

May 23, 1967

J. H. MURRAY

3,320,721

PACKAGING APPARATUS

Filed April 20, 1964

6 Sheets--Sheet 1

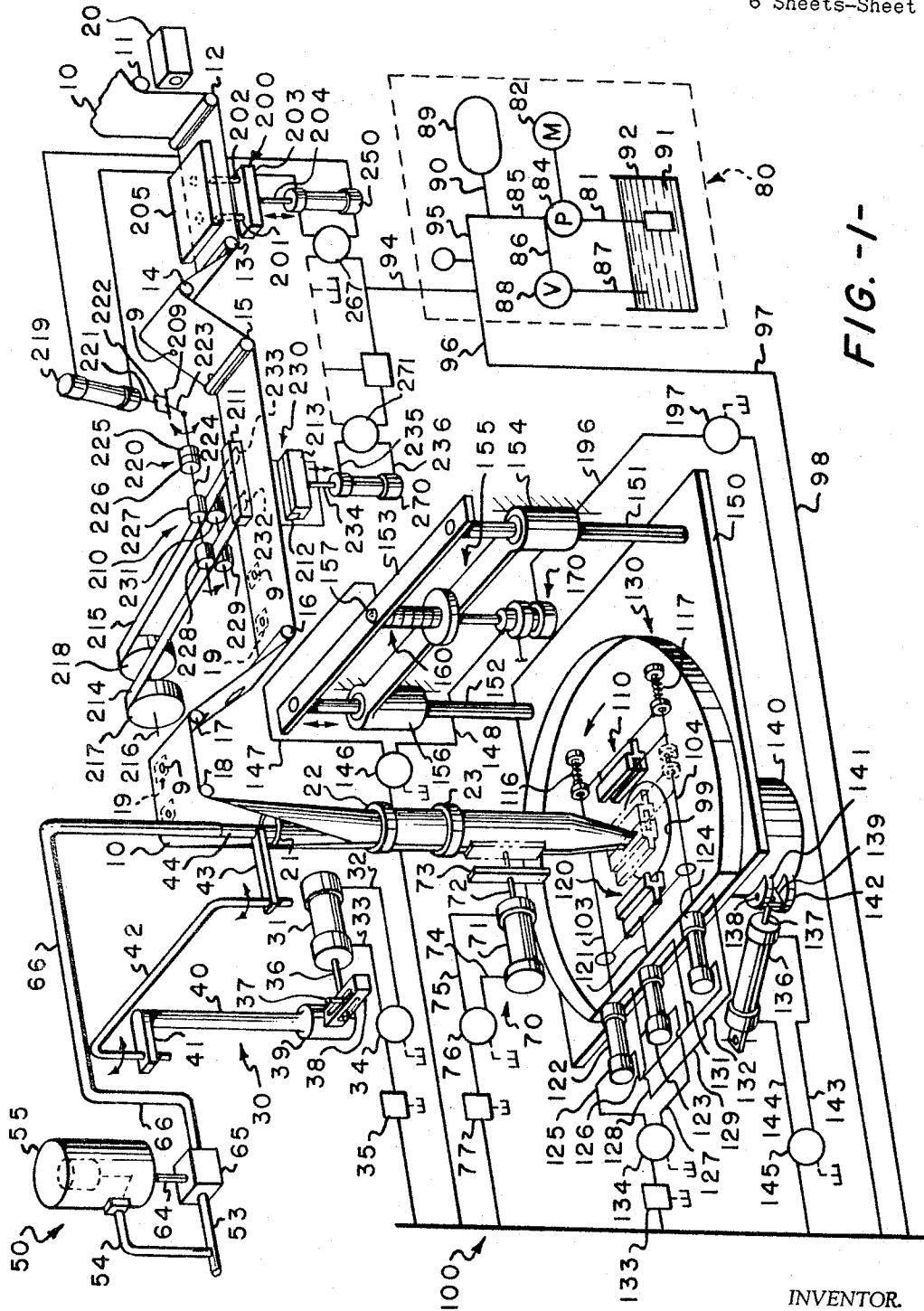


FIG. -1-

INVENTOR.  
JOHN H. MURRAY

BY  
*Shawley C. Proctor*  
ATTORNEY



May 23, 1967

J. H. MURRAY  
PACKAGING APPARATUS

3,320,721

Filed April 20, 1964

6 Sheets-Sheet 3

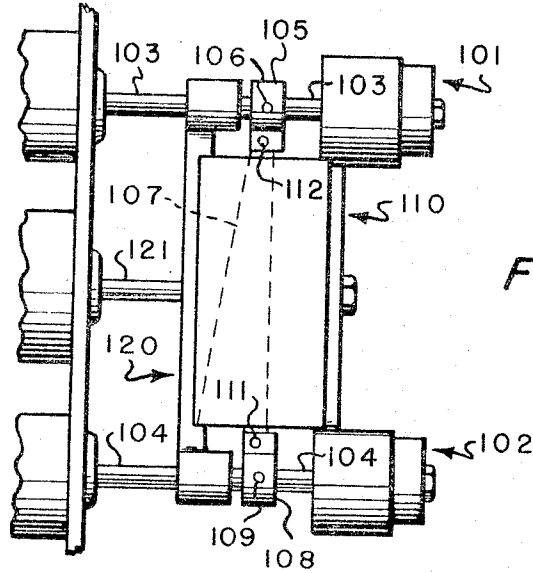


FIG. -4-

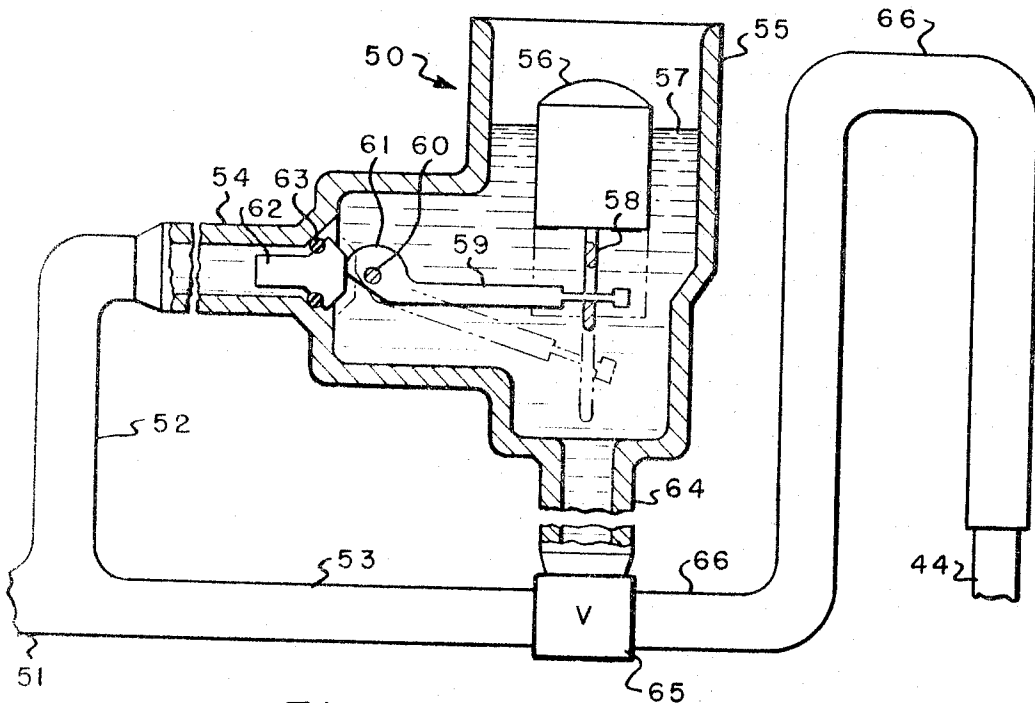


FIG. -5-

INVENTOR  
JOHN H. MURRAY  
BY  
*J. H. Murray*  
ATTORNEY

May 23, 1967

J. H. MURRAY  
PACKAGING APPARATUS

3,320,721

Filed April 20, 1964

6 Sheets-Sheet 4

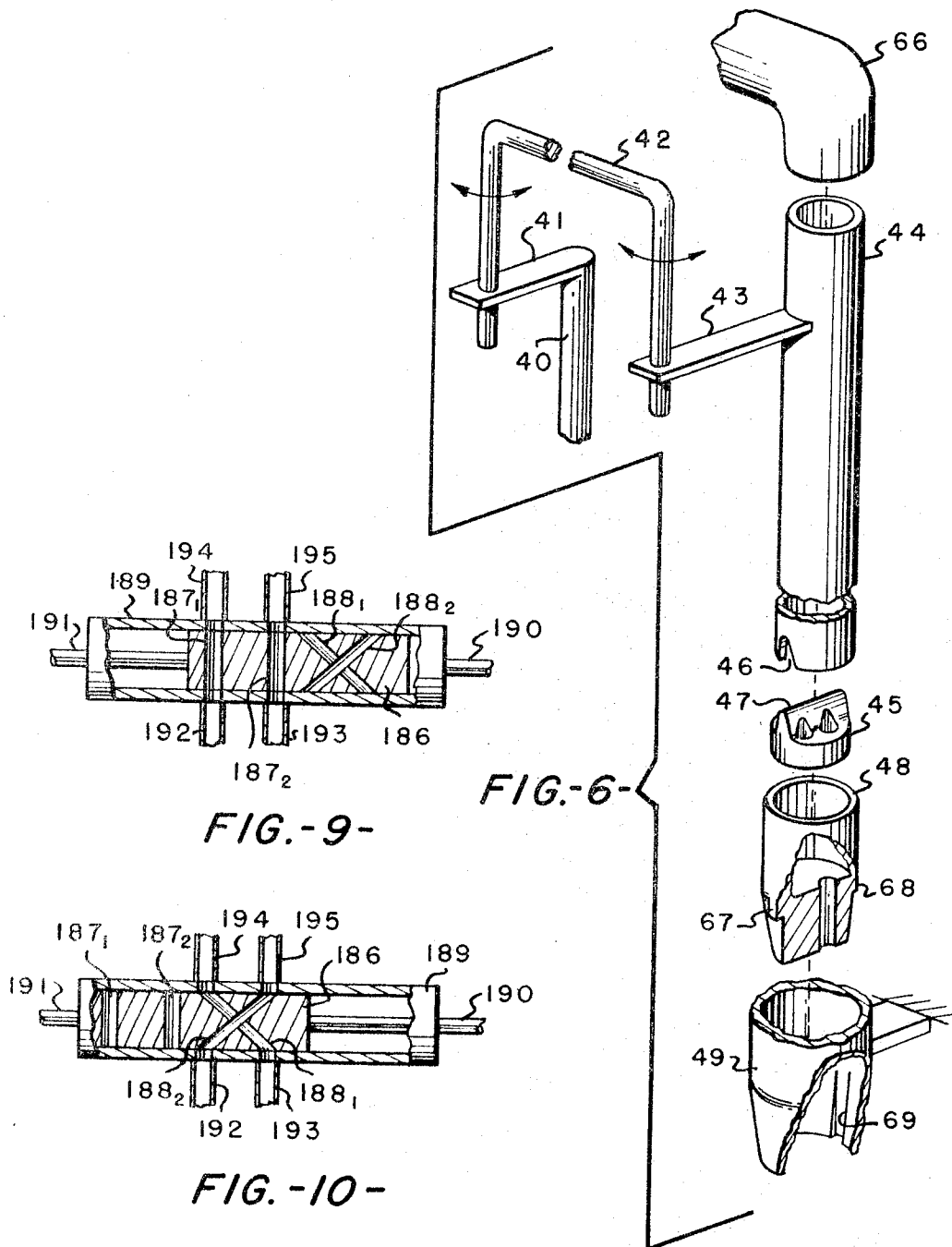


FIG.-9-

FIG.-6-

FIG.-10-

INVENTOR  
JOHN H. MURRAY  
BY *Lawrence A. Proctor*  
ATTORNEY

May 23, 1967

J. H. MURRAY

3,320,721

PACKAGING APPARATUS

Filed April 20, 1964

6 Sheets-Sheet 5

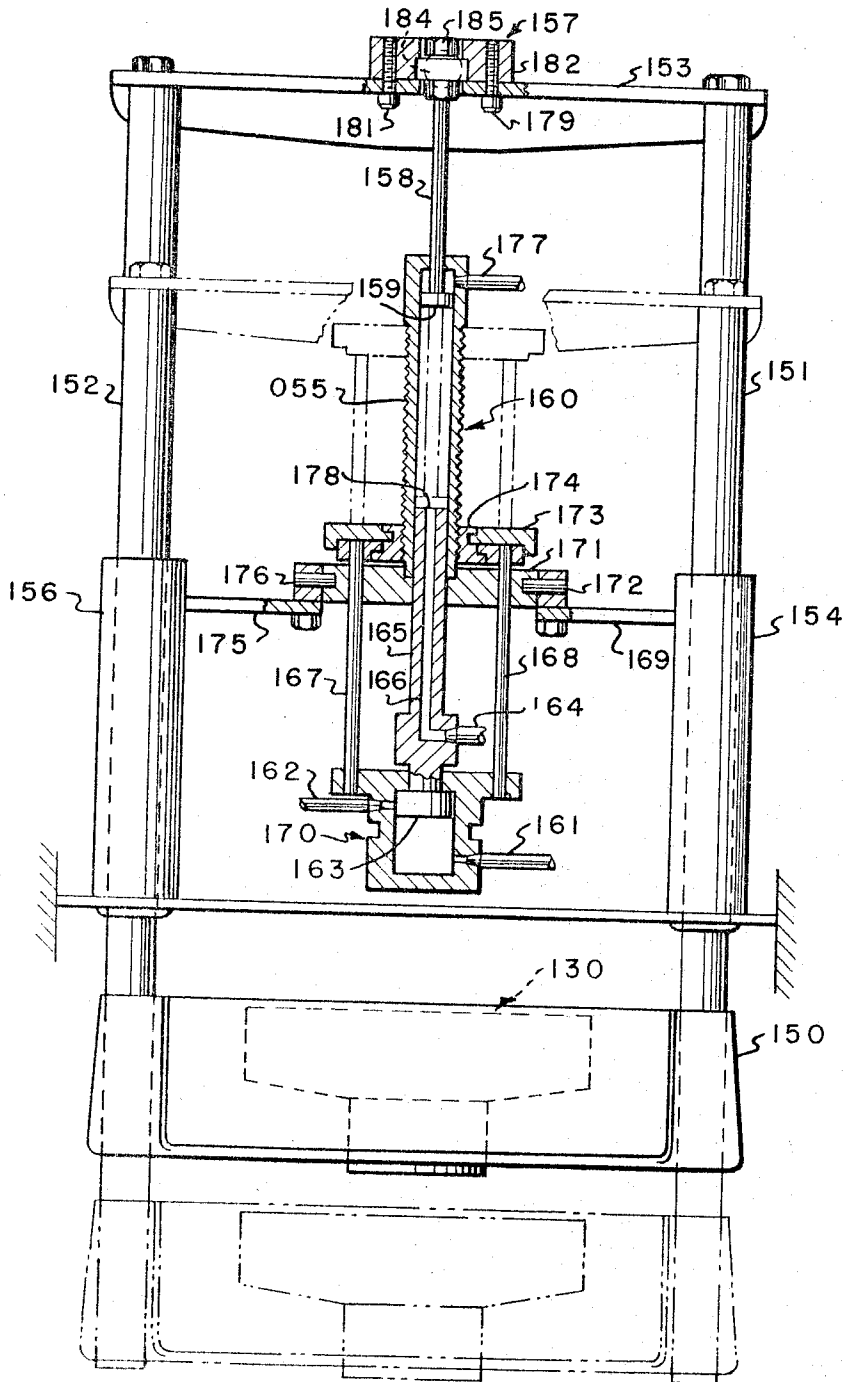


FIG. -7-

INVENTOR

JOHN H. MURRAY

BY

*Shawell C. Proctor*

ATTORNEY

May 23, 1967

J. H. MURRAY  
PACKAGING APPARATUS

3,320,721

Filed April 20, 1964

6 Sheets-Sheet 6

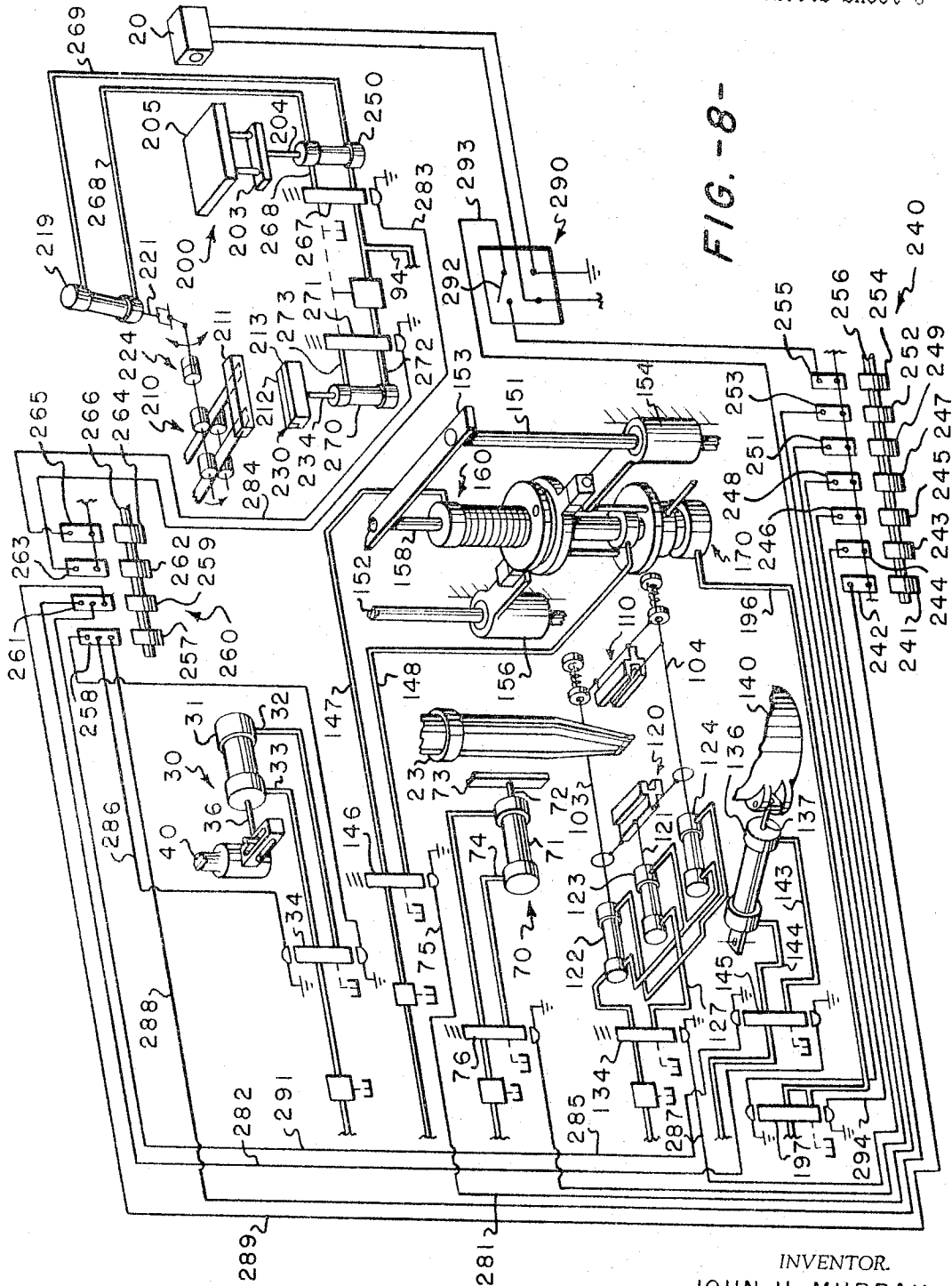


FIG. -8-

INVENTOR.  
JOHN H. MURRAY  
BY *Lawrence C. Proctor*  
ATTORNEY

3,320,721

**PACKAGING APPARATUS**

John H. Murray, Spartanburg, S.C., assignor to Clemson Industries, Inc., White Stone, S.C., a corporation of Delaware

Filed Apr. 20, 1964, Ser. No. 361,138

4 Claims. (Cl. 53—182)

The instant invention is concerned with improvements in packaging machinery. In particular, it relates to improved machines for forming packages from a flat flexible web and a fluent substance introduced into the machine for packaging.

Packaging machines of such general character are known to the art. In such machines, a continuous flat flexible web from a supply roll is passed downwardly through appropriate guides and tube forming means which turn the lateral edges of the web inwardly for contact, and generally for overlap of one edge with the other. The contacting edges, generally coated with a thermoplastic heat flowable material are thus brought together and longitudinally heat sealed. The so-formed tubular shape is guided upon and is enclosed about a vertically disposed tubular filling mandrel for supplying the liquid which is to be contained within the final packages.

Below the filling mandrel the tube is transversely sealed in a first plane to form a tube with an enclosed lower end, i.e. a tubular blank, which blank is supplied with the liquid to be packaged. As the tube moves further downwardly an upper portion of the liquid filled tubular blank is closed, sealed and severed from the tube in a transverse plane above the first transversely applied seal so as to provide a liquid filled package. Where the transverse seals are applied at right angles one to the other a tetrahedron shaped liquid filled package results. On the other hand, where the transverse seals are applied in the same plane one with the other "pillow shaped" liquid filled packages are produced.

In general, such machinery for packaging liquids have met with considerable success, and are used commercially. Nevertheless, however, there are numerous difficulties associated with the use of such machines and not the least of these difficulties is associated with their general complexity. Typical machines of this type necessitate the use of several pairs of sealing jaws carried on several endless chains which contact, seal and draw downwardly the liquid sealed tubular blank to form same into liquid filled packages. Such machines are very bulky and, inter alia, require considerable maintenance and operating labor. Even where sealing jaws are mounted on vertically reciprocable carriages the machines, inter alia, are powered by complex mechanical systems and are fraught with many of the aforesaid difficulties, and more.

