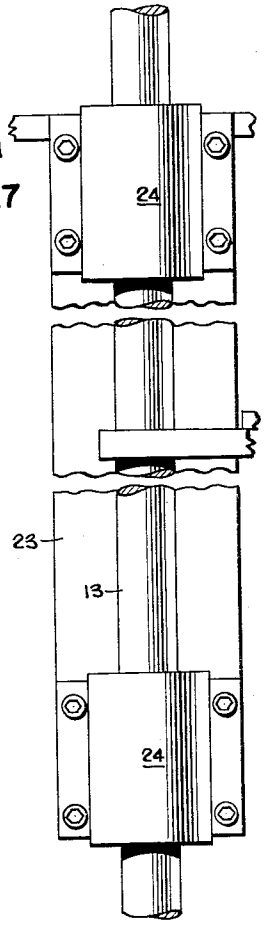



FIG. 26




INVENTORS
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JOSEPH A. LYNCH

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Jan. 9, 1962 C. A. FRANK ETAL 3,015,922

PACKAGING MACHINES

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FIG. 27

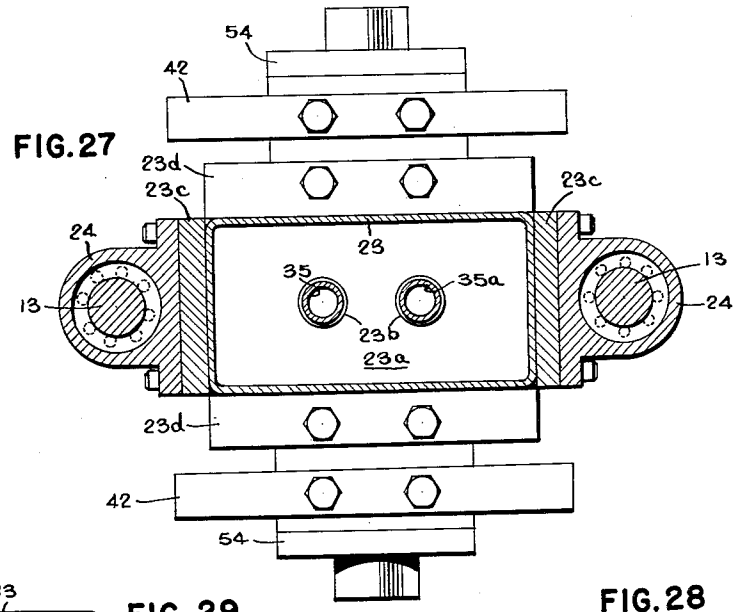



FIG. 29

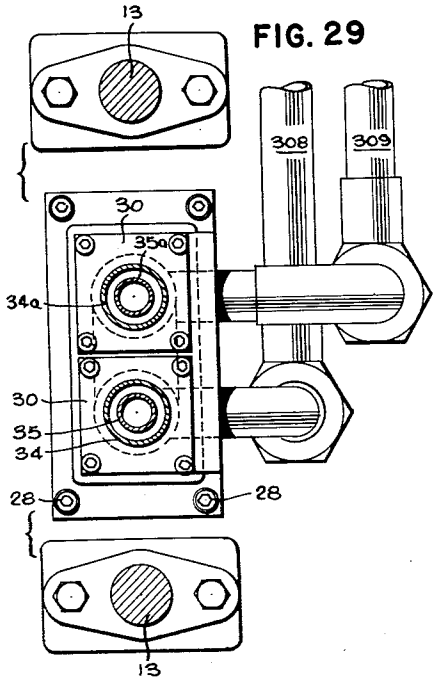
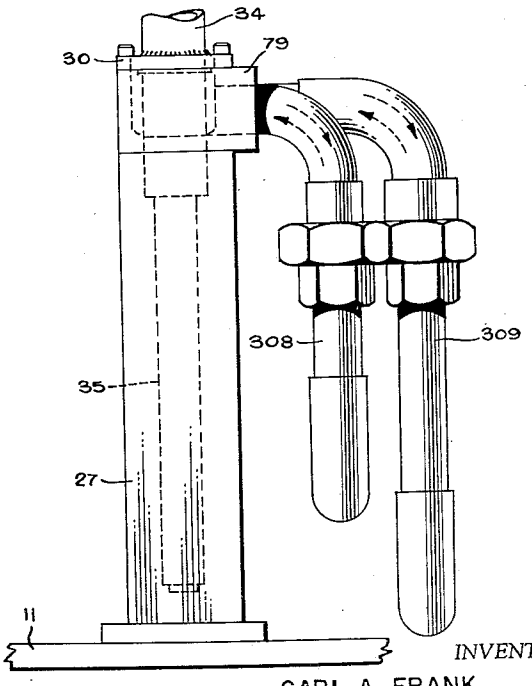



FIG. 28




INVENTORS
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ROBERT B. McCLOSKY
JOSEPH A. LYNCH

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Jan. 9, 1962 C. A. FRANK ETAL 3,015,922

PACKAGING MACHINES

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FIG. 30

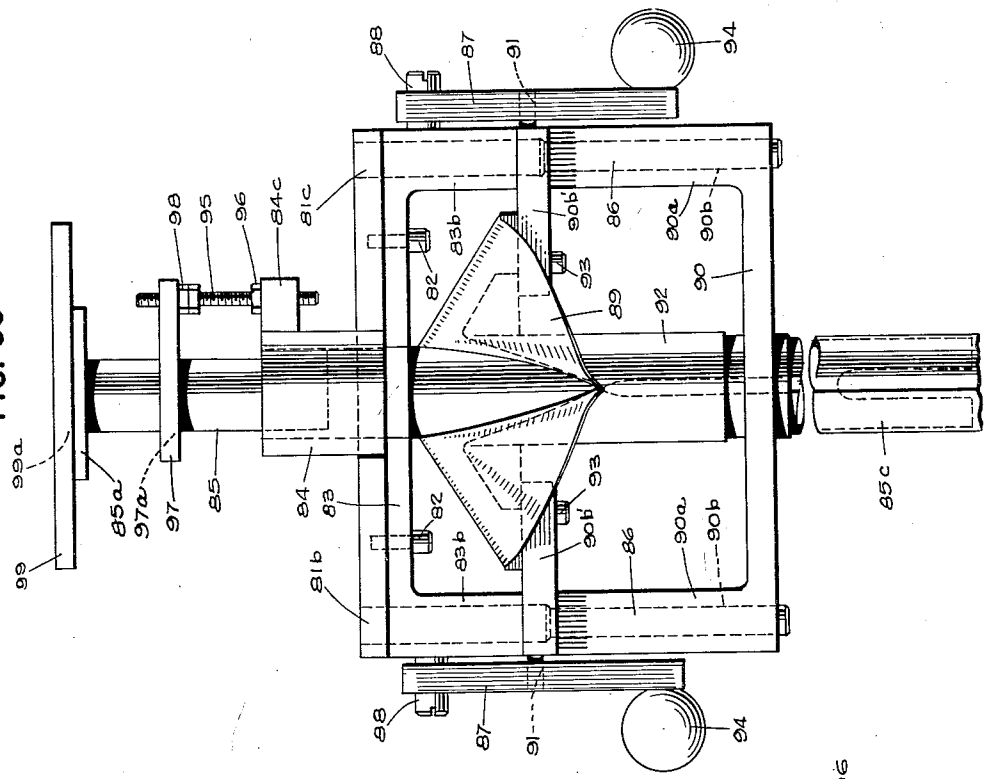
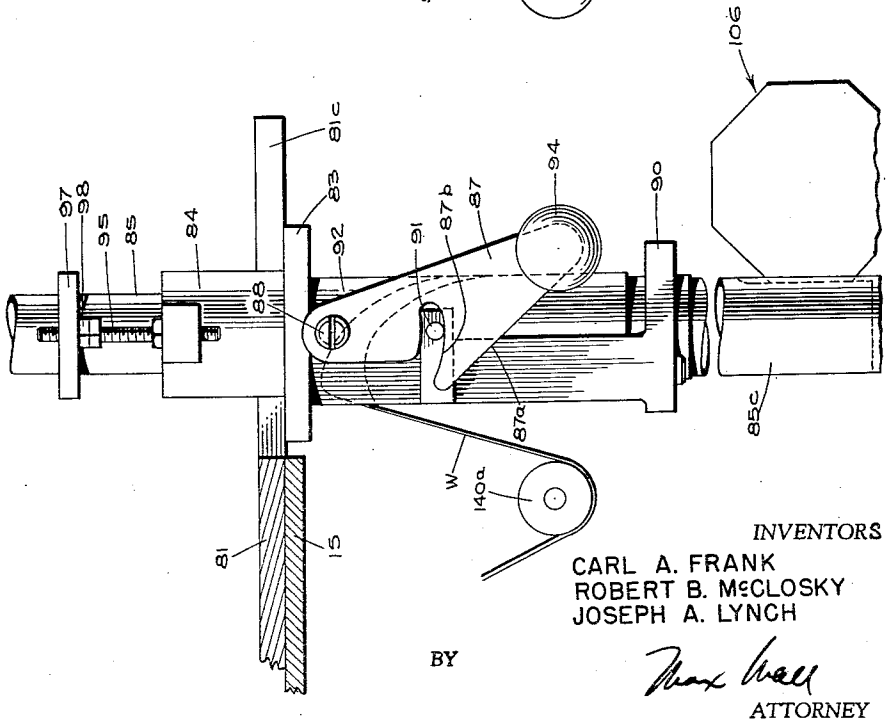



FIG. 31




INVENTORS
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ROBERT B. McCLOSKY
JOSEPH A. LYNCH

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Jan. 9, 1962 C. A. FRANK ETAL 3,015,922

PACKAGING MACHINES

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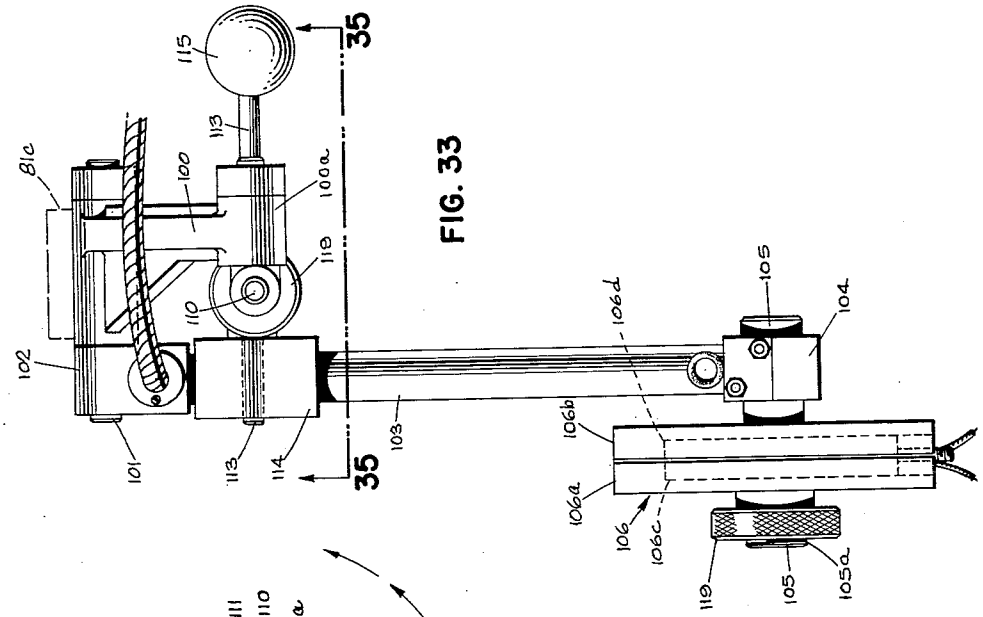



