Aug. 6, 1935. H. E. DIETRICH 2,010,626

TUBE PACKAGING MACHINE AND METHOD

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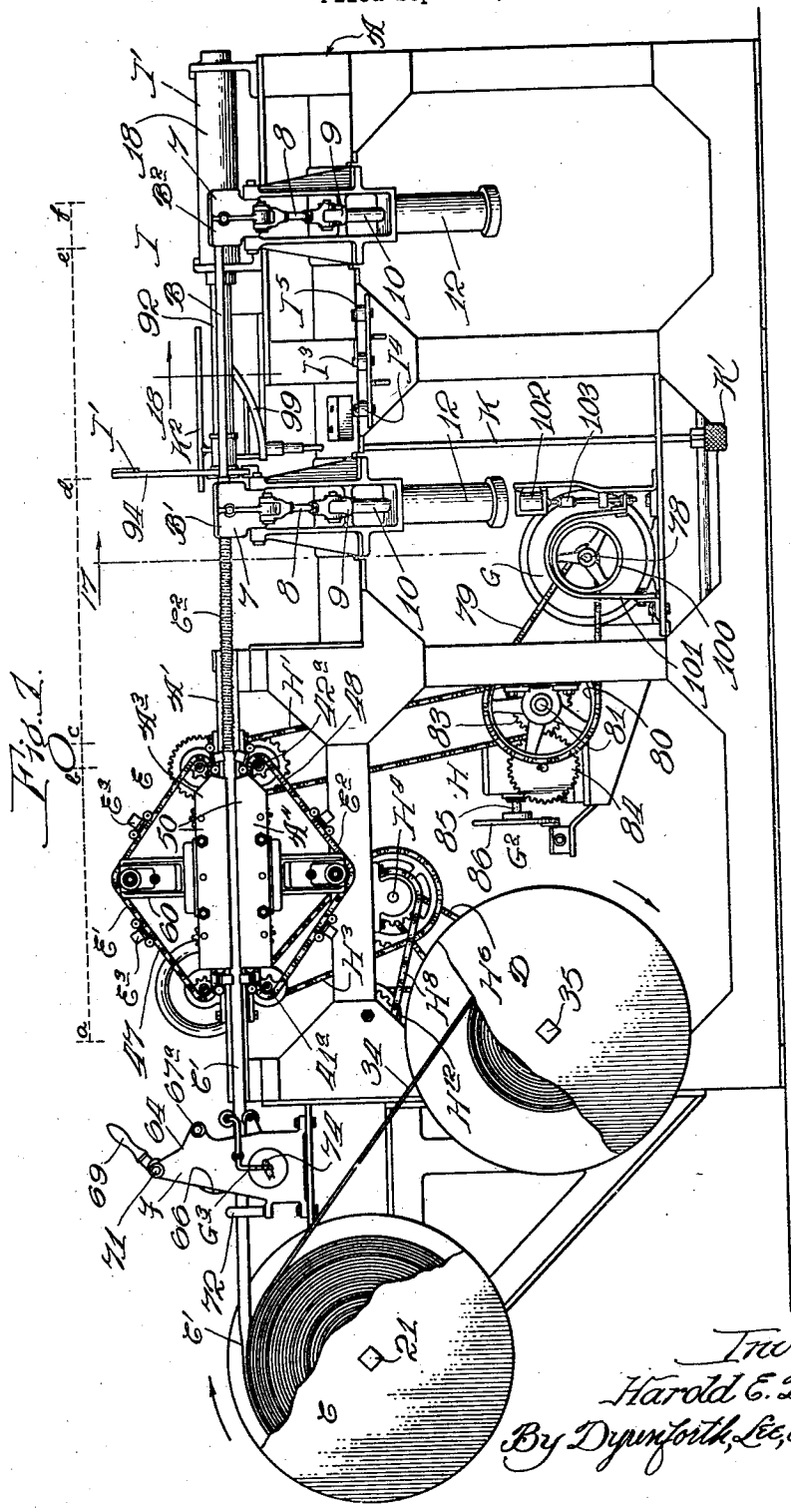

Fig. 1.