Other difficulties associated with the use of prior art apparatus relate to the complexity of liquid metering systems. Aside from this difficulty however is that most such filling mechanisms overflow the packages to be formed so that the seal area of the package is contaminated, inter alia, by the necessity of having to seal the final packages through the material to be packaged. This increases the number of packages which leak or eventually form leaks upon handling. Also, product quality can be impaired to some extent.

Another disadvantage of prior art apparatus is that relating to proper web registration and control. Many packaging machines are not capable of providing such registration and control or the mechanisms employed do not function to the extent of the accuracy and dependability desired.

Because of these and other shortcomings it is a primary object of this invention to provide machines of the general character described but which embody novel and im-

proved features, particularly as relates to the powering and timing of the several operating functions of the machine. A particular object is to provide improved machines which include the novel features of a combination arrangement including the various web feeding, tube forming, sealing and liquid packaging functions above mentioned. It is also an object to provide an improved combination including a tab seal package forming assembly and web registration device which applies corrections to the various machine movements and functions to maintain proper registration and alignment of the web in accordance with any desired indicia marked thereupon. Also it is an object to provide an improved combination of features wherein the operating functions of the machine are actuated by appropriately timed hydraulically responsive operational units.

These and other objects are accomplished in accordance with the present invention which contemplates in combination a packaging machine of the type described and a hydraulic power supply for providing on demand hydraulic fluid in desired quantities at operating pressures to a line or manifold provided with individual valves operated in timed sequence for directing the fluid to the several operating functions of the machine. At each station wherein an operation is to be performed upon the flexible web to contribute to its final formation into a package filled with a fluent substance there is provided cylinder-piston units, i.e. hydraulic motors, to convert fluid power into mechanical power for actuation of the several operating functions. These cylinder-piston units are directed and controlled by signals from a timer which causes the opening and closing of the valves to activate the proper cylinder-piston unit in predetermined sequence.

The present invention will be better understood by reference to the attached drawings and to the detailed description given hereinafter which makes specific reference to the drawings. In the drawings wherein similar reference numerals refer to generally similar or identical parts:

FIGURE 1 is a schematic overall view of the various components, sub-components, combinations and sub-combinations of the new and novel liquid packaging machine showing the relationship of one assembly to another, including in particular, a hydraulic power supply which is manifolded through directional flow control valves to the various cylinder-piston units or fluid actuable motors which provide the various operating features of the machine;

FIGURE 2 shows a hydraulically vertically reciprocable carriage which carries with it a rotatable platform upon which is mounted a pair of hydraulically actuable clamping jaws for grasping and for advancement of the web, and for transverse sealing and severing of a formed packaging from the tubular body, this being generally similar to that embodiment shown as a portion of FIGURE 1 except that the platform is rotated 90° from the view shown in that figure;

FIGURES 3 and 4 provide a detailed showing of the transverse sealing and tube severing mechanism, the former showing the sealing jaws in open position and the latter showing the jaws closed as to effect sealing and severance of a package from the tube, which also is the jaw position for grasping the tube to move same through the apparatus;

FIGURES 5 and 6 show the liquid metering apparatus for providing measured quantities of the fluent substance to be packaged to the tubular blank, FIGURE 5 showing specifically apparatus for providing a ready source of the fluent substance at substantially constant pressure and FIGURE 6 time control mechanism for delivering the desired quantum of fluid to be packaged;

FIGURE 7 illustrates in detail mechanism by means of which the carriage, and consequently the transverse sealing mechanism, is actuated, and shows also the features of a web registration correction cylinder or package length control device;

FIGURE 8 illustrates electrical timing and control mechanism for providing the several sequences of apparatus functions for package formation, and also a timing and control circuit to provide proper web registration; and

FIGURES 9 and 10 are schematic representations of a push-pull or spool type four-way valve which appears so frequently as a solenoid actuated four-way control valve used in the presently described apparatus.

As the following detailed description unfolds, particular attention is directed to FIGURE 1 wherein a more rapid understanding can be gained by relating the descriptions in all subsequent figures back to that first figure.

Referring to FIGURE 1 generally is shown a flat flexible web 10 which is drawn from a supply roll (not shown) and advanced over the several guide rolls 11 through 18, and thence downwardly about and between the mandrel 21 and forming rings 22, 23 to shape the web in tubular form. The web 10 is thermoplastic coated on its upper side, and at a lower portion when formed into a tube is sealed along its longitudinal edges by application of member 73 of longitudinal sealing unit 70 upon the overlapping edges to heat seal these edges together. The open tube is transversely sealed at its bottom by closure upon the tube of the pair of clamping jaws 110, 120 to form an open end vessel or tubular blank. The tubular blank is filled with a metered quantity of a liquid to be packaged therein, the liquid being charged from filling chamber 55 of liquid metering system 50 into the blank via a valved fill tube 44 which extends vertically downwardly within the confines of the forming mandrel 21 and into the tubular blank.