FIG. 33

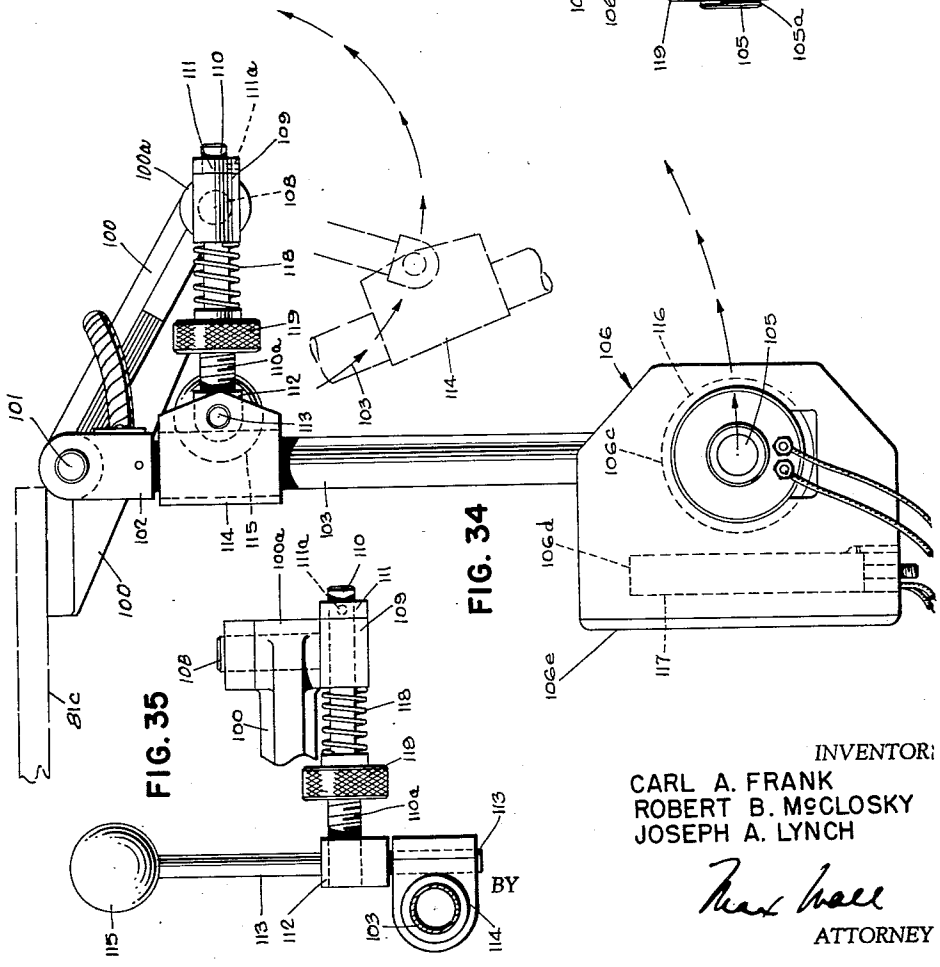



FIG. 34

FIG. 35

INVENTOR:
CARL A. FRANK
ROBERT B. McCLOSKY
JOSEPH A. LYNCH

BY

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PACKAGING MACHINES

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FIG. 38

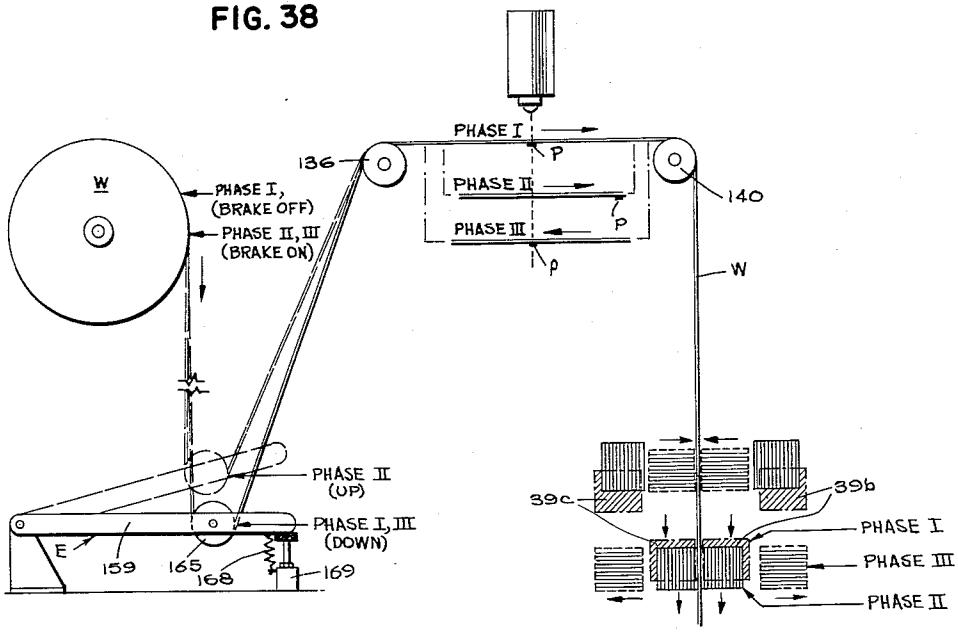



FIG. 36

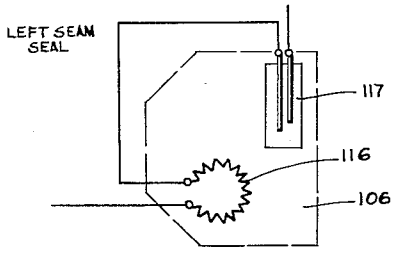



FIG. 37

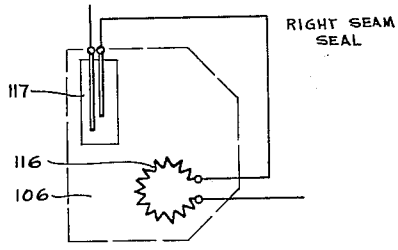
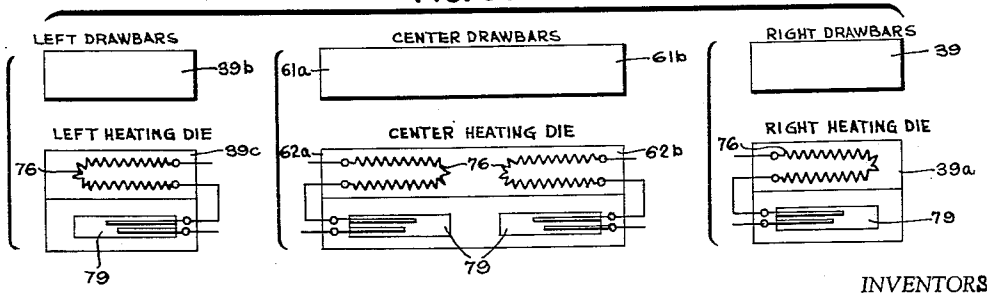



FIG. 39




INVENTORS
CARL A. FRANK
ROBERT B. McCLOSKY
JOSEPH A. LYNCH

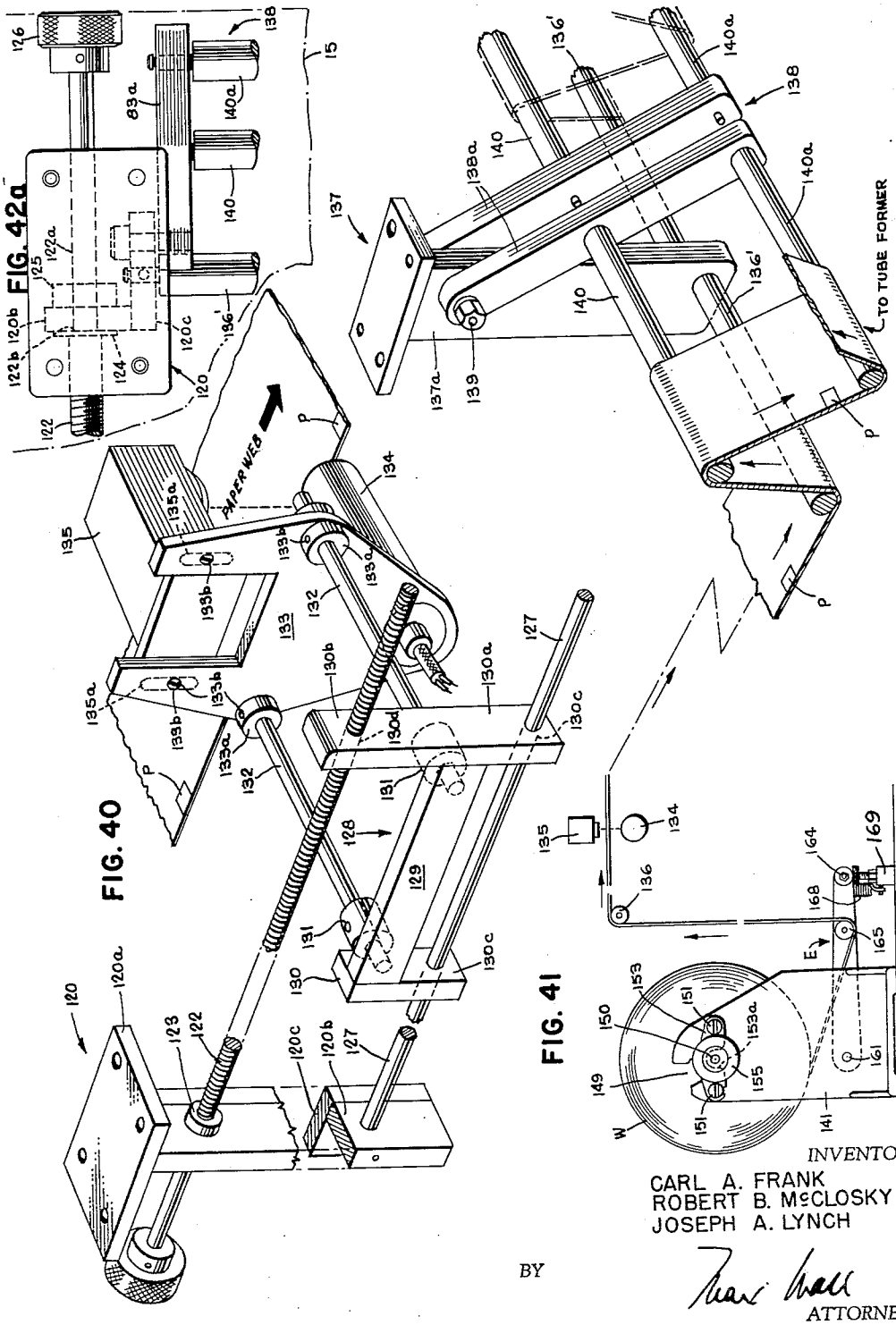
BY

ATTORNEY

Jan. 9, 1962 C. A. FRANK ETAL 3,015,922

PACKAGING MACHINES

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INVENTORS
CARL A. FRANK
ROBERT B. McCLOSKY
JOSEPH A. LYNCH

BY

ATTORNEY

Jan. 9, 1962

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3,015,922

PACKAGING MACHINES

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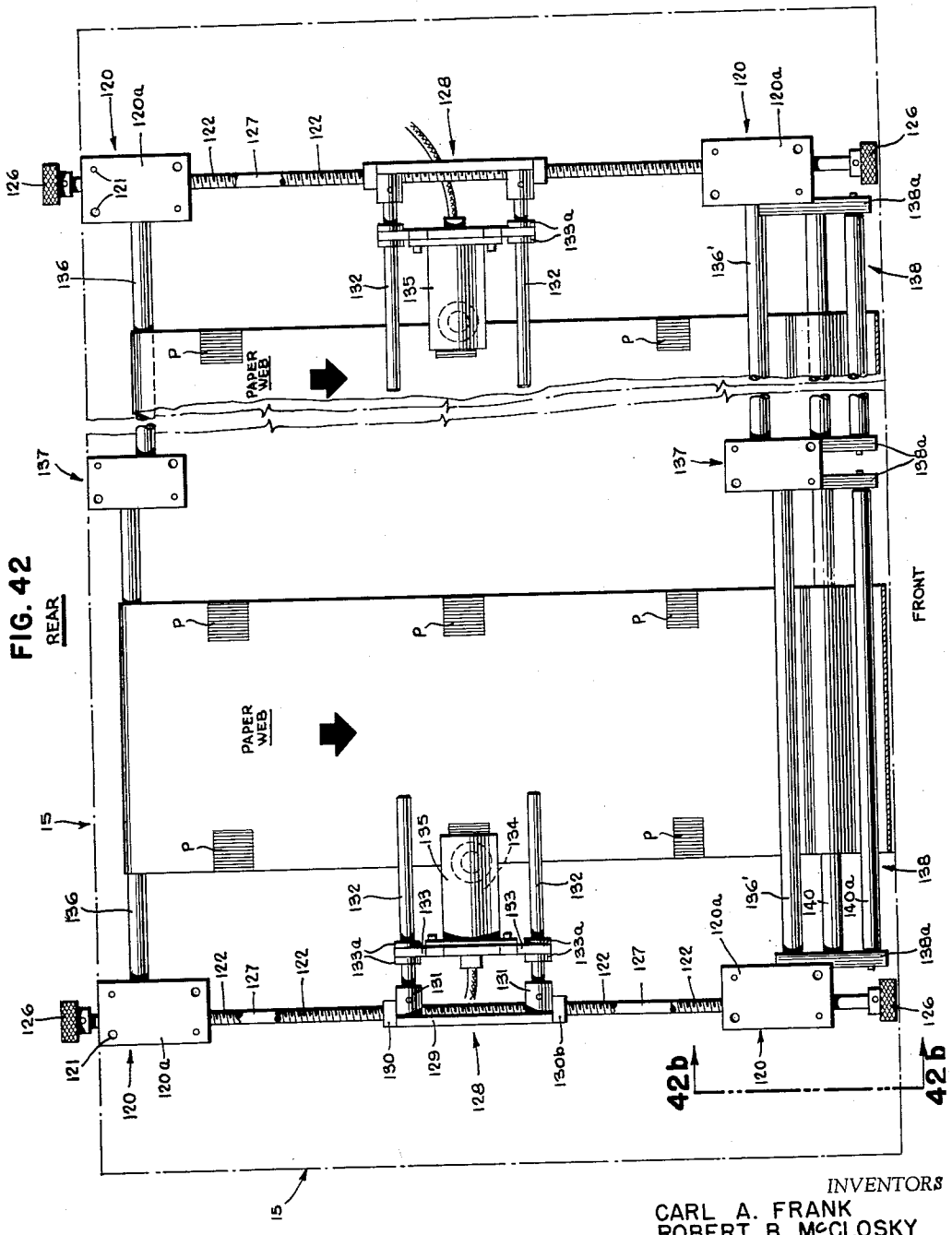



FIG. 42

INVENTORS

CARL A. FRANK
ROBERT B. McCLOSKY
JOSEPH A. LYNCH

BY

ATTORNEY

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PACKAGING MACHINES

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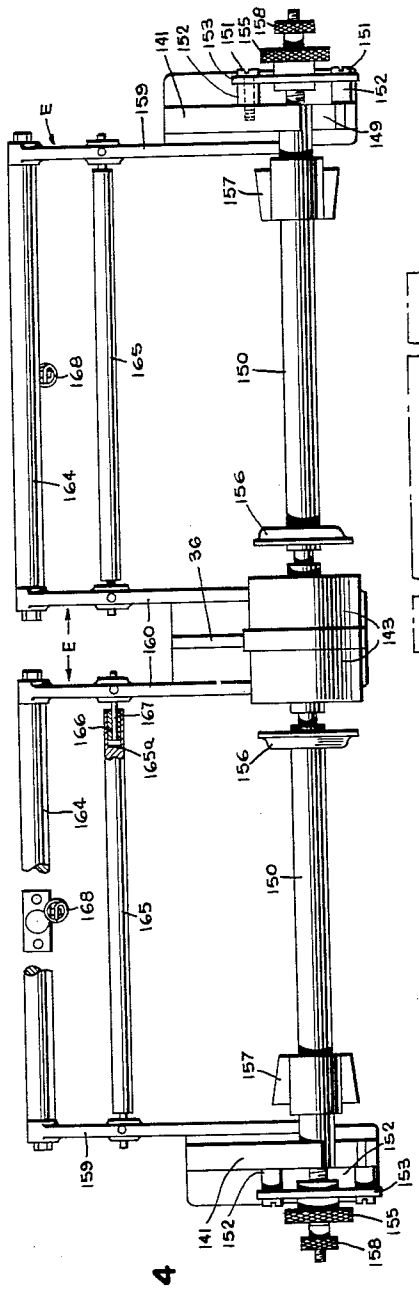