Inventor:
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TUBE PACKAGING MACHINE AND METHOD

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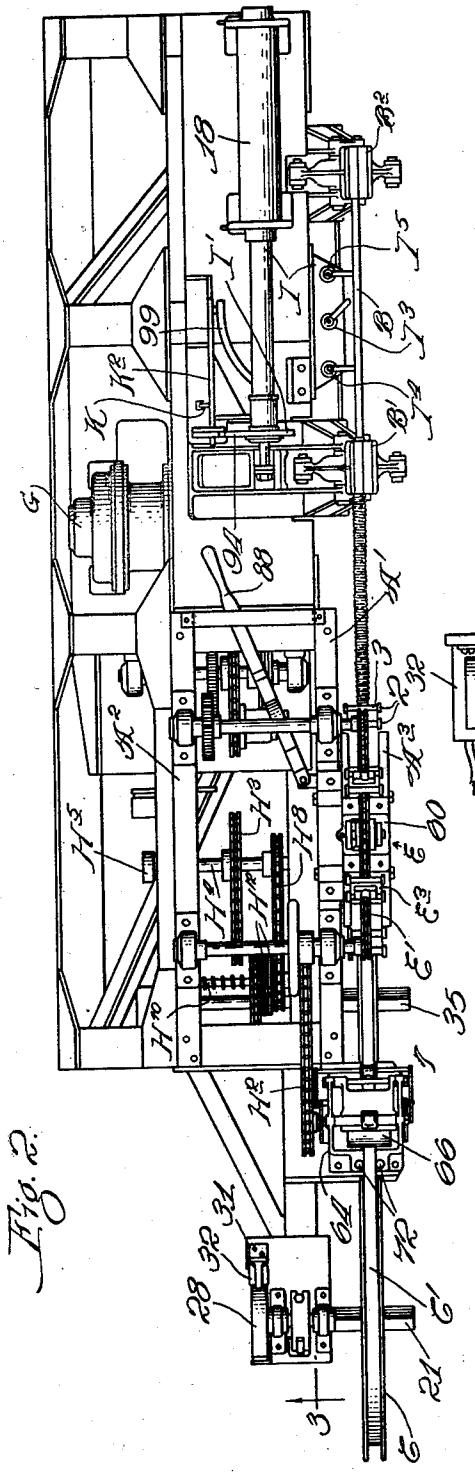

Fig. 2.

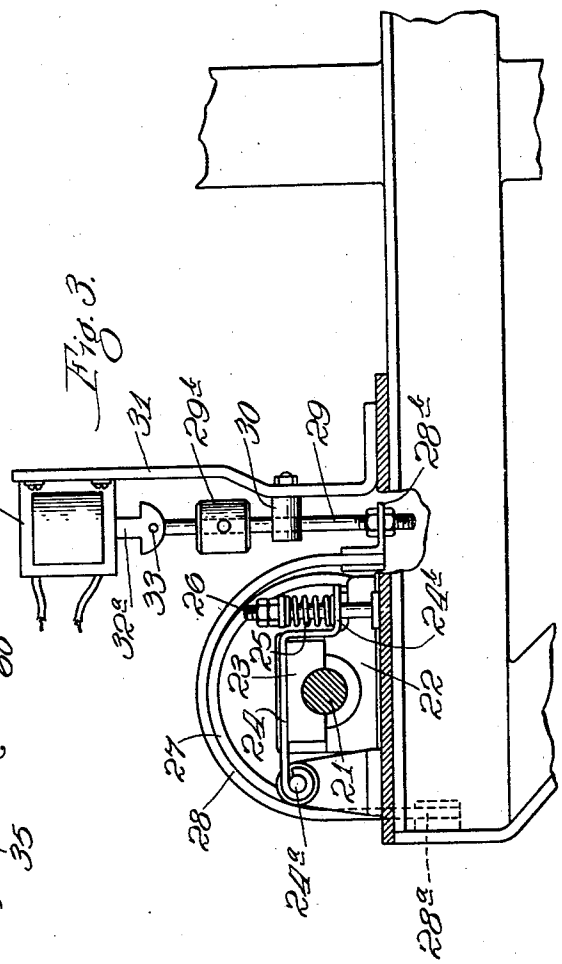

Fig. 3.