In forming liquid filled packages the tubular blank is progressively drawn downwardly by the descent of vertically reciprocable carriage 150 which carries with it the pair of heated movable jaws 110, 120 which closes upon and grasps the tube at the peak of the upward movement of carriage 150, and releases same at the lowermost position of downward movement. The carriage 150 and jaws 110, 120 then move upwardly while the tube remains motionless in its downwardly displaced position. The newly formed blank is filled with liquid. The jaws 110, 120 at the peak of the upstroke of carriage 150 are again closed on the tube at a location above the level of the liquid which is, of course, above the seal previously applied. The liquid filled closed tube segment is then severed through the upper seal to form a closed liquid filled package and then both package and tube, which remain in fixed relative position one to the other, are again drawn downwardly while heat sealing of tube and package continues. At the bottom of the working stroke or downstroke of carriage 150 the grasp of the jaws 110, 120 upon the tube and package is then released and carriage 150 returns to its upward position in resuming the cycle. By this action of carriage 150, the web 10 is drawn in intermittent, movements through the packaging apparatus and liquid filled packages are continuously formed and ejected from the apparatus.

In its passage through the packaging apparatus web 10 then has a series of operations performed thereon, these operations taking place in timed sequence at several operating stations. These operations for package formation also include, preferably, the formation of straw seal openings or pull tab units 19. These tab seal units 19 are small openings 9 formed within the web 10, which openings are covered and sealed closed by tabs placed thereover. These units 19 can even be formed, if desirable, so that the seals can be easily punctured as by passage therethrough of a soda straw for immersion and withdrawal of the liquid contents from the package. In accordance with the present apparatus a pair of holes 9 are

punched in web 10 at the punch station 200 and each of the holes are covered by a tab applied at station 230. A pair of tab seals 19 are so spaced that each will be separated one from the other and will form a component part of an individual liquid filled package.

These series of actions having been described in general terms shall now be described in greater detail and in a sequence described first by tracing a given segment of web 10 as it first enters the machine. Attention therefore is initially directed to the top right side of FIGURE 1 wherein a tensioned flat web 10 from a supply roll (not shown) enters the apparatus.

The web 10, maintained under constant tension by means not shown, is first advanced via rollers 11, 12 through a path across the photoelectric eye 20, the function of which shall be later explained in detail, thence through hydraulically actuated punch assembly 200 which perforates the web 10 with a pair of holes 9 so spaced that each will appear individually within a finished liquid filled carton. In the perforation step the web 10 lies motionless and punch members 201, 202 mounted on the punch plate 203 are projected and passed through the web 10 upon activation of the hydraulic cylinder-piston unit 250. Thus, it will be noted that punch plate 203 is integrally mounted upon piston rod 204 of cylinder-piston assembly 250, and is thrust vertically upward by projection of piston rod 204. In such action the terminal ends of the members 201, 202 pass through the web 10 and into a pair of dies or female members (shown by dotted lines) within punch die 205. The punch members 201, 202 are then withdrawn also while the web 10 is motionless by the reverse movement of punch 203 in timed response to activation of the cylinder-piston unit 250 in the opposite direction, this withdrawing rod 204 back into the cylinder-piston unit 250.

Completion of the tab seal units 19 is accomplished by covering the individual perforations made in the web 10 with tabs, this being accomplished specifically by action of tab seal cover assembly which includes really a tab advancing mechanism 210 and a tab cutting and sealing mechanism 230. Thus, web 10 is next advanced via rollers 13, 14, 15 between the hydraulically actuated tab seal assembly plate 211 and a blade edge 212 mounted upon member 213. Between these members and between the web 10 and member 213 has been placed the ends of a pair of thermoplastic coated tapes 214, 215 advanced by tab advancing mechanism 210. The manner in which this is accomplished and the actual formation of the tab seals 19 are next explained in some detail.

Simultaneously with the activation of hydraulic cylinder-piston unit 250 to project rod 204 for punching holes 9 it will be observed that hydraulic cylinder-piston unit 219 is also activated and its rod 221 is also thrust outwardly. In such activation tapes 214, 215 are withdrawn from rolls 217, 218 mounted on axles 216, and advanced a predetermined amount. It will thus be observed that piston rod 221 which is operatively connected to a one-way clutch assembly 220 via linkage with bifurcated member or yoke 222 and through pivotal member 209 with an L-shaped member having a lever arm 223 and an axle portion 224. This mechanism translates a thrust of rod 221 into an angular force by rotation of arm 223 about axle 224 to produce rotation of disc 225 to which axle 224 is connected. This in turn causes a corresponding rotation of disc 226 which is free to turn only in this one direction. Rotation of disc 226 then causes a corresponding rotation of rolls 227, 228. It will be noted that tapes 214, 215 pass between rolls 227, 228 and back-up friction rolls 229, 231 so that rotation of rolls 227, 228 causes advancement of tapes 214, 215 over each of a pair of holes 9. It will also be noted that the terminal ends 232, 233 of tapes 214, 215 upon advancement lie beneath the web 10 and between member 211 and blade 212 on member 213 of tab seal assembly 230.

Upon activation of hydraulic cylinder-piston unit 270 there is an outward thrust of piston rod 234 and blade 212 of member 213 which is integrally connected with rod 234. The terminal ends of tapes 214, 215 are severed by the "scissor action" resulting from projection of the cutting blade 212 across the edge of member 211. Further, by the same movement the tabs 232, 233 are thrust against web 10 and heat sealed over holes 9. The heat sealing is accomplished by pressure and heating of the tabs 232, 233 between the flat faces of members 211, 213. Generally a small unsealed portion of the applied tab is left extending from the sealed portion to form a pull tab.

In the formation of the tab seal openings 19, which always occurs when web 10 lies motionless, activation of cylinder-piston units 219, 250, as noted, occur in unison and pistons 204, 221 are thrust outwardly. They are also withdrawn simultaneously. The action is just the alternate of that of cylinder-piston unit 270. Holes are punched by punch assembly 200 and tapes 214, 215 are simultaneously advanced while cutting member 212 is retracted. So, upon withdrawal of punching member 203 by reverse movement of rod 204, the rod 221 of cylinder-piston unit 219 is also withdrawn and disc 225 of the one-way clutch assembly 220 is rotated in reverse direction, and through the action of the one-way clutch 224 tapes 214, 215 are not withdrawn. And, simultaneously, when rods 204, 219 of cylinder-piston units 250, 219 are withdrawn rod 234 of cylinder piston unit 270 is thrust outwardly to cut the tapes 214, 215 forming tabs 232, 233 to cover the holes 9 and complete the formation of the tab seal openings 19.

The formation of the tab seals 19, having been completed, web 10 is next advanced via rollers 16, 17, 18 outwardly and thence downwardly whereupon its formation into tubular shape begins. Thus, the flat flexible web 10 is now moved downwardly at right angles from its path of travel over roller 18 and the edges of web 10 are gradually turned toward each other and finally are overlapped and heat sealed together. Thus, web 10 is passed downwardly and gradually enclosed about the forming mandrel 21. The tubular web 10 is passed through the annulus formed between mandrel 21 and forming rings 22, 23. The overlapping edges of the web 10 are then heat sealed one upon the other by application of heated member 73 which causes flow of the thermoplastic coating on the web 10. It should be noted that member 73 is mounted upon piston rod 72 which is an integral part of hydraulic cylinder-piston unit 71. Such longitudinal overlap seams are formed by intermittent applications of members 73 which is reciprocated in response to activation of hydraulic cylinder-piston unit 71. It is obvious that an inside face-to-inside face seal can be also formed by the incorporation of seam forming apparatus well known to the art.

A tubular blank fit for reception of liquid is now formed from the longitudinally sealed tubular shaped web 10 by application of a lateral or transverse seal to close the bottom of the tube. A transverse seal is thus formed by the clamping action upon the tube of the pair of heat sealing jaws 110, 120 which are integrally mounted within the rotatable platform 130 which likewise is an integral portion of reciprocable carriage 150. Upon initiation of a transverse seal by the grasp of heated jaws 110, 120 at the peak of the upstroke of carriage 150 a liquid filled package is severed from the tube and tube and web 10 are then drawn downwardly while the sealing of the package and tube is conducted. At the bottom of the downstroke of carriage 150 the grasp of jaws 110, 120 upon the tube is released. A liquid filled package is discharged from the apparatus via opening 99 to provide a liquid filled package, and a newly formed tubular blank is again in readiness for receiving or continued receiving of liquid.

The clamping jaws 110, 120 and rotatable platform

130 form a portion of a transverse sealing assembly which is capable of forming packages of varying shapes from the tube, especially tetrahedron shaped packages. The precise manner in which this is accomplished shall now be described by continued reference to FIGURE 1 and also by reference to FIGURE 2.

It will be observed that carriage 150 is rigidly affixed in cantilever fashion upon an end of posts 151, 152. Posts 151, 152 are slidable within stationary bearing members 154, 156 of the rigidly affixed support structure 155, and are directly affixed at their opposite ends by connection with yoke 153 which is operatively associated with cylinder-piston unit 160 via connection to piston rod 158 (FIGURE 2). It will be apparent that projection of piston rod 158 results in upward displacement of carriage 150 and conversely, when piston rod 158 is retracted into cylinder-piston unit 160 carriage 150 is moved downwardly; posts 151, 152 sliding within the stationary bearing members 154, 155.