FIG. 44

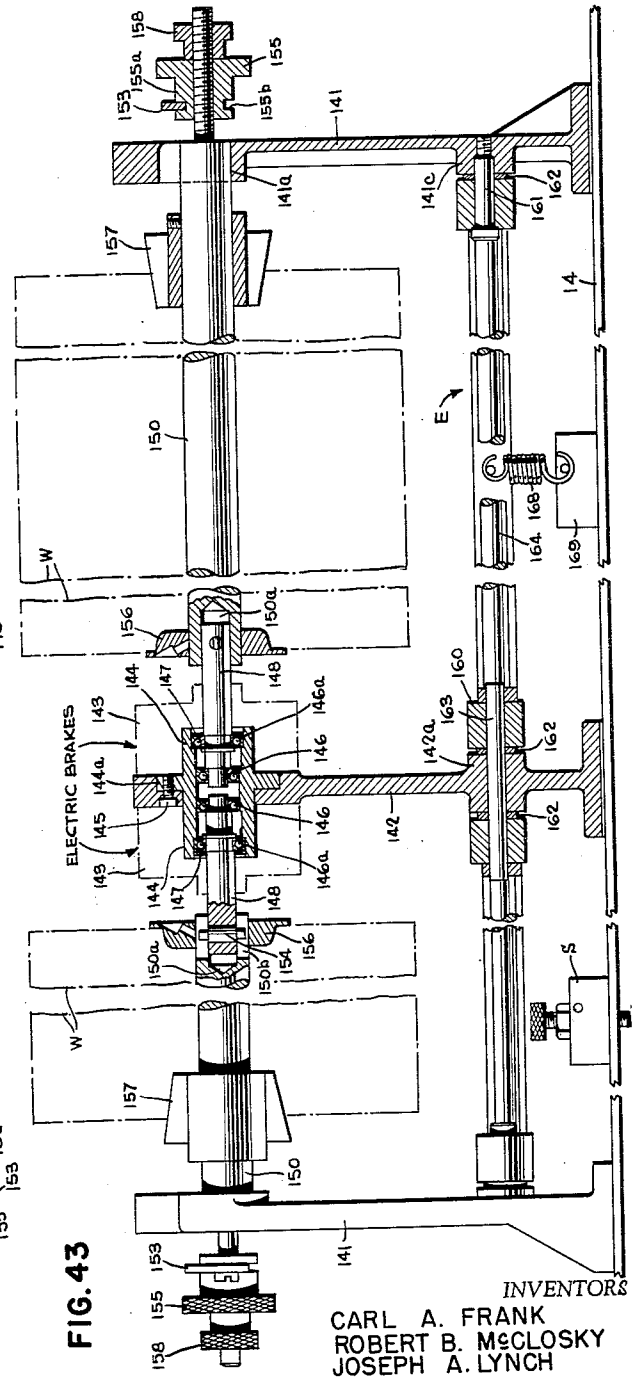



FIG. 43

INVENTORS
CARL A. FRANK
ROBERT B. McCLOSKY
JOSEPH A. LYNCH

BY

ATTORNEY

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PACKAGING MACHINES

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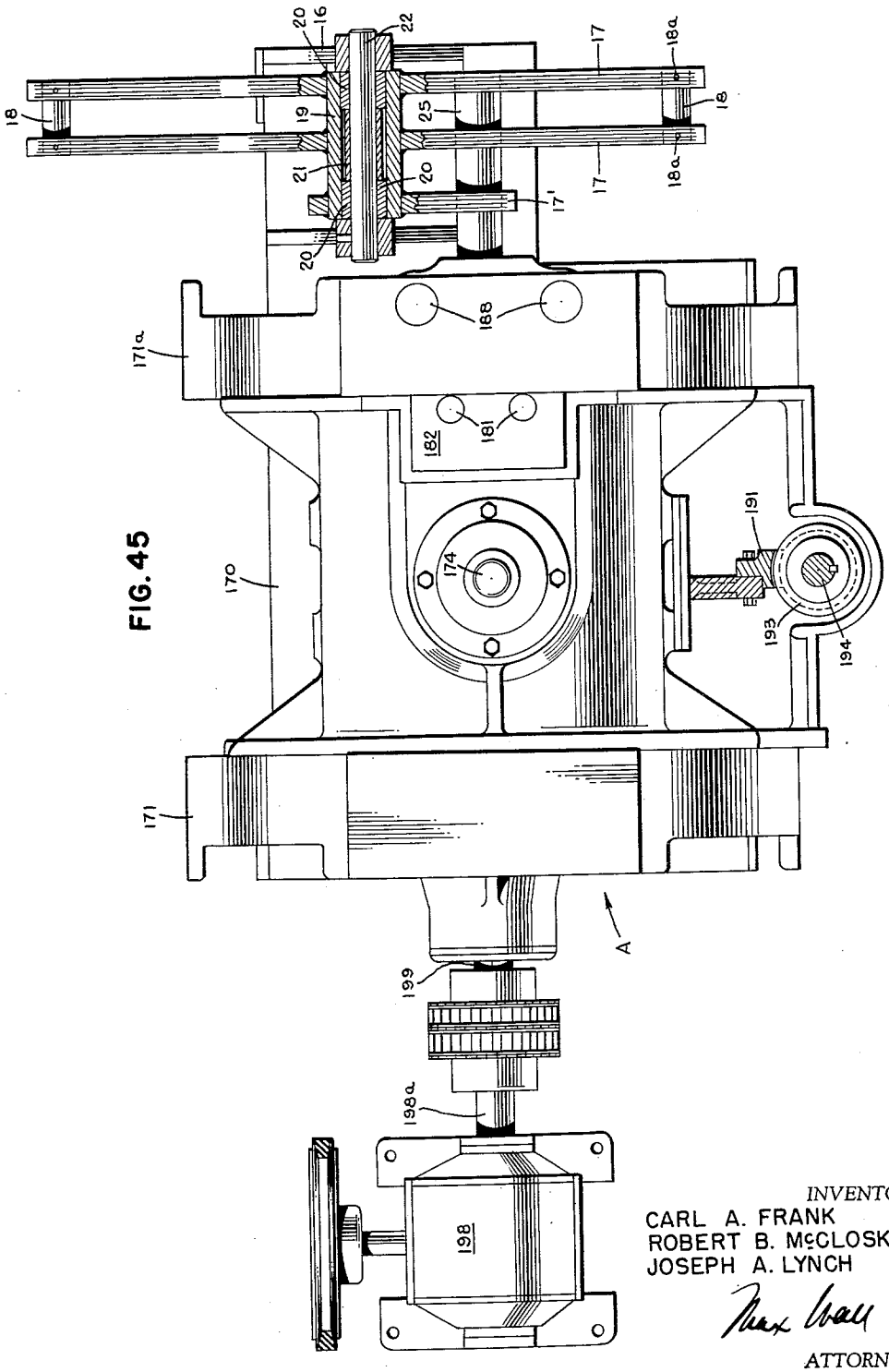



FIG. 45

INVENTORS
CARL A. FRANK
ROBERT B. McCLOSKY
JOSEPH A. LYNCH

ATTORNEY

Jan. 9, 1962 C. A. FRANK ETAL 3,015,922

PACKAGING MACHINES

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FIG. 48

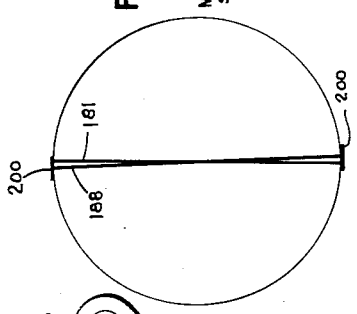



FIG. 49

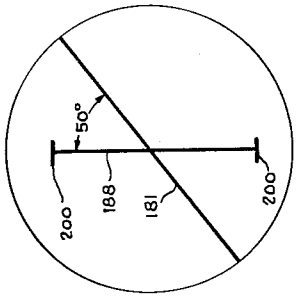



FIG. 50

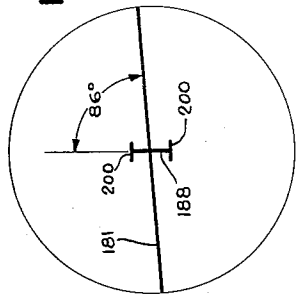
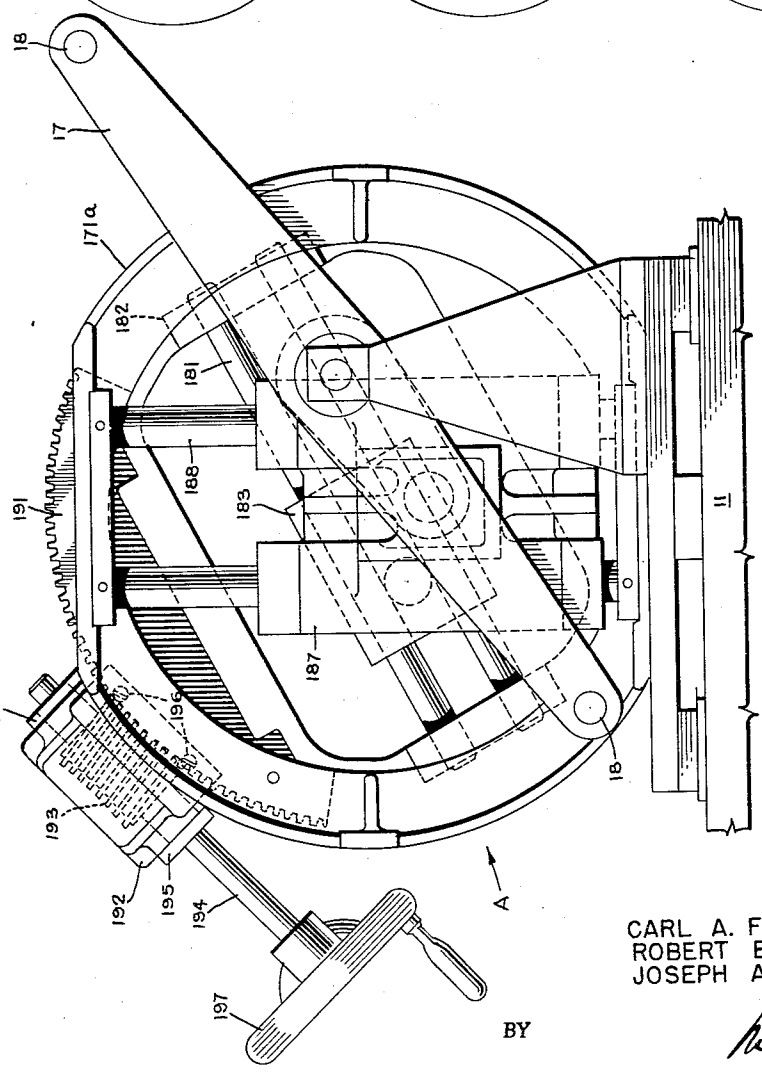



FIG. 46




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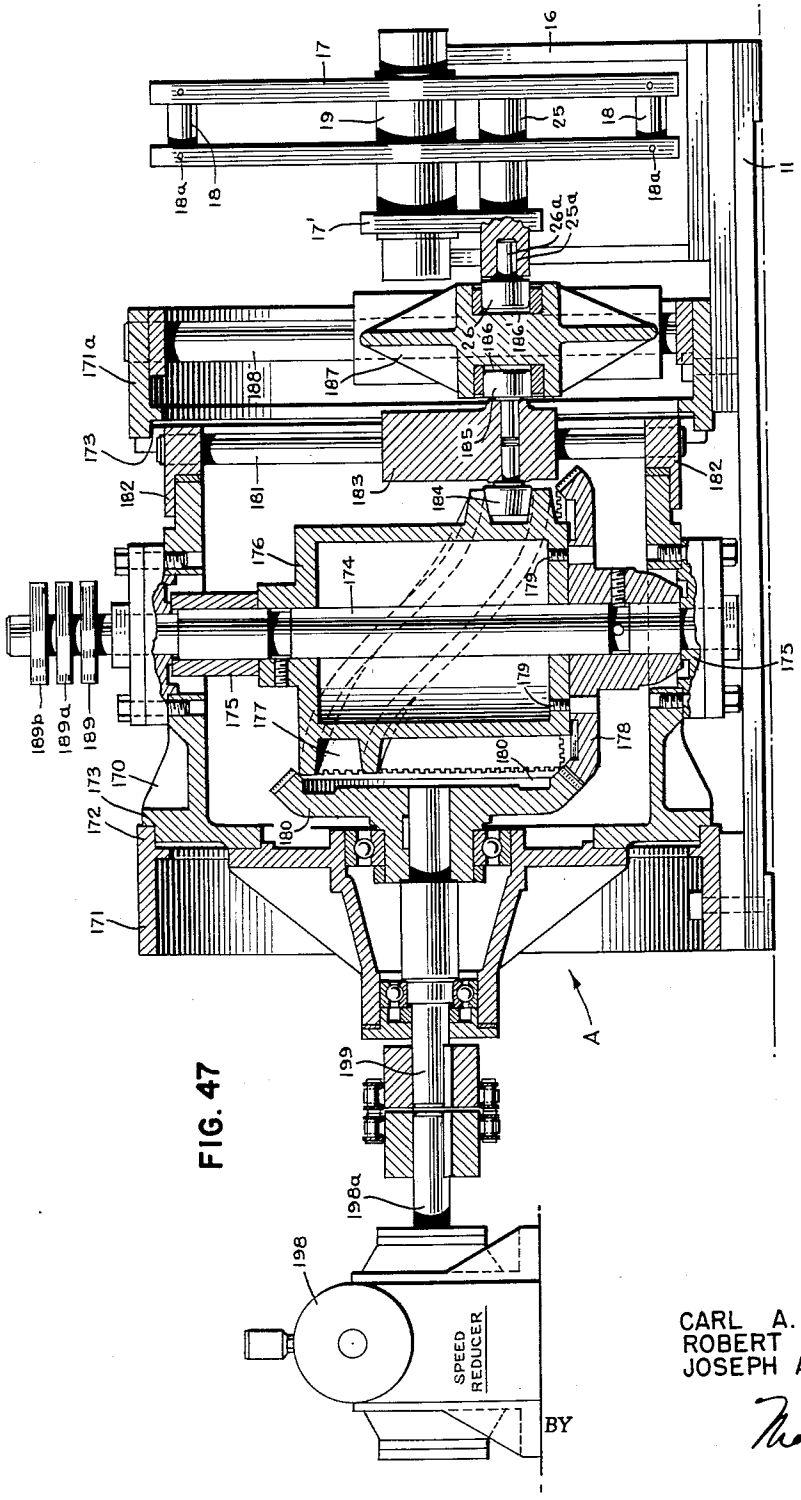



FIG. 47

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FIG. 52

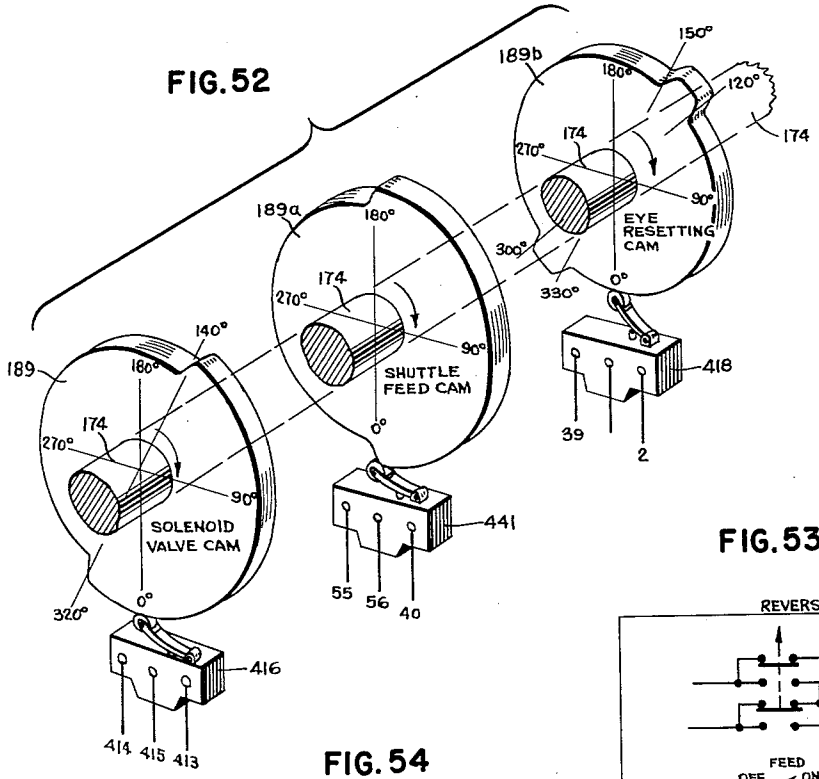



FIG. 53

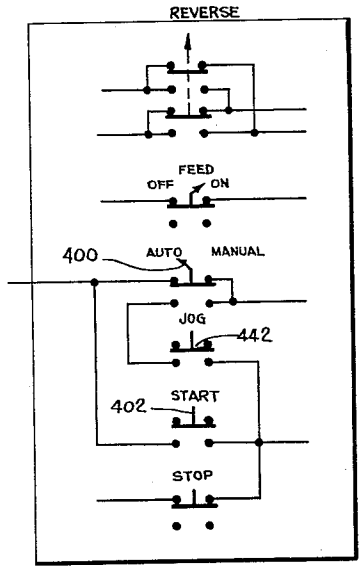
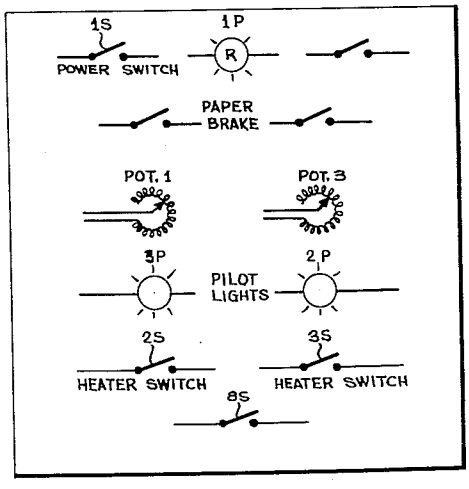