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Aug. 6, 1935. H. E. DIETRICH 2,010,626

TUBE PACKAGING MACHINE AND METHOD

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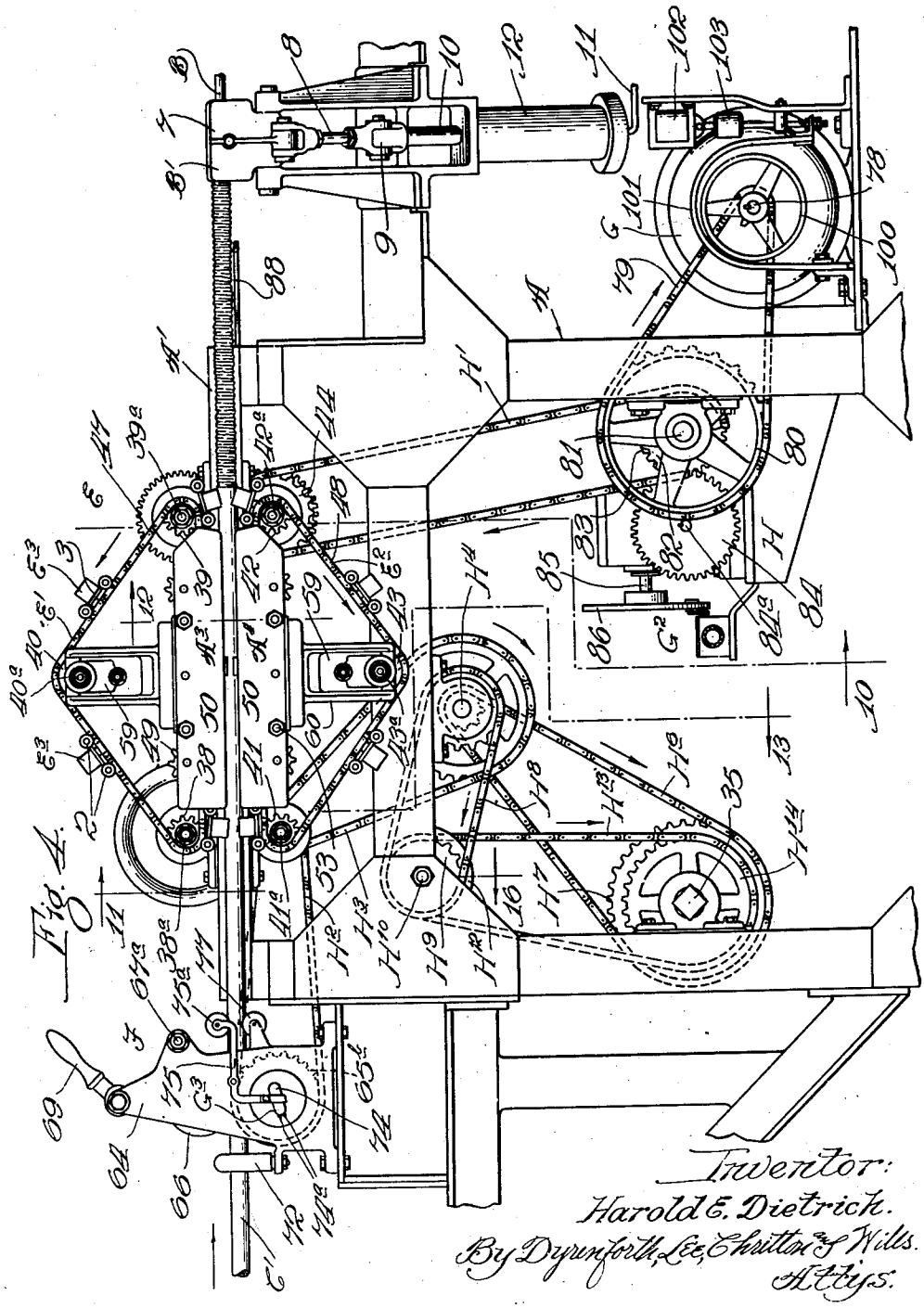

Fig. 4.