Rotatable platform 130, mounted upon carriage 150, and carrying clamping jaws 110, 120 oscillates vertically with the carriage 150 in response to actuation of cylinder piston unit 160. A feature of the transverse sealing assembly is that platform 130, and consequently jaws 110, 120 is rotatable within limits this permitting formation e.g. of tetrahedron shaped packages, as desired. Pillow shaped packages can also be formed but in such package formation platform 130 is not caused to rotate and jaws 110, 120 are always applied in a common plane. Where tetrahedron shaped packages are desired jaws 110, 120 however, are applied alternatively at 90° angles. Thus, the seals of each individual package are formed at right angles one to the other.

In forming a package of any shape jaws 110, 120 grasp the liquid filled blank at the peak of the carriage upstroke, sever the package from the tube, pull tube and package downwardly and, at the lowermost portion of the carriage downstroke the grasp of the jaws 110, 120 are released and the completed package is ejected as heretofore described. This condition is in fact clearly illustrated by reference specifically to FIGURE 1 wherein jaws 110, 120 have just moved apart one from the other. In this condition of operation it is noted that piston rods 103, 104 of cylinder-piston units 122, 124 are projected outwardly and piston rod 121 of cylinder-piston unit 123 is retracted. Further, piston rod 137 of cylinder-piston unit 136 which is operatively associated with the movable platform 130 via pivotal connection to the lower portion of transverse sealing assembly 140 is fully retracted. Thus, it will be noted that piston rod 137 is connected with member 139 mounted between projections 141, 142 by means of pin 138 passing therethrough and that movement of piston rod 137 will produce rotation of member 140 and consequently platform 130 which carries sealing jaws 110, 120. As carriage 130 begins to ascend then rotation of platform 130 is initiated by virtue of the projection of piston rod 137 of cylinder-piston unit 136. The full ninety degree rotation which takes place on the upstroke is readily shown by reference to FIGURE 2 and particularly to the changing condition shown by comparison of FIGURES 1 and 2. In FIGURE 2 a condition is shown wherein the platform 130 has rotated through a full 90° angle and is representative of the moment just prior to closure of jaws 110, 120. Upon closure of jaws 110, 120 the tube is drawn downwardly to complete the formation of the package. As will be apparent cylinder-piston unit 136 can be provided with a piston rod of different lengths so that upon completion of an upstroke the platform is rotated through any desired angle up to 90°.

The transverse sealing and package severance mechanism is described generally by continued reference to FIGURES 1 and 2. Thus, at the peak of the upstroke of carriage 130 jaws 110, 120 close resiliently upon the tube and heat seal transversely the web edges across a narrow band above the level of the liquid. As jaws 110, 120 are

pulled more tightly together by withdrawal of piston rods 103, 104 into cylinder-piston units 122, 124 respectively, and by continued projection of piston rod 121 of cylinder-piston unit 123 springs 116, 117 are compressed to cause projection of blade which severs the filled package by its cutting action as it passes through the transverse seal and into the opposite jaw 120.

This severing action is more precisely shown, however, by specific reference to FIGURES 3 and 4. A single blade 107 is mounted within jaw 110, it being connected at one end to a block 105 by passage of pin 112 there-through and to a second block 108 at its opposite end by means of pin 111. The blocks 105, 108 are, on the other hand, connected to piston rods 103, 104 respectively, by pins 106, 109. It should be noted that blade 107 is mounted to blocks 105 and 108 directly in front of a pair of compressible springs, one of which is shown at 116, which allows the piston rods 103 and 104 to cause the blade 107 to project out of the jaw 110 when the jaws 110 and 120 have come into heat sealing relationship. Thus, springs 116, 117 (not shown) are mounted within compressible housing members 101, 102 affixed directly to piston rods 103, 104 of cylinder-piston units 122, 124 and upon continued retraction of piston rods 103, 104 springs 116, 117 are compressed thus permitting the rods to continue their movement, this in turn carrying forward blade 107.

Both housings 101, 102 are identical and the details of housing 101 are shown by specific reference to the half section portion of FIGURE 3. Thus, it will be noted that continued retraction of piston rod 103, affixed via locking nut 115 to housing member 114 permits continued forward movement of the smaller cylindrical housing 114 into the confines of the outer cylindrical housing 113 of greater diameter while simultaneously spring 116 is compressed. As forward motion continues blade 107 is caused to project beyond the face of jaw 110 through the seal and into a recess provided therefor within jaw 120 which forcibly opposes the motion of jaw 110. After severance the liquid filled package and the tube are held in fixed relative position and sealing is effected during the downstroke of carriage 150 until such time as the grasp of jaws 110, 120 is released and the package ejected. In accordance with a preferred embodiment a more optimum period is provided for proper heat sealing by providing that jaws 110, 120 and carriage 150 move more rapidly on the upstroke than on the downstroke since there is no heat sealing or other working condition to be performed on the upstroke.

The more precise manner in which the vertical movement of carriage 150 is accomplished and the precise driving means for achieving such function is best explained by specific reference to FIGURE 7. In this figure is also shown a portion of the mechanism by means of which web registration is accomplished.

Referring first generally to the figure, as discussed heretofore in connection with FIGURE 1, is shown an adjustable main cylinder-piston unit 160 operatively connected via its reciprocable piston rod 158 and gimbal 157 to yoke assembly 153 which is in turn affixed to posts 151, 152 which supports carriage 150. These latter members are thus directly affixed at one extremity to yoke 153 and to carriage 150 at their opposite extremities. It will be noted that posts 151, 152 are slidable within stationary bearing members 154, 156 and that carriage 150 and consequently rotatable platform 130 oscillate vertically as piston rod 158 moves back and forth within cylinder-piston unit 160.

In the figure also will be noted a secondary cylinder-piston unit 170 which is a part of a photoelectric eye-web registration correction system which shall be later described in detail by reference to FIGURE 8, and again by reference to the present figure. For the present it suffices to say that the registration correction cylinder-piston unit 170 permits shortening of the amplitude of the

carriage stroke so that the movement and positioning of the web can be automatically adjusted within permissible ranges for proper control of package length.

It will be noted that both the main cylinder-piston unit 160 and registration correction cylinder 170 are supported upon a trunnion 171 to which is affixed stationary bearings 154, 156 within which moves posts 151, 152 carrying reciprocable carriage 150. It will be further noted that the bearings are affixed to the trunnion 171 by connection with supporting structure 169, 175 upon which it is secured via pins 172, 176.

The main cylinder-piston unit 160 is constituted of an externally threaded cylindrical barrel 055 having an internal opening within the confines of which is slidably positioned piston rod 158. At one terminal end of piston rod 158 is affixed a piston 159 the external diameter of which is substantially the same as the internal diameter of the opening within cylindrical barrel 055. At the opposite end of piston rod 158 is affixed yoke 153 via connection through gimbal 157. The gimbal 157 is really a ball socket arrangement to relieve pressures which might develop due to slight alignment problems in the structure. It will be noted that gimbal 157 consists of an open centered bearing housing 182 which is affixed to yoke 153 via bolts 179, 181. The end of rod 158 is held therein via its ball member 184 and by locking nut 185.

As is apparent the length of the carriage stroke is determined by the inside linear dimension of cylinder barrel 055 which is the maximum distance over which piston 159 is free to travel. A carriage stroke is thus measured by the distance between the vertical drive cylinder head 178 and the opposite extremity of the cylinder barrel 055 diminished by the thickness of piston 159. The linear dimension within which the piston is free to travel therefore determines the amplitude of the carriage stroke.

It will thus be seen that the upward motion of piston rod 158 is produced by flow of hydraulic fluid into the lower end of threaded cylinder barrel 055 via conduit 164 and channel 166 within vertical cylinder 165. The piston rod 158 moves until the piston 159 "bottoms out" against the upper portion of the cylinder barrel 055. In such upward projection of the piston rod 158 the fluid passing upwardly via conduit 164 fills the chamber of cylinder barrel 055 and exerts pressure against the piston 159 to lift carriage 150. Concurrently with the upward movement of the piston rod 158 hydraulic fluid exits from cylinder barrel 055 via line 177. Conversely, when the direction of movement of piston rod 158 is reversed and it is moved downwardly, to cause carriage 150 to descend, pressurized hydraulic fluid flows into the upper end of the cylinder barrel 055 via line 177 and out of cylinder barrel 055 via conduit 166 and hydraulic line 164. This flow of hydraulic fluid into and out of cylinder barrel 055 causing vertical reciprocation of carriage 150 is regulated by a four-way control valve activated in timed response to a signal.

Adjustment of the length of the carriage stroke is an important feature of this apparatus. One reason of adjustment of the carriage stroke is to change the lengths of the packages to be produced. The manner in which such adjustment is made is shown by continued reference to the figure. Cylindrical barrel 055 can thus be lengthened or shortened by raising or lowering vertical cylinder 165 into the cylinder barrel 055 to lengthen or shorten the opening therein. Rotation of hand wheel 173, which rotates together with threaded collar 174, raises hand wheel 173 itself upwardly carrying with it rods 167, 168 which will elevate the entire registration correction cylinder 170 and cause upward projection of the vertical cylinder 165 into the cylinder barrel 055 to shorten its length. Thus, rotation of the hand wheel 173 with its threaded collar 174 about externally threaded vertical drive cylinder 055 will cause it to move upwardly carrying with it the entire registration correction cylinder

170 the latter moving upwardly with the movement of rods 167, 168 which are raised within trunnion 171 this causing projection of the terminal portion 178 of the vertical cylinder 165 into cylinder barrel 055. Rotation of hand wheel 173 in the opposite direction, to the converse, obviously lengthens the opening within cylinder barrel 055. This feature then permits setting the length of the carriage stroke and consequently the length of a package.