FIG. 54

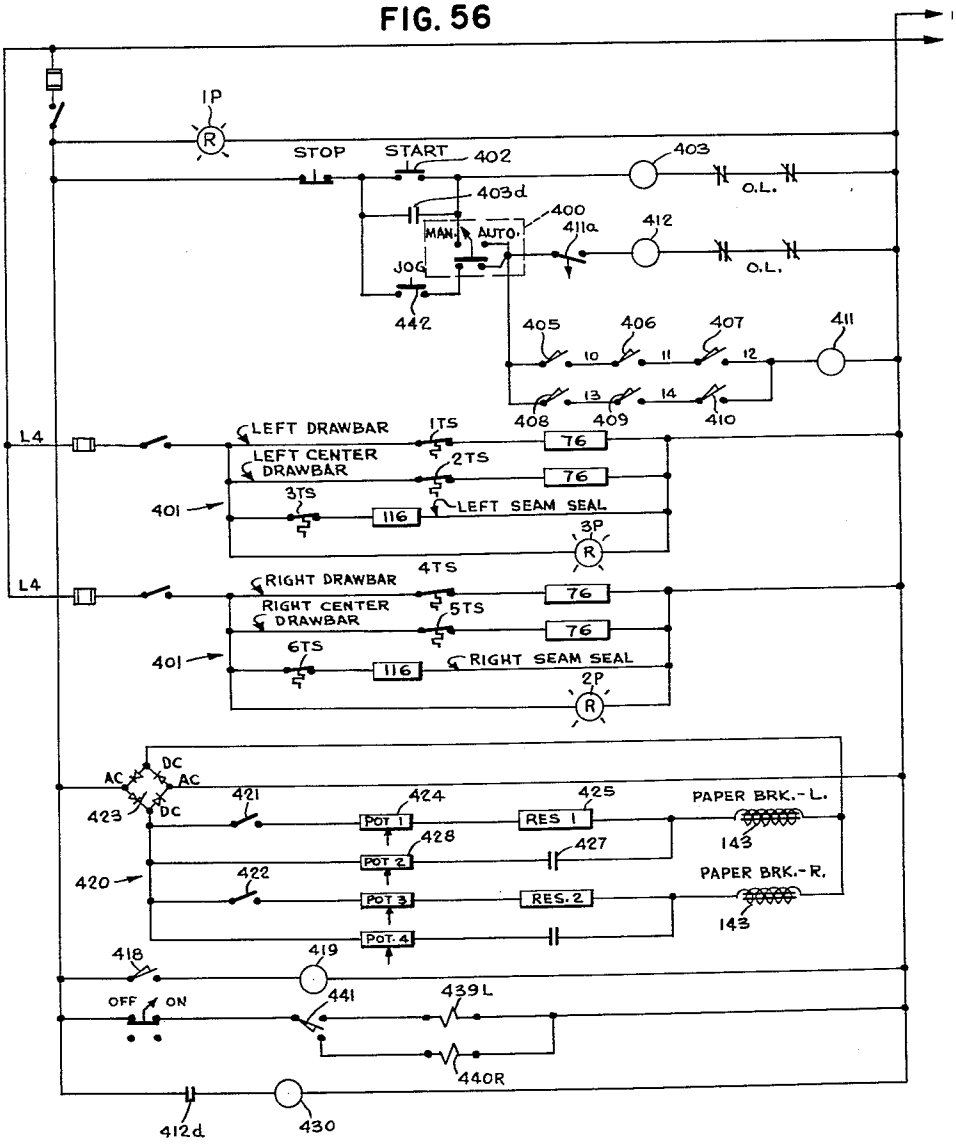



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FIG. 56




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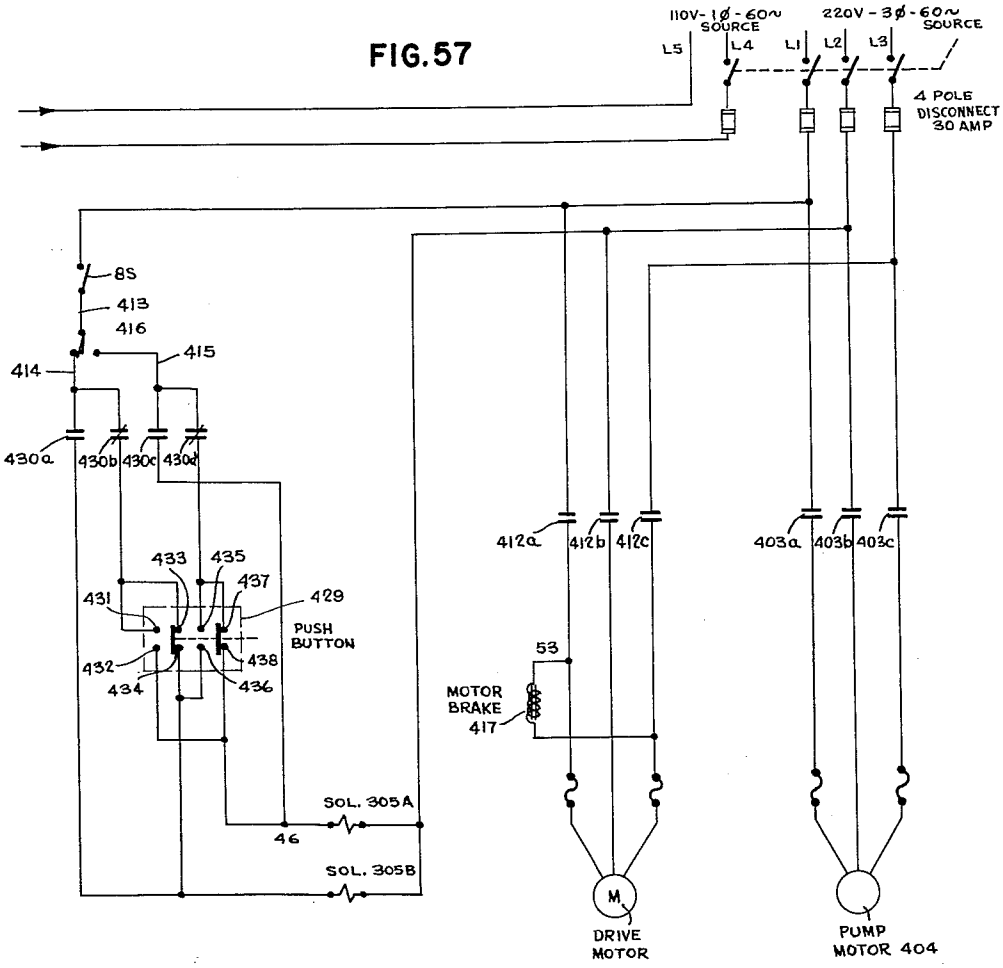
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FIG.57



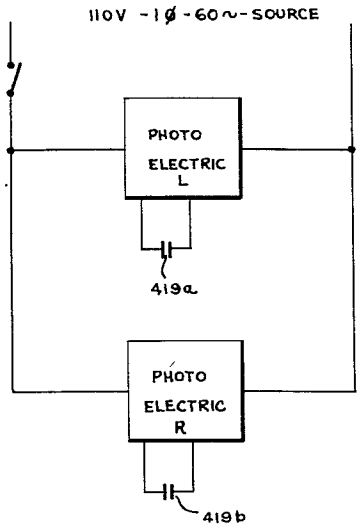




FIG.58

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FIG.59

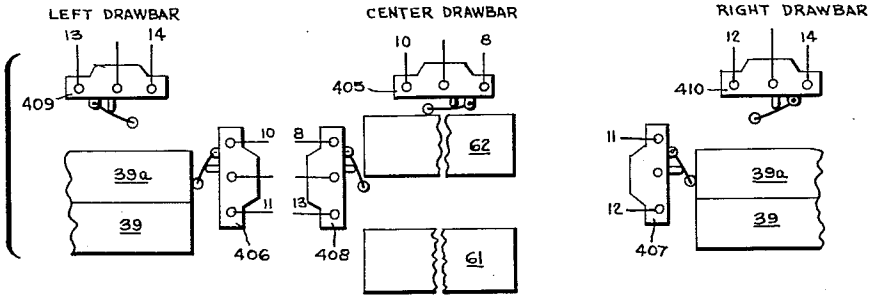



FIG.55

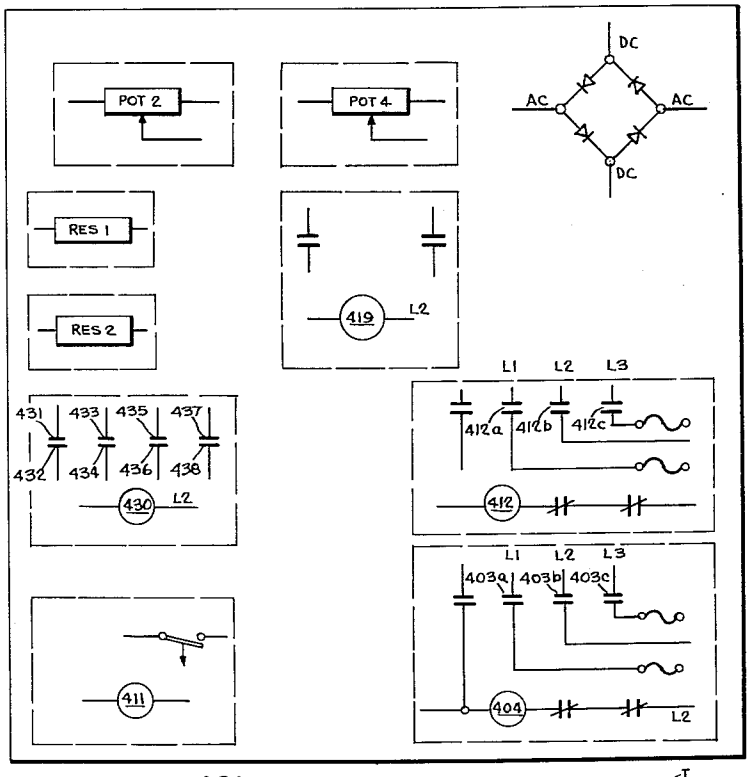



FIG.61

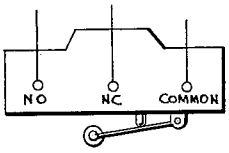
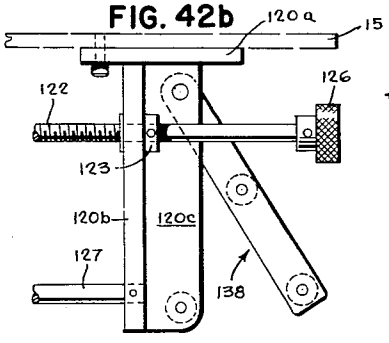



FIG. 42b



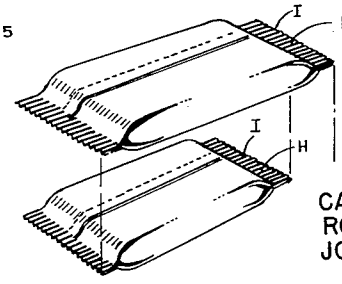



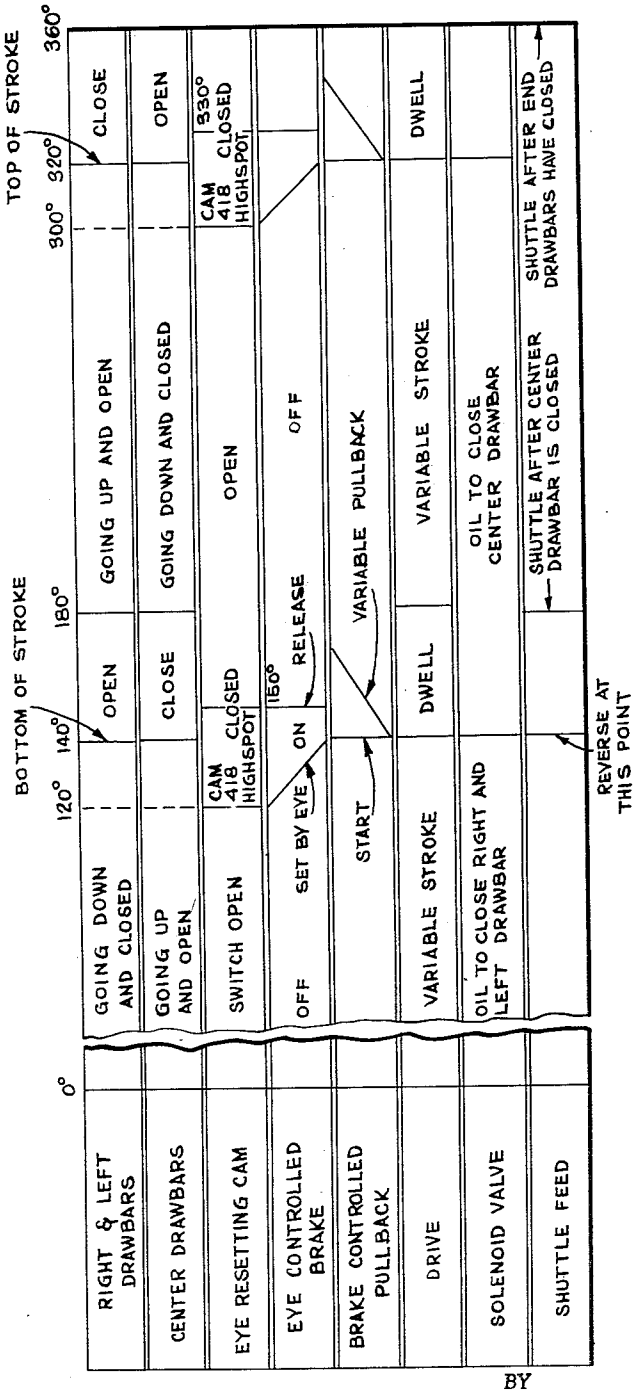

FIG.51

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FIG. 60




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United States Patent Office 3,015,922 Patented Jan. 9, 1962



3,015,922

# PACKAGING MACHINES

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Filed Feb. 27, 1956, Ser. No. 567,856
4 Claims. (Cl. 53—182)

This invention relates to a packaging machine and more particularly to the type of machine which makes a tube, fills it and seals it as a package, the material thereof being drawn from a roll carried by the machine in the form of a web or ribbon. The contents or product of the package may be fluent, such as a granular, kernel or pellet type of material. The machine first forms a tube from the web of material, seals the bottom of the tube, fills it with the product, seals the top, simultaneously sealing the bottom of the next succeeding tube, cuts the sealed tube from the web and discharges the sealed package from the machine. This machine may be called a quadruplex machine, as it forms four complete packages in each cycle of operation. Known machines of this type have heretofore simultaneously produced two complete packages in one cycle of operation, operating on webs of material drawn from two tube formers, but the present machine is an improvement over these prior machines in that an additional two packages, or a total of four are formed, in one cycle of operation, from the same two tube formers, in substantially the same amount of time.

This is accomplished by the use of one additional set of novel drawbars, making a total of three on the machine, these drawbars, as will be more fully outlined herein, holding four sets of sealing dies.

Another object of the invention is to provide a machine of the character described which is much quieter and smoother in operation than similar machines now in use. Novel means are provided to cushion the opening and closing of the jaws of the drawbars, which in known machines has been accompanied by considerable objectionable noise and vibration.

Another object of the invention is to provide a new type of die for closing and sealing the packages formed by the machine.

Another object is to provide a simple and easily operated mechanism for adjusting the stroke of the drawbars to make larger or smaller packages on the same machine, as desired.

A further object is to provide a novel mechanism for driving the drawbars.

A further object is to provide a novel means for removably supporting the tube former so that it may quickly and easily be installed or removed from the machine.

Another object is to provide a novel means for supporting and handling the seam sealing device.

Still a further object is to provide novel means for regulating the movement of the web of material through the machine so that said web is properly gripped for pulling and sealing, without damage to the contents of the package.

Other objects, novel combinations and features will appear as the machine is developed in the following specification.

Referring to the drawings,

FIGURE 1 is a front elevation of the machine.

FIGURE 2 is a side elevation thereof.

FIGURE 3 is a plan view thereof taken along the line 3—3 of FIGURE 1.

FIGURE 4 is a front elevation, with parts shown in section, of the hopper and shuttle feed mechanism which is adapted to be placed on the upper table of the machine as it is shown in FIGURE 1.



FIGURE 5 is a side elevation of the apparatus shown in FIGURE 4.

FIGURE 6 is a fragmentary plan view of the apparatus shown in FIGURE 5.

FIGURE 7 is a horizontal, longitudinal, sectional view through the left hand side drawbar, with parts shown in elevation, and showing a similar view of a portion of the arms of the center drawbar extending from FIGURE 8.

FIGURE 7*a* is a sectional detail taken along the line 7*a*—7*a* of FIGURE 7.

FIGURE 8 is a horizontal, sectional view taken through the central double drawbar, showing a portion of its arms extending to the right and to the left, towards FIGURES 7 and 9, respectively, showing also, in plan, a portion of the arms of the right drawbar, the arms of the respective drawbars overlapping each other.

FIGURE 8*a* is an enlarged detail of a portion of FIGURE 8.

FIGURE 9 is a plan view of the right drawbar showing the position of the controlling microswitches and their actuating cams, and also showing, in plan, a portion of the arms of the center drawbar extending from FIGURE 8.

FIGURE 10 is a plan view, with parts shown in section, of that portion of the arms of the right hand drawbar which hold the sealing and cutting dies, or knife, the latter being shown in operative position, this arrangement being typical of this construction for the other drawbars.

FIGURE 11 is a vertical, sectional view, with parts shown in elevation, taken along the line **11—11** of FIGURE 10, showing the dies in sealing position and the knife in cutting position.

FIGURE 12 is a similar view of a portion of FIGURE 11, with the knife shown in its retracted position and the die block in its stripping position.

FIGURE 13 is a fragmentary perspective view of the die face and a portion of the die block shown in FIGURES 11 and 12.

FIGURE 14 is a fragmentary perspective detail of one end of the rear of the die face.

FIGURE 15 is a top plan view of the die face.

FIGURE 16 is a cross section thereof along the line **16—16** of FIGURE 15.

FIGURE 17 is a plan view of the center, double drawbar.

FIGURE 18 is a front elevation thereof.

FIGURE 19 is a longitudinal, vertical, sectional view, taken along the line **19—19** of FIGURE 17.

FIGURE 20 is a similar view taken along the line **20—20** of FIGURE 17.

FIGURE 21 is a similar view taken along the line **21—21** of FIGURE 18.

FIGURE 22 is a similar view t.ken along the line **22—22** of FIGURE 17.

FIGURE 23 is a schematic diagram of the hydraulic system for opening and closing the drawbars.

FIGURE 24 is a schematic diagram of the means for controlling the solenoid valve of the hydraulic system.

FIGURE 25 is an enlarged detail of a portion of FIGURE 1, partly in section and partly in elevation, showing the carriage for the hydraulic cylinder for the right drawbar and showing the manner in which the hydraulic fluid circulates from the sump or tank through the drawbar cylinders.

FIGURE 26 is a side elevational detail of FIGURE 25.

FIGURE 27 is a bottom plan view, with parts in section, of the drawbar cylinder block and its mounting, taken along the line **27—27** of FIGURE 25.

FIGURE 28 is a side elevational detail of the piping for the hydraulic system of the left hand drawbar as shown in FIGURE 1, showing how the hydraulic fluid

is supplied to the drawbar carriage from the solenoid valve.

FIGURE 29 is a plan view of the detail of FIGURE 28.

FIGURE 30 is a front elevation of the tube forming mechanism.

FIGURE 31 is a side elevation thereof.

FIGURE 32 is a plan view thereof.

FIGURE 33 is a front elevation of the same sealing mechanism.

FIGURE 34 is a side elevation thereof.

FIGURE 35 is a bottom plan view, with parts in section, along the line 35—35 of FIGURE 33.

FIGURES 36 and 37 are diagrammatic views showing the electrical components for the seam sealing mechanism.

FIGURE 38 is a schematic diagram showing how the photo electric cell is coordinated with the other parts of the machine to control the registration point on the web of material so that the drawbars grip the formed tube in proper position for sealing it.

FIGURE 39 is a similar view of the electrical components for the drawbars.

FIGURE 40 is a perspective detail of a portion of the mechanism for supporting and adjusting the photo electric cell.

FIGURE 41 is a schematic view of the paper web feeding and supporting mechanism.

FIGURE 42 is a plan view taken along the line 42—42 of FIGURE 1, showing the paper web feeding and supporting mechanism.

FIGURE 42*a* is an enlarged detail in plan of a portion of FIGURE 42.

FIGURE 42*b* is a view taken along the line 42*b*—42*b* of FIGURE 42.

FIGURE 43 is a front elevation of the paper roll support and brakes therefor.

FIGURE 44 is a plan view thereof.

FIGURE 45 is a plan view of the drive mechanism for the machine.

FIGURE 46 is an end elevation thereof.

FIGURE 47 is a substantially central, vertical, sectional view thereof, with parts in elevation.

FIGURES 48, 49 50 are diagrams showing adjusted positions for the drive mechanism to obtain variations in the stroke of the drawbars.

FIGURE 51 is a perspective view showing a long and a short bag which may be made by means of the foregoing adjusted positions.

FIGURE 52 is a schematic view showing the cam shaft and cams of the drive mechanism in conjunction with the electrical components actuated by same.

FIGURE 53 is a schematic view of the push button station for the machine.

FIGURE 54 is a schematic diagram of the control box panel showing the switches and pilot lights for the machine.

FIGURE 55 is a schematic diagram of the panel box layout for the electrical components.

FIGURES 56 and 57 show the electrical control circuit for the machine.

FIGURE 58 shows the circuit for the photo electric cells.

FIGURE 59 is a schematic diagram of the arrangement of the sensing microswitches on the drawbars.

FIGURE 60 is a time sequence chart for the machine.

FIGURE 61 is an elevation of a microswitch of the kind used in the foregoing figure, with indicating legends.

The machine is built upon a base **10** supporting a plate **11** upon which a vertical frame **12** is erected, the base **10** forming an oil sump as well as a support for the machine structure. At the front of the machine, as shown in FIGURE 1, three pairs or rods rise vertically from the plate **11** upon which they are permanently installed in any suitable manner, as by floor flanges



shown in FIGURES 2, 3 and 29. These rods **13** are hardened and ground and are arranged in pairs, one pair at each end of the machine, and one pair substantially centrally disposed between the other two pairs, as seen in FIGURES 1 and 3. An intermediate table **14** is supported by the frame **12** at a convenient height and an upper table or platform **15** is permanently supported by the frame **12** at its upper extremity.

The rods **13** are supported substantially midway of their length by brackets **14'** which are suitably secured to the table **14**.

A pair of bearing brackets or supports **16** are mounted on the base plate **11**, one bearing bracket between the central and each end pair of rods **13**, the bearing brackets each, respectively, supporting a walking beam **17**, **17***a*, as shown in FIGURE 1. The beam **17** is of duplex construction and as shown more fully in FIGURE 45, comprises a double set of similar bars joined together at their ends by dowel pins **18** fixed thereto with a force fit at each end of the bars **17**, the pins being locked with respect to the bars by crosspins **18***a* passed through the pins and bars. The bars **17** are spaced from one another as shown, and are welded to a centrally disposed hub **19** within which bearings **20** are seated, the bearings being separated by a spacer sleeve **21**. This walking beam rocks on a shaft **22** which is carried by the bracket **16**. A short plate **17'**, spaced from the inner side of beam **17**, is likewise welded to the hub **19** and a rod **25**, having an end socket **25***a*, FIGURE 47, is welded to the beams and plate **17'** with its axis parallel to that of the shaft **22**. A roller bearing **26**, having a stub extension **26***a* firmly seated in said socket, is carried by the rod **25**, the roller bearing forming a connection with the drive unit which will hereinafter be explained. To each free end of each walking beam a connecting rod **17''**, **17'''**, FIGURE 1, is pivotally mounted, the other end of each connecting rod being pivotally joined to a tubular housing and slide member **23**, which constitutes a carriage for the drawbars. Each slide member **23**, see FIGURES 25, 26, is supported by four bearing brackets **24** which are bolted to the housing and on which the latter reciprocates in a vertical direction on a pair of the rods **13**, each bearing bracket being provided with suitable antifriction bearings for this purpose.

It will be noted that the bearing bracket for the walking beam and the walking beam **17**[a] on the right in FIGURE 3 are offset rearwardly with respect to the bracket and beam **17** on the left. The adjacent ends of the respective walking beams are both connected to the central drawbar slide carriage at **23***e*, with the beam **17***a* having its ends overlapping and positioned slightly above the beam **17** when these adjacent ends are in their raised position as shown in FIGURE 1, the respective connecting rod **17'''** for the beam **17***a* being shortened for this purpose. The connecting rods are adjustable for length with respect to the sleeved spherical ends to insure that the same size package will be made by each drawbar.

Each housing is substantially rectangular in cross section, FIGURE 27, is open at its bottom and closed at its top by an integral plate **23***a* having a pair of spaced openings **23***b* which are substantially centrally arranged in said plate to receive hydraulic piping.

*Drawbars*

One double and two single sets or pairs of drawbars are provided. The single drawbars are the two pairs and the central pair is positioned between these two, as shown in FIGURE 1, and diagrammatically in FIGURE 39. All the drawbars and their operating mechanisms are carried on the upper ends of the housings **23**, FIGURE 25.

As indicated, each pair of drawbars is mounted upon a reciprocating carriage comprising the slide housing **23** having the integral top plate **23***a*. The top plate extends outwardly beyond the front and rear walls of the housing

to provide bolting flanges 23d, FIGURES 21 and 27, and the side walls thereof adjacent the top and bottom are reinforced by integral bosses 23c, as best shown in FIGURES 25 and 27. The slide bearings 24 are secured to said bosses, top and bottom of the housing, at each side thereof and slide on the vertical guides 13. The rear wall of the housing is provided with a threaded socket 23e to receive a machine screw which connects the connecting rods 17'', 17''', FIGURE 1, of the walking beams 17, 17a, respectively, to said housing.

The holes 23b in the upper plate 23a are counterbored to receive bushings 25 to which inner oil supply and exhaust tubes 35, 35a are secured, as by silver soldering or welding. These tubes project a short distance above the plate 23a and they extend downwardly into a rectangular casing 27 which is bolted to the machine base at 28.

Seated on the upper end of this casing 27 is a manifold block 29, FIGURE 25. This block is provided with bores 29a adjacent its bottom, and with counterbores 29b extending from the bores 29a to the upper face of the block. A cap piece 30, 30a is provided for each block over the counterbore, each cap being secured to the block by screws 31.

O rings 32 are seated in annular grooves provided therefor in the block 29 to form an oil seal around the counterbore when the caps 30, 30a are applied. Similar grooves are provided for O rings in the bores 29a. The caps 30, 30a have bores 33 therein corresponding in diameter with that of the bores 29a in the manifold, and outer oil tubes 34, 34a are permanently secured in said bores. The outer tubes 34, 34a act as sleeves to receive the inner tubes 35, 35a which are telescopic therewith when the machine is in operation, the outer sleeves being provided with upper and lower sleeve bearings 36 appropriately secured thereto, these bearings providing an anti-friction surface between the two tubes when they move relative to one another. Fluid under pressure is pumped into these tubes through the manifold 307 and up into the drawbar cylinders, as will hereinafter be more fully explained, the fluid flowing to and from the stationary tubes to and from the sliding oil tubes 35, 35a through the series of ports 37 provided in the walls of the latter tubes. Anti-leak seals 38 are provided at the upper and lower ends of the sliding tubes 35, 35a. The circular ports 37 are so disposed on the sliding tubes that they never move above or below these upper and lower seals, respectively, to prevent accidental dissipation of the hydraulic fluid.

The lower anti-friction bushings 36 and seals 38 are fitted to the movable tubes with a loose fit or clearance to allow a slight amount of oil seepage from the system. Since the hydraulic system is a closed circuit, continuous operation of the machine tends to heat up the hydraulic fluid, with a resultant change in its viscosity. Since the drawbar piston cushion arrangement, hereinafter described, and other mechanisms of the machine are designed for operation with a fluid of a substantially fixed viscosity, any appreciable variation in the viscosity of the fluid in the system affects the efficient operation of the machine. As the system is always filled with fluid during operation, and the amount of fluid displaced (by the drawbar pistons) is relatively small, there is no actual continuous circulation of fluid through the system and the amount of oil discharged into the oil reservoir from the exhaust line 312, FIGURE 23, is not actually much more than that displaced by the pistons. Consequently, the oil in the system is not actually recirculated, and much of it remains fairly static in the system where, as indicated above, its viscosity changes with detrimental effects. By allowing a certain amount of leakage or seepage as described, the system is continuously replenished from the reservoir and serves to maintain the oil at its proper operating viscosity.

Each set of end drawbars comprises a pair of irregularly shaped angular arms 39, 39a, having jaws 39b, 39c, FIGURE 7, adapted to reciprocate with respect to each other. A plan view of an end drawbar is shown in FIGURE 9. A cylinder block 40, one for each set of drawbars, is fixed to the respective flanges 23d of each housing 23 by suitable means such as machine screws 41, FIGURE 21.

The cylinders for the end drawbars are indicated by the reference character 40 and the cylinder for the central, double drawbars is 40a. The construction is similar for all three, but the end cylinders are reversed for right and left hand arrangement. Similarly affixed to the cylinder block on each front and rear side of said housing 23 are a pair of channel shaped shaft hangers 42, FIGURE 22, having ears 42a bored to receive the horizontal guide rods 43.

These rods 43 support the drawbars 39, 39a which carry sleeve ball bearings 44, FIGURE 8, to reduce friction to a minimum and to produce a smooth, sliding movement. The bearings are locked in position by a snap ring 45, FIGURE 19 which in turn is held in position by a collar 46 in which a sealing ring 47 is fitted to wipe the rods free of dust and grit as the drawbars reciprocate. While the foregoing details are described in connection with the end, single drawbars, the description applies equally well to the central, double drawbars.

Each cylinder block 40, 40a is bored to provide a hydraulic cylinder which is closed by end caps 49, FIGURES 8, 20, 21, and each end of the cylinder carries a piston 50 supported on a piston rod 51. Each drawbar has a recess 52, which is a well formed in its body to receive the ends of the cylinder when the drawbars are in their closed position. Each piston rod 51 extends outwardly through this recess and through an opening 53 in the wall of the drawbar. The extremity 51a of the piston rod is threaded and a reinforcing flange 54 is threaded onto the end of this rod, the flange being fixed to the wall of the drawbar by machine screws 55. A lock nut 55a secures the piston rod to the flange 54. Thus, the reciprocating movement of the pistons carries the pairs of drawbars in the same movement. To insure their moving in absolute synchronization, a rack and gear mechanism is provided for each cylinder block. A gear 56 is mounted on the left side wall of the cylinder block and each drawbar supports a rack meshing with said gear. Referring to the double drawbars 61, 62, an upper rack 57, FIGURE 21, is carried by a part of the rear drawbar 61 and a lower, corresponding rack 58 is carried by the front drawbar 62. The upper rack is supported by an overhanging plate 59 which is fastened to a flange 61d of the rear part of the drawbar 61 which overhangs the cylinder block. The lower rack 58 is fixed to the bearing boss 60 of the opposite drawbar. On the left side of the machine, due to a reversal of parts, the upper rack is fixed to the front portion of the drawbar, and the lower rack to the rear portion thereof, the pinion lying between them on the right side of the cylinder block. The construction and principle of operation is essentially the same on each side of the machine and the end drawbars operate in unison. Thus, when the pairs of drawbars are opened and closed by hydraulic means, the rack and pinion arrangement by which they are tied together will insure their synchronization of movement.

The cylinders for the two end drawbars are of similar size, but the central cylinder for the double drawbars is larger and of greater capacity to handle the greater load to which it is subjected.