To provide proper web registration the carriage stroke can also be shortened as the occasion demands by upward projection of the vertical cylinder 165 in response to an appropriate correcting signal. Pursuant to this embodiment a signal from a primary sensing device, as from photoelectric eye 20, activates a three-way valve permitting pressurized flow of hydraulic fluid into line 161 in the chamber of correction cylinder 170 to act against piston head 163 to cause upward projection of vertical cylinder 165 into the path of piston 159 to effectively shorten the length of cylinder barrel 055. In this manner the carriage stroke is shortened and web 10 is moved downwardly to a lesser extent. After such correction has been made the free-way valve is activated in the opposite direction to permit discharge of hydraulic fluid from line 161. As the vertical cylinder 165 is moved downwardly by the force of piston 159 against terminal end 178 the vertical cylinder 165 is then forced back into its proper position and remains there until a new correction is desired. The purpose of this correction, as will be explained later, is to constantly apply a correction so that the package length will always be maintained within limits without drift from one extreme to another.

The package filling mechanism 30, 50 shall now be described in detail by reference particularly to FIGURES 5 and 6. Reference to these figures thus shows an intermediate supply chamber 55 in metering system 50 which provides a supply of liquid at constant pressure for charging portions from said chamber 55 in response to a signal timed in sequence and duration with reference to the overall cycle to activate fill tube 44 of valve control mechanism 30 to meter into the blank the correct amount of liquid at the proper time.

Prior to completion of an upstroke of carriage 150 the flow of liquid from the supply chamber 55, previously filled to a desired operating level is initiated.

Upon discharging the desired quantity of liquid from chamber 55 through line 64, valve 65, line 66 and fill tube 44, as will be observed by specific reference to FIGURE 5, float 56 moves downwardly as liquid level 57 falls. It will be readily observed that the downward movement of the float 56 pushes downwardly via action of arm 58 upon linking arm 59. It will also be observed that the linking arm 59 is pivotally connected via pin 60 to a wall (not shown) of chamber 55. The arm 59 is provided with a cammed surface 61 a portion of which rests against plug 62. Downward rotation of the arm 59 moves cammed surface 61 horizontally away from plug 62. Such movement lessens the horizontal thrust of cam surface 61 against plug 62 so that it moves horizontally to the right under the supply pressure and into chamber 55. This unseating of plug 62 permits flow of the supply liquid around O ring 63 into supply chamber 55. By this action the chamber is refilled when liquid is discharged; and, as it is refilled the float 56 again rises. The rising of the float 56, simultaneously raises upwardly the link arm 59 which again cams shut plug 62 to again shut off the supply of liquid into chamber 55. In a normal rapid filling operation the actual effect of this constant filling and discharging of chamber 55 is more accurately defined as an oscillating of the plug 62 as well as of the liquid level 57.

In a normal packaging operation then liquid flows substantially continuously from supply (not shown) through lines 51, 52, 54 into the filling chamber 55 to provide virtually constant liquid level. Liquid, in like manner flows out of the chamber 55 via line 64, valve 65, line 66

and through fill tube 44. A line 53 and three-way valve 65 is provided so that the system can be purged of air as prior to start-up. The precise manner in which the proper quantum of liquid is metered to the tubular blank through fill tube 44 is by the timed action of cylinder-piston unit 31, and this is best shown by specific reference to FIGURES 1 and 6.

In response to a timed signal cylinder-piston unit 31 is activated and piston rod 36 is thrust outwardly so that its shank 37 pushes against projection 38 mounted on the enlarged portion 39 of shaft 40, causing rotation of said shaft 40. Rotation of shaft 40 causes a corresponding rotation of lever arm 41 which pulls on link 42 causing also a corresponding rotation of arm 43 since the latter arm members are connected via linking member 42. Referring to FIGURE 6 specifically, it will be readily seen that this action on arm 43 rotates fill tube 44 which is pivotally connected to line 66, and the action also rotates perforated valve disc 45 keyed thereto by projection of its cam surface 47 into notch 46 of fill tube 44. This aligns the openings of said valve disc 45 and those of the rigidly fixed discharge nozzle 48 within which valve disc 47 is projected and pivotally fitted. Because beveled nozzle 48 is fitted into and keyed with the fixed cylindrical member 49 via the lands 67, 68 and mating groove 69 (and another not shown) it does not rotate and liquid flows through fill tube 44. Liquid flows from chamber 55 as long as the valved fill tube 44 remains open. As the opening of valve disc 45 and nozzle 48 move out of alignment on continued projection of piston rod 36 the flow of liquid ceases. Upon withdrawal of cylinder-piston rod 36 into cylinder-piston unit 31 the projection 38 is rotated in the opposite direction and with its arm 43 so as to again align and then unalign the openings within the valve disc 45 and discharge nozzle 48 one with the other, this again initiating and then cutting off the flow of liquid through fill tube 44.

All of the hydraulic cylinder-piston units referred to, to be described later in detail with reference to the timing cycle, are actuated by hydraulic system 80 which is operatively associated with each of said units through suitable directional flow valves 34, 76, 134, 145, 146, 197, 267, 271, through lines 96, 97, 98 to manifold 100 and line 94, respectively.

Directional flow valves suitable for the practice of this invention are known to the art, a preferred type of four-way valve known to the trade as a spool valve. A schematic representation of such valve is illustrated in FIGURES 9 and 10. In each of the figures is shown a spool 186 containing two pairs of openings 187<sub>1</sub>, 187<sub>2</sub>, and 188<sub>1</sub>, 188<sub>2</sub>. The spool is slidable to the right or to the left within the confines of the cylindrical body 189 in accordance with a push or pull upon the projections 190, 191. It will be apparent that either or both these projections 190, 191 can constitute the core of a solenoid (not shown) and be actuated by an electrical signal. Thus, a solenoid might be used at either end of cylindrical body 189 and spring loaded at the other so that when the solenoid is no longer activated the spool will be returned to an original position. Such valves can obviously be actuated by other methods, or even by hand.

It will also be observed that when one pair of the openings 188<sub>1</sub>, 188<sub>2</sub> is closed to inlets 192, 194 and outlets 193, 195 the other pair of openings 187<sub>1</sub>, 187<sub>2</sub> is open thereto and that a shift in the alignment of these openings will reverse the direction of fluid flow.

In FIGURE 9 then where the spool 186 is to the extreme right liquid is free to flow upwardly through line 192, through opening 187<sub>1</sub> of the valve and into line 194. Simultaneously, liquid flows in the reverse direction through line 195, through the valve opening 187<sub>2</sub> and into the line 193. The direction of fluid flow, however, is exactly the reverse in lines 194, 195 when spool 186 is shifted to the extreme left position as in FIGURE 10. In this figure the flow of fluid is from line 192 through

conduit 188<sub>2</sub> and into line 195. On the other hand, the flow of liquid from line 194 is through valve opening 188<sub>1</sub> and to line 193. The action of the two and three-way directional flow valves also used herein are quite common and shall not be described in specific detail.

The hydraulic system 80 shown by reference to FIGURE 1 is constituted of a suitable sized pump 84, driven by motor 82. The pump 84 is provided with a supply of hydraulic fluid 91 from reservoir 92. Thus, pump 84 withdraws oil via its suction line 81 and discharges same via its discharge line 85 through lines 95, 96, 97, 98 to manifold 100 and to line 94, respectively. A safety device is provided at the discharge side of pump 84 consisting of a two-way relief valve 88 which connects to the discharge side of the pump via line 86 and with the reservoir 91 by connection through line 87. Any type of pump 82—i.e. gear, vane, piston, or the like—can be employed and motor means 82 can be electrical, steam, pneumatic or the like.

Preferably the hydraulic system includes also an accumulator device 89 operatively connected to the discharge side of pump by a suitable line 90 leading into line 85. Such device can be any of several known types. For example, it can be a gas filled bag in contact with the pressurized hydraulic fluid so that the former can deflate upon increase of hydraulic pressure and which, correspondingly, can inflate upon decreased pressure so as to modulate the pressure supplied by the hydraulic system.

By reference to FIGURE 8 will be described an overall operating cycle from an interval of time wherein carriage 150 is at the bottom of its stroke, a liquid filled carton has just been ejected and web 10 lies motionless. The light beam transmitted by the photoelectric eye 20 at this time falls upon indicia on the web 10 and the beam is reflected back to the detector portion of the photoelectric eye 20.