Each of the end, oppositely extending jaw portions 39b, 39c of the drawbars, respectively, are channel shaped in cross section, as shown in FIGURE 11, to receive and hold the cutting knife and sealing dies, which will be more fully described.

The foregoing description of drawbar jaw construction specifically applies to the single end drawbars, but the construction and assembly is similar for the central, dou-

ble drawbars **61**, **62**. In the latter case, however, the double drawbars **61**, **62** have a double set of right and left hand oppositely extending jaws **61***a*, **61***b* and **62***a*, **62***b*, respectively, to support the cutting knife and sealing dies.

*Cutting and sealing dies*

The sealing dies for sealing the tops and bottoms of the tube to form packages (see FIGURE 51) are carried by the drawbars and the dies are made in complementary pairs. The cutting knife is incorporated with the dies and is carried by one member of the pair, but the sealing and cutting is effected by the complementary action of both members of the pair. They are structurally similar for all the drawbars, but are made in left and right hand sets for the left and right hand sides of the drawbars.

As shown in FIGURES 10–14, sections are taken through a pair of drawbars for a right hand setup, FIGURE 9. These views show a backing block **63** of a heavy material such as steel, seated in the channelled jaw portion **39***c* of a drawbar **39***a* in which the channelled portion extends to the right. This block **63** has a shouldered bore **64** which receives a complementary shouldered pin **65**, the pin extending through the block and projecting outwardly on each side thereof. One end of the pin extends through the wall of the drawbar and it is fastened thereto by a screw **66** which extends into a threaded socket **65***a* of the pin. The other end of the pin carries a stripping die block **67**, this block being substantially co-extensive in length with that of the backing block. The stripping block has a slot **67***a* provided in its forward face and a hole **67***b* is bored in the back wall of the block at each end behind the slot, these holes coinciding substantially with the location of the bores **64**, to receive the ends of the respective pins **65**. A cutting knife **68** is supported in the block **67** by the pins **65** which are slotted at **65***b* to receive it. The ends of the knife and pin **65** are drilled transversely to receive a cross pin **69** which locks them together.

Adjacent each pin **65**, the backing block **63** is bored transversely at **70** to receive a stiff compression spring **71** which is of a length greater than the depth of the hole in which it is seated. One end of each of these springs is backed against the back wall of the channel shaped section of the drawbar **39***b*, and the other end projects forwardly of the face of the backing block **63**, as shown in FIGURE 10, to push against the adjacent face of the stripping die block **67**, displacing the latter block forwardly, so that the knife is withdrawn within the stripping block, as shown in FIGURE 12.

The forward face of the stripping die block **67** is formed as shown in FIGURE 13, wherein a longitudinal section thereof is taken below the knife. In this view, the forward face has the recess **67***a'* formed therein, which is coextensive with its length. A further longitudinal recess **67***c*, substantially centrally located and of shorter length than **67***a*, is countersunk into a wall of the recess **67***a'*. Holes **67***d* are bored in the vertical walls of the block **67** behind these recesses and concentric counterbores **67***d'* of greater diameter are provided from the opposite wall of the stripping block **67** to meet them.

The die member fitted to the face of the stripping block is formed into two strips **72**, one each positioned above and below the knife **68**. One of these strips is indicated at FIGURE 15 and comprises an elongated body **72**, preferably of a silicone rubber, but other suitable resilient, yieldable materials may be used. This strip is serrated as at **72***a* along its pressure die face and on its rear face **72***b* a pair of headed stud members **72***c* are formed, one at each end of the strip. A rib **72***d* is raised along a portion of the length of the strip on its rear face **72***b* and additional headed studs **72***c'* extend outwardly of the rib. In assembly, the headed studs **72***c* and **72***c'* of the die strip are forced through the respective holes **67***d*, FIGURE 13, until the heads of the studs pass into the counterbores **67***d'* where the heads of the studs expand and firmly secure the strip **72** in the recess **67***a'*, the rib **72***d* extending into the corresponding recess **67***c*.

The opposite and complementary die assembly includes a backing block **73** seated in the channel-shaped jaw portion **39***b* of the opposite and complementary drawbar and is locked therein by screws **74**, which pass through the block and engage in the threaded socket **75***a* of the die block **75**, thus securing this whole unit to the drawbar. Both these blocks are preferably of a good heat conductive material.

The block **73** on its face adjacent the block **75**, is provided with slots **73***a* to receive a hairpin electrical heating element **76**. On a plane behind these slots the block is further bored at **77** and **78**. The bore **77** is an enlarged bore provided to receive a thermostatic switch element **79** furnished to control the operation of the heating element as well as its temperature. A screw **80**, FIGURE 10, is provided for adjustment of the switch.

A concentric pilot bore **77***a*, FIGURE 10, of reduced diameter, leads away from the bore **77** to the end of the block. This bore is provided so that a tool may be inserted for the removal of the thermostat when necessary. The bore **78** is provided to receive the electrical conductors leading away from the thermostat, one of which is connected to the one terminal of the hairpin heater, and the other of which goes to the source of current. The other terminal of the heater is likewise connected to the source of current.

The front face of the die member **75** has a centrally located longitudinal slot **75***b* which is substantially coextensive in length with that of the knife **68** and receives it when the knife is in its extended and cutting position. The front face of this block **75** above and below this slot is serrated in a manner complementary to the serrations on the resilient strips **72**, which it engages when the drawbars are in their closed and gripping position.

*Tube formers*

At the upper portion of the machine and supported by the upper table **15**, a pair of tube forming devices extend downwardly towards the drawbars. These tube formers are each positioned between the outer and inner sets of slide rods **13**, as best shown in FIGURE 1.

A plate **81** is fixed to the upper table **15** so that it is positioned between the outer and inner sets of rods **13**, and this plate overhangs the table **15** as more clearly shown in FIGURE 32. The overhanging portion is formed with a semi-circular cut-out **81***a* at its forward end, forming a bifurcation **81***b*, **81***c*, the arm **81***c* of which is longer than the other. A tube forming assembly is positioned in the cut-out portion and is bolted at **82** to said plate. The tube forming assembly comprises an upper yoke member **83** having a centrally positioned, upwardly extending sleeve portion **84**. A tube **85** is seated in said sleeve and extends upwardly thereof and has a flange **85***a* at its upper end. The downwardly extending arms **83***b* of said yoke are tubular and each have a downwardly extending rod **86** press fitted into a socket in said arms. A cam locking lever **87** is pivoted to the outer side of each arm at **88**. This lever has a cam surface **87***a* along one side and has a cam slot **87***b* cut into its body about midway of its length, the cam surface **87***a* terminating just short of its intersection with the cam slot **87***b*.

A tube former **89** is seated in a yoke **90** having upwardly extending arms **90***a*, each arm being provided with a bore **90***b* to receive the pins **86**. Each arm of the yoke also carries a crosspiece **90***b'* which has a pin **91** extending laterally from the outer side thereof at is upper portion. The tube former **89** is bolted to these crosspieces at **93**. The yoke comprising the parts **90**, **90***a*, **90***b'* and the tube former **89**, is one unit and is applied to the machine by sliding it vertically over the open bottom end of the tube **85** until the pins **91** strike the cam surface **87***a* of the locking lever, the pins **86** sliding into the sockets **90***b* of the arms **90***a*. Continued upward movement of the

tube former causes the locking levers to swing on their respective pivots until the pins **91** reach the intersection with the cam slot **87***b*, whereupon the pins enter said slots in said levers and the levers fall of their own weight to their former substantially vertical position, and the plates **90***b'* butt against the lower ends of the sockets **83***b*, thus locking the pins **91** in the cam slot **87***b* and locking the tube former **89**, **92** and its supporting yoke to the upper yoke **83**. Obviously, by pulling the handles **94** of the levers towards the operator to swing them upwardly on their pivots **88**, the tube former may be released from the upper yoke and removed from the machine.

The sleeve **84** of the upper yoke has a boss **84***c* extending from one side and a screw threaded adjusting rod **95** is movable vertically in said boss. A nut **96** is provided to lock said screw in adjusted position with respect to said boss. A friction clamp **97** is loosely seated on a nut **98** on the upper end of said screw and is provided with a bore **97***a* slightly greater than the diameter of said tube **85**, said tube extending through said bore. Thus, said tube **85** may be raised with respect to said clamp **97** without difficulty, but a slight downward movement of the tube causes the clamp to drop slightly at an angle thereto and to grip the sidewall thereof with a friction grip, locking it and preventing further downward movement of the tube. The flange **85***a* at the upper end of the tube **85** has a plate **99** secured thereto, said plate having an opening **99***a* therein coextensive in diameter and concentric with the bore of said tube. This opening is arranged to coincide with the mouth of a feeding assembly positioned above it which will hereinafter be described.

*Seam sealing assembly*

A seam sealing assembly, FIGURES 33, 34, 35, is supported from the arm **81***c* to form a seal for the opposite side edges of the web of material in the tube forming process, as the material is fed over the tube former. This includes a supporting angular bracket **100** suitably secured to the underside of the arm **81***c*. This bracket extends forwardly and downwardly of the machine, and carries a horizontal pivot pin **101** at its upper end. A seam sealing member is pivotally attached to this pin by means of a clevis **102** pivoted on said rod, the clevis carrying a hollow conduit or arm **103** which supports a lower clevis or block **104**. This block is bored horizontally to receive a sleeve **105**, one end of which is threaded at **105***a* and extends laterally of the block, as shown in FIGURE 33. A seam sealer unit **106** is rotatably mounted on the threaded portion of the sleeve so that it may be locked in any adjusted position. The forward lower end of the bracket **100** carries a boss **100***a* which is bored horizontally to receive a pin **108** of a crosshead member **109**. This crosshead carries a pressure bar or rod **110** slidably supported therein, one end of this rod projecting through the crosshead and having a collar **111** fixed thereto by set screw **111***a*. The other end of the rod is screw threaded at **110***a* for a portion of its length and carries a crosshead **112** at the end of the screw, the latter crosshead being permanently fixed to said screw as by brazing or silver soldering. A rod **113**, screw threaded at each end, extends through said cross head at right angles to the pressure bar **110** and this rod passes through a sliding crosshead **114** mounted on the conduit **103**. A handle **115** is fixed to each end of said rod **113**, only one of which is shown. The seam sealer unit **106** comprises a pair of plates **106***a*, **106***b*, preferably brass, which are recessed at **106***c* and **106***d* to receive, respectively, a disk heating element **116** and a thermostatic control switch **117**, each having a pair of electrical terminals. The control switch **117**, FIGURE 34 is positioned between the plane sealing face **106***e* and the heating element **116** for effective control of the temperature at the sealing face.

The seam sealer **106** is swung into and out of operative position against the tube **85***c* of the tube former, FIGURE 31, by grasping the handles **115** and pulling the crosshead **114** downwardly on the conduit **103**. This causes the crosshead **114** to swing in an arc about the axis of the pin **108** as a pivot, with the seam sealer at the end of the conduit **103** swinging in an arc about the axis of the pin **101**.

The rod **110** with its associated compression spring **118** and knurled adjusting collar **119** which is threaded on said rod, form a pressure bar or link which maintains the seam sealer in pressure contact with the tube **85**. This pressure is effected by the spring **118** which, when compressed between the crosshead **109** and the collar **119**, exerts its force against the collar **119** and bar **110** which pushes against the sliding crosshead **114** and conduit **103** to press the seam sealer against the tube **85**.

*Web control device*

A photo electric cell is duplicated on each side of the machine, so a description of its arrangement and operation on one side will suffice. It functions, in connection with the compensating bar to be described later, to control the adjustment and feed of the web of packaging material to insure proper registry of the printed web with the sealing dies carried by the drawbars, so that the sealing action of the jaws and the movement thereof is synchronized with the movement of the web to take effect on that portion of the formed tube where it is intended to take effect, and not on the printed or other portions thereof.

Referring now to FIGURES 40–42, to the underside of the upper table **15**, at each of its four corners, a downwardly extending bracket **120**, FIGURE 40, is secured by machine screws **121**. Each bracket has a base plate **120***a* with an angle member having webs **120***b* and **120***c*, respectively. A transversely extending screw **122** is supported across the webs **120***b*. Where the screw is supported at the rear side of the machine, it has a bearing sleeve **123** sweated or otherwise permanently mounted thereon where it passes through the web **120***b* to form a bearing surface for the screw in said web. Where said screw **122** passes through the web **120***b* at the front side of the machine, it has a reduced neck **122***a* which forms a shoulder at **122***b* with the threaded portion **122** and a washer **124** is seated against said shoulder and bears against the web **120***b*. A collar **125** is pinned on said neck **122***a* on the other side of said web to lock the screw against longitudinal movement. A knurled knob **126** is pinned to each free end of each screw **122**.

Spaced from the screw **122**, but at a lower level, see FIGURE 40, a rod **127** is supported at each end in the oppositely disposed webs **120***b*. A carriage **128** for the photoelectric cell is movably supported on said screw and rod, said carriage comprising an h-frame having a crossbar **129** with downwardly extending legs **130**, **130***a* which are bored at **130***c* to receive the rod **127**, upon which these legs slide. The leg **130***a* is extended upwardly at **130***b* and is provided adjacent its end with a threaded bore **130***d* to accommodate the screw **122** upon which it is mounted. The bar **129** has a pair of spaced bosses or lugs **131** extending horizontally therefrom and a horizontally extending rod **132** is pinned in a socket formed in each lug. A plate **133** is provided with enlarged bosses **133***a* which are bored horizontally to receive the rods **132** upon which they slide. Set screws **133***b* are provided in said bosses to lock said plate in any adjusted position on said rods as determined by the conditions of operation. A light sensitive cell **134** is fixed to the lower end of the plate **133**, the upper end of which is forked to receive and adjustably support a light source **135** for said cell. The light source is mounted between the arms of the forked plate, each arm of which has a longitudinal slot **135***a* at each side edge and machine screws pass through said slots to support the light source. The light source is so mounted so as to project its light beam towards the sensitive cell **134**. By means of the

slots 135*a* the light source may be adjusted vertically as necessary with respect to the cell to comply with operating conditions. By turning the knobs 126, the screw 122 is rotated and this moves the carriage 128 forwardly or rearwardly of the machine as desired.

Paper rollers 136, 136', FIGURES 41, 42 are rotatably supported at one end by the webs 120*c* of the brackets 120 at the front and rear of the machine. An intermedate bracket 137, FIGURE 42, suitably supports the other end of said rollers. At the front of the machine, a pair of swingable frames 138 are pivotally supported at 139 from the brackets 120, 137. Each frame 138 comprises a pair of oppositely disposed arms 138*a* between which paper rollers 140, 140*a* are rotatably supported. These frames 138 are adjustable vertically to swing so that the roller 140*a* can be properly positioned in line with the rear edge of the folder 89, so as to properly feed paper at the correct angle to the folder. The frames 138 are locked in their adjusted position by means of lock nuts on the screws 139 which lock the frame sides 138*a* to the bracket portion 137*a*.

*Web material support*

A reel assembly comprising a web material supporting and feeding mechanism, including a brake and slack takeup, is supported on the intermedate table 14 at the rear thereof, as shown in FIGURE 2.

Referring now to FIGURES 2 and 43, the reel mechanism includes a pair of end bearing supports or brackets 141, and a centrally positioned bearing and brake support 142. The centrally disposed support 142 supports a pair of electric brakes diagrammatically shown at 143, each brake being seated on a hub 144 extending from each side of a faceplate 144*a*, the faceplate being, in turn, fixed to the support 142 by means of screws 145. The brake may be of any known make, such as is shown, for example, in Bulletin No. 6158, of Warner Electric Brake and Clutch Company, Beloit, Wisconsin. The hub 144 carries a pair of inner, frictionally seated ball bearings 146 and a pair of outer ball bearings 146*a*, the latter being secured by a retaining ring 147, seated in an appropriate groove in the internal bore of the hub. Each brake 143 carries an outwardly extending stub shaft 148, each shaft being supported in one end of the hub and seated in an appropriate pair of said ball bearings.

Each end bracket 141 may be a casting or stamping which is provided on its upper end with an open slot 149, FIGURE 41, extending generally upwardly and rearwardly of the machine, the slot being rounded at its lower end to form a bearing 141*a* for the shaft 150. Extending outwardly of each bracket and in a plane substantially parallel with the shaft 150, a pair of spaced studs 151 are provided, each of which carries a spacer sleeve 152. A latch 153 is pivoted on one of the studs at one end, and its other end has a slot 153*a* cut into it so that it may be slipped over the opposite stud. The sleeves 152 space said latch from the side wall of the bracket 141

The inner end of each shaft 150 is bored out at 150*a* and this end is longitudinally slotted at 150*b*. The bore 150*a* is slipped over the free end of the stub shaft 148, and this stub shaft is keyed to the shaft 150 by means of a pin 154 passing through the shaft 148 and engaging the walls of the slot 150*b*. The other end of each shaft is supported by the bearing surface 141*a* in each bracket 141.

A large knurled nut 155, having a reduced boss 155*a*, is threaded on the free end of the shaft 150. An annular groove 155*b*, FIGURE 43, is cut into this boss and the latch 153 has a cutout portion 153*a*, FIGURE 41, cut on a radius complementary to that of the reduced diameter of the boss 155*a* where the groove 155*b* is provided. The latch 153 lies in this groove when it is closed. The shaft 150 carries a pair of spaced cones 156, 157 upon which the roll W of web material is supported for delivery of the web to the machine drawbars. From the foregoing description it will be seen that rotation of the hand nut 155 will cause axial adjustment of the shaft 150, the nut 155 being fixed in position by the latch 153 which is immovably supported on the studs 151. This adjustment may be required to center or align the web with respect to the tube forming mechanism. When so adjusted, a lock nut 158 is screwed against the nut 155 to lock it in adjusted position. When it is desired to replace the reel, the latch 153 is swung on its pivot to lift it out of the slot 155*b* and the shaft may then be shifted endwise to remove it from its support in the stub shaft 148. It may then be raised vertically through the slot 149 in support 141 to remove it from the machine. The foregoing construction of the web material support is duplicated on the other side of the machine, except that one side is constructed and arranged for right hand operation and the other for left hand.

*Slack takeup mechanism*

A slack takeup mechanism is provided for each roll or web of packaging material, and these are supported by the lower portion of the brackets 141, 142, FIGURES 43, 44. Each mechanism comprises a swingable frame E having spaced arms 159, 160, the arm 159 being pivotally mounted on a pin or bolt 161 seated in the boss 141*c* of the bracket 141. A hardened washer 162 is interposed between the arm and boss. The opposite arm 160 is pivoted to a stub shaft 163 secured in a boss 142*a* in the bracket 142, the shaft 163 being in axial alignment with the bolt 161. This arm 160 is likewise spaced from its support by a hardened washer 162. The two arms extend forwardly of the shaft 150 as shown in FIGURE 44 and their free ends are rigidly joined by a transverse bar 164. The respective arms 159, 160 are also connected, intermediate their ends, by a roller bar 165 which is bored at each end at 165*a* to receive bronze bearings 166 each of which is seated on a pin 167 carried by each arm. Each frame E forms a compensating or slack takeup mechanism for the web of material as it is fed through the machine, as will be described herein, and the frame is normally urged downwardly towards the table 14 by means of a tension spring 168 appropriately secured at one end to the transverse bar 164, and at its other end to a tension adjusting mechanism 169, diagrammatically shown fixed to the table 14. The pull of spring 168 is great enough to resist the pull of he drawbars when the roll W moves freely, but when the brakes are applied and the roll W stops, the pull of the drawbars will overcome the tension of the spring to lift the frame E.

As shown in FIGURE 41, each web of packaging material is passed from the roll W downwardly under the roller bar 165 on the slack takeup frame, and thence upwardly past the photo electric cell under the roller 136' and up over the roller 140, down under the roller 140*a* to the tube formers heretofore described, where the web is formed into a tube, and then the web passes to the drawbar mechanism, where the tube is gripped, sealed at the bottom, filled with a product, sealed at the top, cut off and passed from the machine. See also FIGURE 38.

It should be pointed out here, by way of explanation, that with the cutting knife 68 positioned centrally within the sealing dies, it cuts the sealed portion of the tube midway of its length, so that the upper half of the sealed portion constitutes the sealed bottom of an upper portion of the tube, while the lower half of said sealed portion constitutes the sealed top of a lower portion of the tube, the lower portion having now been completed as a package.

The roll of packaging material W is provided with spaced registration points P along its length, which are passed between the light source 135 and the sensitive cell 134 which are suitably mounted on the machine in the path of the web of material as it moves to the tube forming mechanism, as shown in FIGURES 40, 41. These registration points P establish the spaced positions at

which the drawbars grip and seal the tube which is formed from the web of material, and the photo electric cell is so adjusted with respect to the passing web W as it moves through the machine, as to insure that the drawbars grip the web at the proper registration point to seal the package above and below the product space therein. The product space is the space between the registration points P, less the space required for sealing the package.

The adjustment is accomplished by connecting the eye electrically with the paper roll brake **143**. When the eye, or photo electric cell, picks up a registration point on the moving web, it energizes a relay which operates to set the corresponding brake **143**, locking the shaft **150**, thus momentarily stopping the feed from the roll W, even though the drawbar continues to pull the formed tube a short distance, moving the point P beyond the eye. Under the pull of the drawbar mechanism, the slack takeup frame E will rise against the tension of the spring **168**, pivoting on pins **161**, **163** to pay out slightly more web material, as diagrammatically indicated in FIGURE 38. When the drawbar reaches the lower end of its stroke and opens its jaws, the spring **168** snaps the frame E down to its starting position, thereby pulling the point P back under the eye and causing the release of the brake. An adjustable stop member S is provided for each frame E to regulate the stopping or rest position of said frame.

The electrical components and circuits for accomplishing the foregoing objects are described elsewhere herein.

*Drive mechanism*

The drive unit for the machine is mounted upon the base plate **11** and comprises a mechanism generally indicated at A, having a rotatable housing **170** which is supported on a frame comprised of substantially circular flanges **171**, **171***a*, which in turn are suitably bolted to the baseplate **11**. Each flange has an inwardly extending rim **172**, **172***a*, respectively, and each end wall of the housing **170** has a complementarily formed recess **173** to receive said rim, the contacting faces of the rim and recess being machined to a close, but sliding fit.

A cam shaft **174** extends centrally through said housing and is supported in spaced bearings **175** suitably secured to the housing. A cam assembly **176** having a helical cam slot **177** is fixed to this shaft, and it carries a bevel gear **178** secured to its lower end by machine screws or rivets **179**. At right angles to this gear, and suitably mounted in bearings in the side wall of the housing, is a bevel drive gear **180** which meshes with the gear **178**. On the opposite side of the housing a pair of spaced, vertically extending guide rods **181** are set in mounting blocks **182** which are fixed to the frame of the housing **170**. A reciprocating slide **183** is mounted upon these guides. This slide carries a roller **184** which extends into the housing **170** and is seated in the slot **177** of the helical cam, the peripheral surface of the roller being tapered to conform to the configuration of the cam slot. Similarly supported, and extending from the opposite side of the slide **183** is another roller **185** which projects beyond the housing **170** and extends into a sleeved socket **186** of a reciprocating slide **187**, supported on spaced guide rods **188** which are immovably secured to the flange **171***a*. The opposite face of the slide **187** has a similar sleeved socket **186'** which received the roller **26** carried in the socket **25***a* of the rod **25**, forming the connection with the walking beam **17** heretofore described.

One end of the cam shaft **174** extends outwardly of the housing **170** and carries three cam members, **189**, **189***a* and **189***b*, which operate microswitches suitably secured to said housing. The microswitch **418**, operated by cam **189***b*, controls the operation and timing of the photo electric cell. The microswitch **416**, operated by the cam **189**, controls the operation of the solenoid valve **305** for supplying hydraulic fluid to the drawbar cylinders **40**, and he microswitch **441** controls the operation of the shuttle feed mechanism for supplying the product to the formed tubes, these cams and associated switches being shown schematically in FIGURE 52.

Supported exteriorly of the housing **170** and positioned substantially centrally thereon, is a gear segment **191** which extends partially around said housing. A cap member **192** is secured over said housing and gear and supports worm gear **193** which meshes with said gear segment, the worm being fixed to a shaft **194**, journalled in spaced bearings **195** fixed in the cap **192**. The cap member **192** is secured to the flanges **171**, **171***a* by screws **196** or other suitable means. With the cap and worm supported by the spaced flanges which are fixed to the machine base, it will be apparent that rotation of the worm by means of hand wheel **197** will cause the gear segment to rotate, thereby causing rotation of the housing **170** with respect to its side supporting flanges **171**, **171***a*, the walls defining the recesses **173** of the housing sliding against the rims **172**, **172***a*, respectively.

The cam **176** and camshaft **174** of this drive unit are driven by a motor M, FIGURES 1 and 2, through a speed reducer **198**, the drive shaft **198***a* of the reducer being coupled, by means of a chain or other suitable coupling means, to a coupling member keyed to a shaft **199**, which is keyed to the hub of bevelled drive gear **180**, within the housing **170**. Rotation of the drive gear **180** is transmitted to the meshing gear **178**, which causes rotation of the helical cam **176** and the cam shaft **174**, thus periodically operating the microswitches **416**, **418** and **441**. The helical cam **176** transmits its motion to the tapered roller **184**, causing reciprocation of the slide **183** on the guide bars **181**. This, in turn, through the roller **185**, transmits reciprocating motion to the slide **187** and thereupon to the plate **17'** to operate the walking beams **17**, **17***a*. The two beams are tied together operatively, by means of their connecting rods **17''**, **17'''** which are both secured to the reciprocating carriage for the double drawbar, at **23***e*, FIGURE 1.

The vertical bars **188** always remain stationary and vertical, but the guide bars **181** rotate with the housing **170** when its position is adjusted by the operation of the hand wheel **197**. By means of this adjustment, the stroke of the drawbars can be adjusted to any length required by the size of the package being made. This stroke is infinitely variable within the range of the mechanism, and the adjustment of the stroke is effected by varying the relationship between the slide **183** with its supporting bars, and the slide **187**, with its supporting bars, as will be evident by reference to FIGURES 48–50, wherein the position of the slide carrying bars **181** and **188**, respectively, is depicted in varying relationships. In FIGURE 48, where the bars approach a parallel position, the maximum lengh of stroke is obtained. In FIGURE 49, the bars **181** have been shifted approximately 50°, and in FIGURE 50, the bars **181** have been shifted approximately 86° with respect to the position of the bars **188**.

The effect of these adjustments is seen in the short horizontal lines **200**, the disance between which defines the mean length of stroke of the slide connecting the drive unit with the walking beam **17**, and correspondingly defines the length of stroke of the walking beams **17**, **17***a* and the drawbars to which they are connected, for the particular adjusments shown. Thus, when the bars **181**, **188** are substantially parallel, a maximum stroke is obtained, and when they approach a position at right angles to one another, substantially no stroke is obtained. Therefore, by turning the hand wheel **197**, the length of stroke of the drawbars may be adjusted to make a long or a short package, as shown in FIGURE 51, which packages are merely illustrative of the order of the sizes which may be made.

*Shuttle feeding device*

Referring now to FIGURES 1, 4, 5 and 6, a pair of spaced brackets **201**, **202** are erected on the upper platform **15**. These brackets are suitably secured to the top

15 by machine screws 203. At their upper extremities, these brackets support a horizontal bar 204 which extends a distance outwardly beyond each bracket. Below this bar, and at its left end, a short bar 205 is supported in the bracket 201, the axis of the two bars lying in substantially the same vertical plane. Both bars are pinned to their supports. A sliding frame 206 is mounted to reciprocate on the bars 204, 205 at one end of the machine, and a short slide bearing 207 is mounted on the bar 204 at the other end of the machine. A plate 208 is permanently affixed to the upper surface of the bracket 206 and to the slide bearing 207. An hydraulic cylinder 209 is fixed to one side of the bracket 201, with its piston rod 209*a* projecting through an opening provided therefor in the wall of the bracket 201, the rod 209*a* being permanently secured to the sliding frame 206. It will be apparent from the construction that when the cylinder 209 is operated by the hydraulic system, to be outlined elsewhere herein, the unit comprising the frame 206, bearing slide 207 and plate 208 will be reciprocated axially on the bars 204, 205, the purpose of which will hereinafter appear.

At the rear of the supporting brackets 201, 202, a further bar 210, FIGURE 5 is permanently affixed thereto. A hopper 211 has its front and rear walls 211*a* and 211*b*, respectively, extended downwardly at their meeting edges to form a flange 211*c*. By means of this flange, the hopper is secured to the bar 210 by machine screws passing through the respective parts. A post 212 at each end of the machine, rising from the table 15, supports the hopper at its rear. At each end of the hopper, a vertically extending angular bracket 213 is secured to the bar 100, these brackets having a horizontal arm 213*a* extending forwardly of the machine and supporting a cross bar 214.

An angular plate 215 is permanently mounted over the plate 208, the plate 215 having an upwardly extending apron 215*a*. Both plates 208 and 215 are bored at spaced points 216, 216*a* to receive bushings 217, 217*a* which project downwardly therefrom towards the plate 99 and slide bushings 218, 218*a* are provided between the respective bushings 217, 217*a* and said plate 99, thus providing for feed communication from the hopper 211 to the plate 215 and thence through the respective bushings 217, 218 and 217*a*, 218*a* to the feeding tube 85, FIGURE 4, in a manner as will be explained.

The machine has two feed tubes 85 but the plates 208 and 215 (which slide as one unit when cylinder 209 is operated) are provided with four openings 216, 216*a*.

The hopper is provided with three spaced, guiding baffles 219, the two end baffles being of greater height than the intermediate one. Sliding trap doors 220, 220*a* are provided in the wall 211*a* of the hopper and a friction lock 221 is provided for locking each door in open position. The baffles 219 will guide the contents of the hopper to the open trap doors 220, through which said contents may flow onto the plate 215. Wiping brushes 222 are adjustably suspended from the cross bar 214 in front of and to one side of the trap doors in such a manner as to brush lightly over the surface of the plate 215 as it shuttles back and forth when the machine is in operation, the brushes being mounted in pairs to bracket the openings of the trap doors and thus limit the amount of material discharged from the hopper between the brushes to the plate 215. Each alternate trap door is arranged to coincide with either the openings 216 or 216*a* of the plate 215 as it shuttles back and forth for the length of its stroke. In the position shown in FIGURE 4, with the trap doors open, material will be discharged from the door 220*a* onto the plate 215 and into the bushings, filling the respective bushings 217*a*, 218*a*, which at this time are closed at the bottom by the plates 99. Material is also simultaneously discharged from the door 220 to the plate 215 in the space between the brushes. The frame 206, plates 208 and 215 carried thereby are reciprocated from left to right as a unit when the cylinder 209 is actuated.

When the cylinder 209 is actuated, the table 208, 215 will be moved to the right, whereupon the bushings 217*a*, 218*a* will slide to the right on the table 99 and displace bushings 217, 218 to the right, positioning bushings 217*a*, 218*a* over the tube 85 and discharging their contents into said tube, whence it flows into the formed tube previously discussed.