Referring to the figure is shown two different groups of Microswitches 240, 260. Each of the Microswitches of the group is in electrical contact, when closed and a respective circuit completed, with a solenoid actuated directional flow valve so that actuation of the respective circuit opens or reverses the flow of hydraulic fluid to the respective hydraulic cylinder-piston unit providing an operating function of the machine. The individual Microswitches are closed in timed sequence to provide the desired apparatus function, many of which occur simultaneously or in predetermined sequence. Thus, Microswitch groups 240 and 260 are closed in predetermined sequence by a series of rotating discs, mounted upon shafts 256, 266 rotated by motor means not shown. Each disc is provided with a cam surface (not shown) to affect closure of an adjacent Microswitch. Obviously, a number of independently mounted discs or groups of discs can be utilized to define any machine function at a pre-selected time. Also, discs can be employed each rotating at different speeds driven by single motor means, but wherein the different series of discs are mounted on different shafts geared together at desired gear-ratios. In the presently described apparatus, in fact, Microswitch group 260 is acted upon by a series of camming discs of similar diameter revolving at one-half the speed of those which act upon Microswitch group 240.

In initially describing a cycle it shall be assumed that the switch 292 within the photoelectric scanning circuit therefore remains open during the following first cycle of operation so that no correction is applied to the registration correction cylinder 170.

In operation, the following sequences of operations occur:

An upstroke of carriage 150 is initiated: Microswitch 246 is cammed shut by rotation of disc 245 to energize the four-way solenoid valve 146 via energization of circuit 281 shifting the spool of the valve to initiate flow of pressurized hydraulic fluid via line 148 into the bottom of the cylinder-piston unit 160 and causing flow

outwardly from the cylinder-piston unit via flow through line 147. Piston rod 158 is thus projected outwardly and carriage 150 begins its ascent.

Rotation of jaws 110, 120 is initiated simultaneously; Microswitch 261 is cammed shut by rotating disc 259 and double acting solenoid four-way valve 145 activated via energization of circuit 291 to cause flow of pressurized hydraulic fluid via line 144 into hydraulic cylinder-piston unit 136 this causing projection of piston rod 137 so that the rotatable member 140 begins to revolve as the carriage 150 moves upward.

While carriage 150 moves upward the punch mechanism 200, tape advancing mechanism 210, tab cutting mechanism 230 and longitudinal seal unit 270 go through an entire cycle of operation. On initiation of the upstroke holes 9 are punched and tapes 214, 215 are simultaneously advanced by activation of cylinder-piston units 219, 250. Simultaneous activation of cylinder-piston unit 71 produces a longitudinal seam while activation of cylinder-piston unit 270 activates knife 212 of the tab cutting mechanism 230. Prior to the carriage 150 reaching the peak of the upstroke, however, the reverse function of each of these operations also occurs. The punch member 203 of the punch mechanism 200 is withdrawn and simultaneously the tape advancing mechanism 210 is repositioned. The longitudinal seal member 73 of cylinder piston unit 70 is withdrawn and activation of cylinder-piston unit 270 causes retraction of knife 212.

Simultaneously with initiation of the upstroke then punch assembly 200 is activated to punch holes and the tab advancing mechanism advances the tapes: solenoid valve 267 is activated by the camming shut of Microswitch 263 by action of disc 262 this causing activation of circuit 283 to reverse the flow of fluid through cylinder-piston unit 250. Thus, fluid flows into cylindrical piston rod 204 which moves the punch plate 203 upwardly into dies 201, 202 through web 10. Concurrently, fluid flows via line 269 the upper end of cylinder-piston unit 219 causing extension of piston 221 which via action upon clutch 224 activates tape advancing mechanism 210 to advance the tapes.

Simultaneously, and alternately with the punch-tape advance function, a tab seal unit 19 (FIGURE 1) is completed: Rotating disc 264 cams closed Microswitch 265 activating solenoid valve 271 via energization of circuit 284 causing activation of cylinder-piston unit 270 by flow of hydraulic fluid via line 272 into the lower end of the unit to project piston rod 234 which carries knife blade 212 upwardly to sever the tabs and to apply the face of heat sealing member 213 against the tabs and back-up plate 211 to form straw seals 19. Unit then also retracts before peak of upstroke.

Simultaneously, a longitudinal sealing of the tube is completed by action of cylinder piston unit assembly 70: Microswitch 248 is cammed shut by rotation of disc 247 to activate through circuit 285 the four-way solenoid valve 76 causing flow of hydraulic fluid into cylinder-piston unit 71 via line 74 causing projection of the piston 72 which applies member 73 against the web 10 to heat seal together the longitudinal edges.

Near the peak of the upstroke punch assembly 200 and tape advancing mechanism 210 is repositioned via action upon one-way clutch 220: solenoid valve 267 is again activated by the opening of Microswitch 263 and de-energizing of circuit 283 so that the spool is shifted to reverse the flow of pressurized hydraulic fluid. Fluid thus flows into cylinder-piston unit 250 via line 268 which retracts piston rod 204 and, simultaneously, withdraws piston rod 221 of cylinder-piston unit 219 so that the latter through action of one-way clutch assembly 224 is repositioned.

The tab seal member 213 simultaneously is withdrawn: current ceases to flow in circuit 284 because the camming

action of disc 264 upon Microswitch ceases and Microswitch 265 permitted to open. When this happens the spool of the spring loaded solenoid valve 271 shifts and causes reversal of fluid flow into the cylinder 270 via line 273 and outwardly through line 272 so that piston 273 is withdrawn, this in turn withdrawing tab seal member 213.

Simultaneously, the longitudinal sealing member 73 is withdrawn: current ceases to flow in circuit 285 by virtue of the opening of Microswitch 248 the camming action thereupon the disc 247 having ceased. This action causes a shifting of the spool of the spring loaded solenoid valve 76 to reverse the flow of hydraulic fluid to piston unit 71 via line 75 to produce a withdrawal of longitudinal sealing member 73.

At the peak of the upstroke rotatable member 140 and consequently jaws 110, 120 having completed a full 90 degree rotation, disc 249 cams shut Microswitch 251 to energize circuit 287, this triggering four-way solenoid valve 134 causing flow of hydraulic fluid into the cylinder-piston units 122, 123, 124 causing projection of rod 121 and withdrawal of rods 103, 104 to affect closure of jaws 110, 120 upon the tube transversely sealing and severing the package from the tube.

The upward movement of carriage 150 ends and the carriage begins its working stroke: current ceases to flow in circuit 281 as Microswitch 246 opens upon the ceasing of the camming action thereupon by disc 245. The spool of spring loaded solenoid valve 146 then shifts and the direction of flow of hydraulic fluid to main cylinder 160 is reversed. The movement of carriage 150 is thus initiated and moved downwardly by flow of fluid into cylinder-piston unit 160 via line 147 outwardly via line 148. This action draws the tube downwardly and web 10 is pulled through the machine.

The filling of the tubular blank is initiated and completed with each single projection or withdrawal of piston rod 36. Thus, as fill tube 44 begins a rotation the openings of disc 45 and those of nozzle 48 are brought into alignment and flow of liquid through fill tube 44 is begun. As piston rod 36 continues the openings come into full alignment, one set of openings with the other, and then move out of alignment. Flow then diminishes and finally stops when the openings are no longer aligned.

All of the operating variables of the fill system are readily controllable. Thus, for a liquid of any given viscosity the fill tube and openings therein can be properly sized. Moreover, the desired time of delivery is readily provided by sizing lines 32, 33, to cylinder-piston unit 31 so that the openings remain open for the desired interval. An adjustable dialing system can even be employed in lines 32, 33 if desired. Furthermore, a substantially constant pressure is provided upon the liquid.

A major advantage of this liquid free system is that an accurate metered quantity of liquid is provided to the blank and seal contamination is avoided. There is, in fact, even no contamination caused from splashing or blowing of liquid upon the seals because very low pressure is generally required to provide a rapid and smooth delivery of liquid or other fluent substance to the blank.

For most liquid the tubular blank is filled with the desired quantity of liquid long prior to completion of the carriage downstroke. If desired, however, the entire carriage cycle from initial closing of jaws 110, 120 can be used to affect filling of the tubular blank.

Upon arrival of carriage 150 at the bottom of its working stroke the grasp of jaws 110, 120 upon the tube and the sealed liquid filled package is released. This happens when solenoid valve 34 and its circuit 287 is de-energized by the opening of Microswitch 251 by the ceasing of the camming action by disc 249.

As the bottom of the downstroke rotation of platform 130 and consequently jaws 110, 120 are initiated.

While carriage 150 dwells at the bottom of its downstroke disc 241 cams shut Microswitch 242 energizing circuit 289 this in turn pulsing circuit 282, through connec-

tion with Microswitch 261, this shifting the spool of solenoid valve 145 causing flow of hydraulic fluid into cylinder-piston unit 136 via line 143 causing withdrawal of piston rod 137 to produce rotation of member 140. It is noted that Microswitch 242 is closed every single machine cycle and that Microswitch 261 directs the pulse alternately to either side of solenoid valve 145. This then results in a single projection or withdrawal of piston rod 137 for each cycle. The foregoing cycle is then repeated ad infinitum.

The web punch assembly 200 and tab forming and advancing mechanism 210 and severing mechanism 230, it is again noted, are activated only during alternate cycles—i.e. only once for every two cycles of all other operations. Hence, the group of Microswitches 250 are activated by a series of cammed discs mounted on shaft 266 which rotate at only one-half the speed of those discs of similar diameter mounted on shaft 266 which activate Microswitch group 240. Obviously, however, this ratio is selected only because two straw seals 19 are formed simultaneously and hence provide straw seal units for two packages.

A feature of this invention is that a correction is periodically applied to assure a proper predetermined package length. In an operation wherein packages were continuously formed and no effort made to closely control package length the lengths of the different packages would be quite variable and would make centering of written descriptions, trademarks, brandnames and the like normally appearing on a package difficult or impossible. To provide such web registration and control a photoelectric control system shall now be defined which applies periodic corrections to the length of the carriage stroke.

The stroke of the carriage 150 is deliberately set to slightly overtravel the desired package length e.g. by a few thousandths of an inch. The overtravel thus causes all package lengths to be slightly longer than the preselected optimum and there is no drift to a package of length shorter than this optimum. Over a plurality of cycles, however, there is an accumulation of overfeeds and the light projected from photoelectric eye 20 senses a change in the positioning of web 10 when it is scanned at a preselected time. When this happens the light is e.g. transmitted, diffracted or otherwise changed so that the intensity of the reflected beam is altered. Sensing such change a correction is applied upon the registration control cylinder 170 to project a piston 165 into the path of the piston 159 to shorten the carriage stroke. This then brings the web 10 back into registration.

While proper package length is being maintained within the desired ranges the light signal or beam from the photoelectric cell 20 (circuitry not shown) impinges upon the web 10 and does not "see" an indicia mark at a preselected time when web 10 lies motionless. Because of the overtravel, however, the mark eventually is aligned with the beam and a different portion of the light is reflected back to the receiver (not shown) of the photoelectric cell 20 when the scanning takes place. When this condition occurs the switch 292 within the relay control box 290 closes to complete a circuit which is open or closed depending on whether or not Microswitch 255 is open or closed. When Microswitch 255 is cammed closed during the carriage upstroke by action thereupon of disc 254 circuit 293 is activated and the spool of solenoid valve 197 is shifted and line 196 opened to permit flow of hydraulic fluid into the bottom of registration correction cylinder 170 causing projection of vertical cylinder 165 upwardly into cylinder barrel 178 to a predetermined extent, which is some small multiple of the distance of overtravel. Thus, the face 178 of the vertical cylinder 165 is projected into barrel 055 to shorten the effective length of the stroke of cylinder piston rod 158 on the next succeeding downstroke by shortening its downward movement by a predetermined amount. After the shortened downstroke has been affected switch 253 is cammed closed to pulse the opposite side of solenoid valve 197 to open hydraulic line 196 to sump. The pulsing of

this return solenoid on valve 197 is made every machine cycle at this point irrespective of whether a shortened stroke or correction has been made on the previous downstroke. The correction is applied for additional cycles of the machine, as necessary, until the eye 20 no longer registers upon the indicia. When correction no longer becomes necessary, solenoid valve 197 again pulses line 196 to sump, and when carriage 150 begins its downstroke and piston 159 contacts face 178 of vertical drive cylinder 165 the piston 158 forces the vertical cylinder 165 back into its unextended position.

Having described the invention, that which is claimed is:

1. In a machine for forming packages from a fluent substance and a continuous flat flexible web wherein is included means for providing several sequences of operations including forming a tube from the web by shaping it about a mandrel, longitudinally and transversely sealing the tube to form a blank, filling the blank with the fluent substance to be packaged and again transversely sealing the tube to enclose the package and then severing the package from the web, the combination comprising:

a carriage carrying a rotatable platform upon which is mounted a pair of hydraulically actuatable clamping jaws,

said carriage being mounted by connections at one side thereof to the terminal ends of a pair of posts, the opposite ends of said posts being affixed to a yoke assembly which is in turn mounted via a piston rod upon the piston of a hydraulic cylinder-piston unit operatively associated with a solenoid actuated directional flow valve for initiating and reversing a flow of hydraulic fluid to and from said cylinder-piston unit to produce projection and retraction of the piston and vertical reciprocation of the carriage,

said clamping jaws being operatively associated with pistons of hydraulic cylinder-piston units in turn operatively associated with solenoid actuated directional flow valves for initiating and reversing the flow of hydraulic fluid to and from said cylinder-piston units; to close said jaws upon the tube for transversely sealing same and for moving the tube downwardly upon the forming mandrel as the carriage descends; and to open said jaws at the termination of the carriage downstroke after the tube has been progressed through the machine and the carriage is ready to ascend.

said rotatable platform being operatively affixed to the piston of a cylinder-piston unit in turn operatively associated with a solenoid actuated directional flow valve for initiating and reversing the flow of hydraulic fluid to and from said cylinder-piston unit to produce movement of said piston so that the platform and consequently the clamping jaws mounted thereupon can be rotated through an angle on the upward movement of said carriage,

a hydraulic supply system including a hydraulic fluid reservoir, a pump having an intake side from the reservoir and an exhaust side to manifold lines connecting said hydraulic fluid supply with the aforesaid solenoid actuated directional flow valves, and an automatic timer device operatively associated through electrical circuits with said solenoid actuated directional flow valves to coordinate the machine functions in predetermined sequence by providing hydraulic fluid to the respective cylinder-piston units for conversion of the hydraulic power into mechanical movement at the appropriate time for providing the several operating functions of the machine.

2. In a machine for forming packages from a fluent substance and a continuous flat flexible web wherein is included means for providing several sequences of operations including forming a tube from the web by shaping it about a mandrel, longitudinally and transversely sealing the tube to form a blank, filling the blank with the

fluent substance to be packaged and again transversely sealing the tube to enclose the package and then severing the package from the web, the combination comprising:

a carriage carrying a rotatable platform upon which is mounted a pair of oppositely disposed hydraulically actuatable clamping jaws,

said carriage being mounted in cantilever fashion by connections at one side thereof upon the ends of a pair of posts slidably mounted within fixed bearing members constituting a portion of the machine frame, the opposite ends of said posts being affixed to a yoke assembly which is in turn mounted upon the piston of a hydraulic cylinder-piston unit which is in turn operatively associated with a solenoid actuated directional flow valve for initiating and reversing a flow of hydraulic fluid to and from said cylinder-piston unit to produce projection and retraction of the piston and vertical reciprocation of the carriage,

each of said clamping jaws being also operatively associated with the piston of a hydraulic cylinder-piston unit these units being in turn operatively associated with a solenoid actuated directional flow valve for initiating and reversing the flow of hydraulic fluid to and from said cylinder-piston units; to close said jaws upon the tube for transversely sealing same and for moving the tube downwardly upon the forming mandrel as the carriage descends; and, to open said jaws at the termination of the carriage downstroke after the tube has been progressed through the machine and the carriage is ready to ascend,

said rotatable platform being operatively affixed to the piston of a cylinder-piston unit in turn operatively associated with a solenoid actuated directional flow valve for initiating and reversing the flow of hydraulic fluid to and from said cylinder-piston unit to produce movement of said piston so that the platform and consequently the jaws mounted thereupon can be rotated through an angle up to about 90° upon upward movement of said carriage,

a longitudinal seal for sealing together the edges of the web to form a tube, said longitudinal seal being operatively associated with the piston of a cylinder-piston unit which is in turn operatively associated with a solenoid actuated directional flow valve for transmitting hydraulic fluid to and from said cylinder-piston unit to project and retract the seal from the web edges,

a valved fill tube operatively associated with the piston of a hydraulic cylinder-piston unit which is in turn associated with a solenoid actuated directional flow control valve for initiating and reversing the flow of hydraulic fluid to and from said cylinder-piston unit to open and close the valve of said tube to charge the fluent substance into the tubular blank, a hydraulic supply system including a hydraulic fluid reservoir, a pump having an intake side from the reservoir and an exhaust side to manifold lines connecting said hydraulic fluid supply with the aforesaid solenoid actuated directional flow valves,

an automatic timer device providing a series of rotating discs camming surfaces which open and close Micro-switches within electrical circuits to energize and de-energize the circuits associated with said solenoid actuated directional flow valves to activate same in predetermined sequence for providing hydraulic fluid to the cylinder-piston units for conversion of the hydraulic power into mechanical movement at the appropriate time to provide the several operating functions of the machine.

3. A machine for forming a filled package comprising: means supplying a web of material, means to shape said web into a tube, means to longitudinally seal said tube,

**17**

a reciprocally mounted carriage, a pair of clamping jaws rotably mounted on said carriage, means to supply fill material into said tube when one end of said tube has been sealed and a hydraulic control system to sequentially close said clamping jaws on said tube to form a first seal, 5  
 move said carriage downwardly, open said clamping jaws to release said tube, move said carriage upwardly while rotating said clamping jaws and closing said clamping jaws again to provide a second seal on said tube at an angle to said first seal.

10

**18**

4. The structure of claim 3 wherein said clamping jaws are rotated approximately 90° so that said second seal is approximately perpendicular to said first seal.

**References Cited by the Examiner**

## UNITED STATES PATENTS

3,228,170 1/1966 Eisenstadt ----- 53—182

GRANVILLE Y. CUSTER, JR., *Primary Examiner.*