Simultaneously, the bushings 217 and 218 will move past the adjacent brushes at the left of the trap door 220 and will become positioned in front of said trap door, whereupon these bushings will become filled with the product accumulated on the table between the sets of brushes. As the table 215 makes its return stroke, the bushings 217, 218 are moved to the left, again passing under the adjacent brushes 222, which wipe surplus material from the openings, displacing bushings 217*a*, 218*a* and discharging the contents of 217, 218 into the tube 85.

The diameter of the bushings 217, 218, and 217*a*, 218*a*, and their length, as measured from the top of plate 215 to the top of plate 99, determines the amount of the product to be discharged into the tube 85. The volume may be varied by increasing or decreasing the length and diameter of the bushings, and by raising or lowering the height of the table 99, which may be accomplished by raising or lowering the feed tubes 85 in the friction clamp 97. As the number of delivery tubes may be one or more (two are shown) and the feeding and shuttling mechanism therefor are the same, a description of the construction and operation of the one, as above, will suffice for an understanding thereof.

*The hydraulic system*

The cylinders 40, 40*a* and the respective drawbars connected to them as previously described, are operated by hydraulic pressure, and the hydraulic circuit is shown diagrammatically in FIGURE 23. In this figure, the base 10 includes the fluid reservoir from which fluid is drawn through line 301 by continuously operating, variable pressure, variable volume pump 300, and the fluid is pumped through line 302, past a check valve into accumulator 303 until a desired pressure in said accumulator and line is attained. Simultaneously, the fluid under pressure flows through branch line 304 to one side of an electrically energized four way solenoid 305, having a valve 305A and a valve 305B at opposite ends thereof.

With the system filled with fluid and the end, single drawbars assumed in their upper position, with the jaws opened, the center double drawbar will be in its lower position and closed. In this position, the timing cam 189 (at 320° position as noted in FIGURE 60), on the shaft 174 of the drive unit, operates the microswitch 416 which is electrically connected to and energizes the right hand coil in solenoid 305 to operate the valve 305A to channel the fluid under pressure from pump 300, accumulator 303 and the line 304 through the valve 305A into the line 306, manifold 307, branch lines 35, 35′ and 35*a*$^2$ into the cylinder ports 202″ of end cylinders 40, and into 202*a*′ of cylinder 40*a* of the central, double drawbar. The fluid under pressure will flow into the end cylinders through port 202″, along passage 315, radial ports 316 and opening 317 around the piston rod 51 into the cylinder, pushing the pistons 50 towards each other, thus closing the end drawbar jaws into the position in which they are shown in FIGURES 7, 8 and 9.

While these pistons 50 are moving towards each other and closing the drawbar jaws, the hydraulic fluid in the cylinders between the pistons is forced out of the cylinders through ports 202′, 202*a*″, 202′, through lines 35*a*, 35*a*′, 35*a*$^2$, respectively, manifold 310, line 311 and solenoid valve 305, whence it exhausts through valve B into the tank.

While oil under pressure is fed to the end drawbars, it is simultaneously fed to the double drawbar which is then at its lowest position, jaws closed, while the end drawbars

are at their upper, open position. The incoming fluid flows from manifold **307** to branch **308***a*, into port **202***a'* between the pistons, forcing them and the drawbar jaws apart. As this takes place, the oil behind these pistons is forced out through restricted passage **317***a*, FIGURE 8*a*, radial port **316***a*, and passage **315***a* through cylinder port **202***a''* into branch line **35***a'*, manifold **310**, line **311**, through solenoid valve **305** whence it is channeled into the exhaust line **312**, and into the tank.

The effect of this cycle of action is seen in FIGURES 7, 8 and 9 and is attained at 360° or 0° position as indicated in FIGURE 60. Rotation of the main cam shaft **174** and cam **189**, 140° further, together with the mechanical drive for the drawbars, moves the end, closed drawbars down, and the center, open, drawbars up. At this point 180° of cam rotation has taken place and one half of the cycle of operation has been accomplished.

The continued rotation of the timing cam **189** again actuates the microswitch **416**, which in turn energizes the left hand coil of solenoid **305**, operating valve **305B**, effecting a reversal of the direction of fluid flow in the lines **306** and **311**, causing the single, end drawbars to open and the center drawbars to close (at 180°). The outer or end drawbars move up and close and the center drawbars move down and open at 360° on the timing chart. This completes the hydraulic cycle and one complete cycle of the operation of the drawbars.

During this period, at every upward and downward movement of the drawbars, the pump **300** builds up pressure in the accumulator and in pressure lines **302, 304**. A check valve **314** is provided in line **302** to prevent blow back and loss of pressure from the accumulator if the machine is stopped momentarily for any reason.

It is desirable to open the drawbars quickly, yet smoothly, and without jarring or shock. The hydraulic system is operated at a pressure range of about 220–250 lbs. p.s.i. This pressure is applied to the opposing pistons in forcing them apart. Therefore, some means is provided to cushion the retractile movement of the pistons. This is accomplished by providing the restricted passages **317, 317***a* behind the pistons for the exhaust of fluid from the cylinder, as shown in FIGURE 8*a*. The rear portions of each of the pistons **50** are cupped as at **50***a* to seat over and close the cupped annular collar **50***b* to close the restricted ports **317, 317***a* and shut off the flow of fluid when the pistons reach their extreme retractile positions.

In operation, therefore, the pressure of fluid from the respective supply ports forces the pistons to the rear of the cylinders quickly and smoothly, and eliminates the shock which would otherwise be present when the piston contacted the rear wall of the cylinder. The drawbars are thus cushioned on opening. The use of the resilient die on one of the meeting die blocks cushions the closing of the drawbar jaws, and consequently eliminates the shock and noise of that phase of the operating cycle. The combination of these features results in greatly reducing the noise, shock and vibration inherent in machines of this type.

*Electrical system*

The electrical system for the machine is designed for manual or automatic operation. It is set for manual operation to make all necessary preparations and adjustments before it is turned to automatic operation.

Assuming that the machine has been adjusted in all respects and wrapping material such as paper or cellophane, for example, has been threaded under the compensating bar **165**, past the photo electric cell and through the folders to the drawbars, the automatic-manual switch **400**, FIG. 56 is set for automatic operation. Power switch **1S**, FIGURES 54, 56, is then closed, turning on the control circuit and pilot light **1P** is lighted as an indication that the circuit is closed. Switch **8S** for the hydraulic circuit is then closed to energize the circuit for the solenoid valve. Switches **2S** and **3S** are then closed, energizing the heater circuits **401** for the seam sealers and drawbar heaters **76** and sufficient time is allowed for these elements to heat up to the proper working temperature. The energizing of the heater circuits lights up the pilot lights **2P** and **3P** on the principal control panel, FIGURE 54 found at the side of the machine. Thermal switches **1TS** through **6TS** are found in the same circuits with the heaters **76** for the drawbars and **116** for the seam sealers, FIGURES 36, 37, 56, and these switches are set to open their respective heater circuits when a predetermined temperature is reached. They close the circuit again when the temperature goes below the predetermined degree.

The "start" button **402**, FIGURES 53, 56, is now depressed, closing the circuit to and energizing magnetic starter coil **403**, closing contacts **403***a*, **403***b*, **403***c*, FIGURE 57, which in turn starts the hydraulic pump motor **404**, the circuit being held closed by an auxiliary contact **403***d*, FIGURE 56. After the pump has built up pressure in the hyddraulic system, the respective drawbars open and close according to their positions in the cycle of operation. With the drawbars assuming positions just after 0° on the time chart, FIGURE 60, limit switches **405, 406, 407** are closed and time delay relay **411** is then energized and contact **411***a* of this relay is closed, energizing relay coil **412** which in turn closes contacts **412***a*, **412***b* and **412***c*, FIGURE 54. This starts the mechanical drive motor M.

At this time, the cam **189** is in position as shown in FIGURE 52, actuating microswitch **416**, connecting wires **413** and **414**, which operates the coil **305B** of solenoid **305**, FIGURE 24. This holds the center drawbars open and the outer drawbars closed. When the cam **189** reaches the 140° position, microswitch **416** disconnects wires **413, 414** and connects **413, 415**, thereby deenergizing solenoid coil **305B** and energizing coil **305A**, permitting oil to flow to close the center drawbars and open the end drawbars.

During this transition, all the limit switches **405** through **410** are open and time delay relay coil **411** becomes deenergized. However, contacts **411***a* remain closed due to the time delay feature during this normal transition period, keeping relay coil **412** energized, contacts **412***a*, **412***b* and **412***c* are closed and maintaining current to drive motor M. Should the drawbars fail to close in the normal time interval (due to some abnormal interference or obstruction) the time delay relay contact **411***a* will then open, deenergizing coil relay **412**, opening contacts **412***a*, **412***b*, **412***c*, cutting off current to the drive motor. As the current is shut off, the motor brake **417** is applied, stopping the mechanical drive.

Assuming that there is no obstruction, the motor M continues to run and the outer drawbars continue to open and the center drawbars continue to close. At 180° of the cam **189**, the right and left drawbars are fully open and the center drawbars are fully closed.

The hydraulic action of opening and closing of the drawbars is independent of the mechanical arrangement which moves them vertically and the machine is so timed that there can be no opening or closing of the drawbars while they are moving vertically. The synchronization of the mechanical and hydraulic features of the machine is ensured by the action of the limit switches **405** through **410**.

At 180°, the center drawbars are closed and are starting down and the outer drawbars are open and starting up. At 320° the vertical stroke is completed, and at this point the cam **189** reverses switch **416**, deenergizing the coil of valve **305A** and energizing the coil of valve **305B**. From 320° to 360° the outer drawbars close and the center drawbars open, which completes the cycle of operation.

The eye resetting cam **189***b* actuates micro-switch **418** from 120° to 150° and from 300° to 330°, closing circuit

to relay coil 419, which closes contacts 419*a*, 419*b*, which reset the photo electric cells.

At the time the machine is started, left and right paper brake switches 421 and 422 are closed. Referring now to the paper brake circuits 420, which include two paper brakes with identical circuits, the rectifier 423 converts the A.C. to D.C. for operation of the brakes. The potentiometer 424, in series with resistance 425, is set to provide a small voltage across the paper brake armature, providing drag on the paper rolls. The braking action varies directly with the voltage across the brake armature. The more resistance offered by potentiometer 424 and resistance 425, the less voltage across brake 143. When the photo electric cell registers, its contact 427 closes, making a parallel circuit comprised of potentiometer 424 and resistance 425 and potentiometer 428. The resistances in parallel have a lower effective resistance that that of potentiometer 424 and resistance 425 in series alone, and the voltage across left paper brake 143 is greatly increased, causing the brake to hold and stop the paper roll. The action of the brake is so timed by the photo electric cell that the paper roll is stopped just before the drawbars finish their downward stroke, and the last portion of the stroke causes the paper web to raise the compensating frame E. After the stroke is complete and the drawbars open, the frame E pulls the web back into its proper position (for the cutoff knife).

A reversing switch 429 is provided so that the drawbars may be reversed to clear any obstruction which may occur between them. When the mechanical drive motor M is running, relay 412 is energized, contact 412*d* is closed and relay coil 430 is energized. Normally open contacts 430*a* and 430*c* are closed and normally closed contacts 430*b* and 430*d* are open. The reversing switch 429 is then by-passed. Thus, the reversing switch is effective only when the mechanical drive is inoperative, eliminating the danger of damaging the drawbars through accidental reversing while they are in vertical motion.

When the relay is deenergized (motor M not running) the contact 412*d* is opened, relay coil 430 is deenergized and contacts 430*a* and 430*c* open. Contacts 430*b* and 430*d* close. The circuit is closed through the reversing switch 429 which may now be pressed, breaking the connection between contacts 433—434 and 437—438, connecting terminals 431 with 432, 435 with 436, which reverses the current to solenoid 305.

The shuttle feed solenoid 439 is energized when microswitch 441 is in normally closed position and feed solenoid 440 is energized when microswitch 441 is in position where the normally open contact is closed. Microswitch 441 is actuated by the cam 189*a* on the mechanical drive shaft 174 (FIGURE 52). Solenoid 439 becomes energized just after the center drawbars close, causing the shuttle feed to move over the feed tube, discharging its contents into the seam seal tube.

When the automatic-manual switch 400 is placed in the manual position, the jog button may be pressed, completing the circuit and by-passing the holding contact 403*d* to allow the machine to be operated intermittently while setting up the machine originally, or while adjusting or testing it.

Assuming packaging material threaded through the machine to the folders as indicated in FIGURES 41, 31, and pulled through the folders and formed into a tube, with the heat on in the heat sealers and drawbars or dies, the packaging material will be handled as digrammatically illustrated in FIGURE 38, where the action is divided into three phases.

Assuming that the end, single drawbars have moved from their upper, opened position and have gripped the tube between their jaws, cut it and are about to move downward, the photo cell will register point P on the web W, setting the brakes 143. This is indicated as phase I in FIGURE 38. As the drawbar moves downward the brake holds the web of roll W against further movement. The continued pull of the drawbar therefore causes the web W to pull against the slack takeup mechanism, lifting the frame E against the tension of spring 168, causing the registration point P to move past the photo cell. This is designated as phase II. As the end drawbars reach the limit of their downward stroke, they open, releasing the tube, whereupon the frame E is pulled down by the spring 168, restoring the registration point P to its starting position and repositioning the web for proper gripping by the central, double drawbar. This is indicated as phase III.

When the single, end drawbars are in their lower, closed position, the center, double drawbars are in their upper, open position, about to close on the tube, seal it horizontally as at H, FIGURE 51, cut it with the knife at I. Shortly after it is sealed, the tube is filled with the product and is pulled down by the double drawbar, whereupon the single end drawbars open, releasing the completed package, move up, grip the upper end of the tube over the product, seal it and cut it midway of the sealed portion and move down again, repeating the cycle. As the jaws open at the end of each downward stroke, they release a completed package. Thus, the end, single drawbars each release a package, and the center, double drawbar releases two more, making a total of four packages during each cycle of operation.

We claim:

1. A packaging machine comprising pairs of end drawbars and a pair of intermediate drawbars disposed between said pairs, a reciprocable carriage for supporting each pair, driving means for said pairs, said intermediate pair being reciprocated alternately with respect to the end pairs, a walking beam connecting each end drawbar with the central drawbar, said driving means being connected to one of said walking beams.

2. A packaging machine comprising a tube former to form tubes, a pair of jaws movable in closing directions to grip said tube, an additional pair of jaws movable in the same closing directions to grip said tube at a point spaced from said first pair of jaws, said pairs of jaws overlapping one another, means to reciprocate said first pair of jaws in one direction and said additional pair of jaws in the opposite direction, said reciprocating means including a walking beam positioned between the two pairs of jaws, means to close the jaws of said respective pairs to grip said tube at one point in their stroke and to open and release said tube at another point in their stroke, the reciprocation of said jaws and the opening and closing thereof being synchronized so that the jaws of one of said pairs remains open as the closed jaws of the other of said pairs passes between them.

3. A packaging machine comprising a pair of tube formers to form tubes, pairs of end drawbars and a pair of intermediate drawbars disposed between said end pairs to alternately grip a tube at spaced points and pull it, said intermediate drawbars comprising a pair of arms extending in opposite directions in the same plane towards each end drawbar and opening and closing in unison, said respective end and intermediate drawbars overlapping each other and operating in the same plane on one of said tubes, one of said end pairs and its respective overlapping portion of the intermediate drawbar operating upon one tube, the other of said end pairs and its respective overlapping portion of the intermediate drawbar operating on another tube, means for reciprocating said respective pairs of drawbars alternately with respect to one another and means for opening and closing each pair alternately to grip and pull a tube, the tubes being pulled in unison, the reciprocation of said drawbars and the opening and closing thereof being synchronized so that the jaws of one of the pairs remains open while the jaws of the other pair pass between them.

4. A machine according to claim 3 in which a walking beam connects each end drawbar with the intermediate drawbar, and means for driving said walking beam.

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