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Aug. 6, 1935. H. E. DIETRICH 2,010,626

TUBE PACKAGING MACHINE AND METHOD

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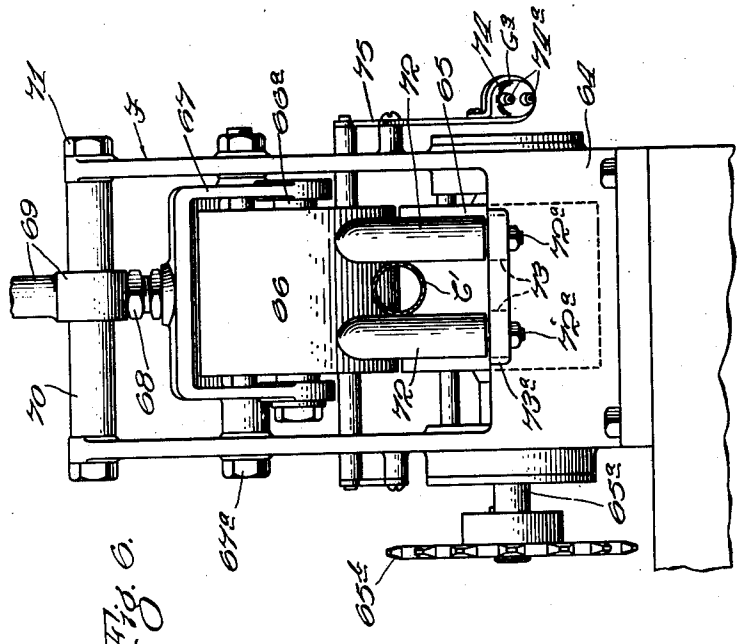

Fig. 6.

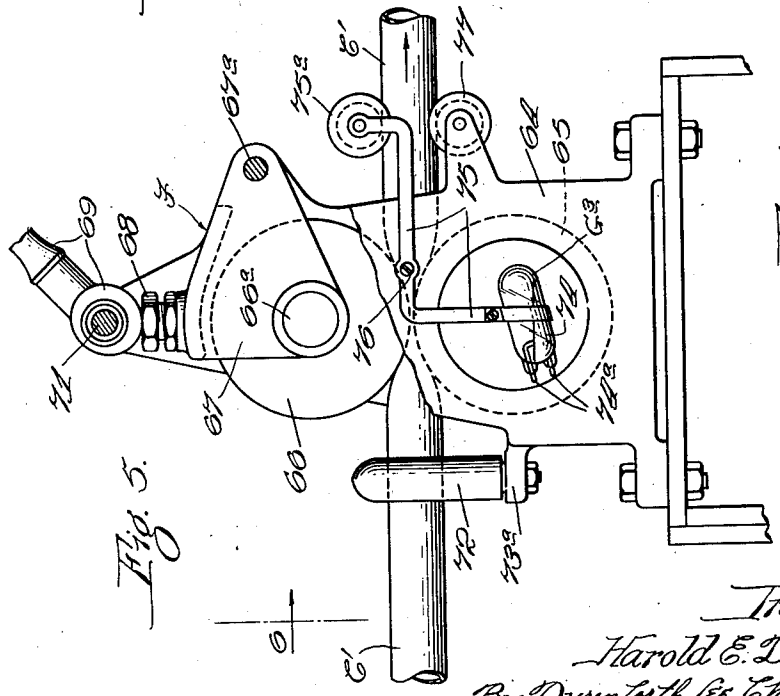

Fig. 5.

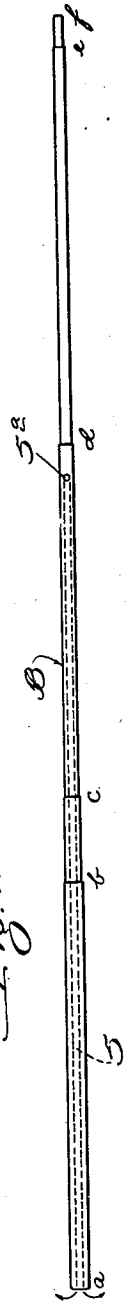

Fig. 4.

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TUBE PACKAGING MACHINE AND METHOD

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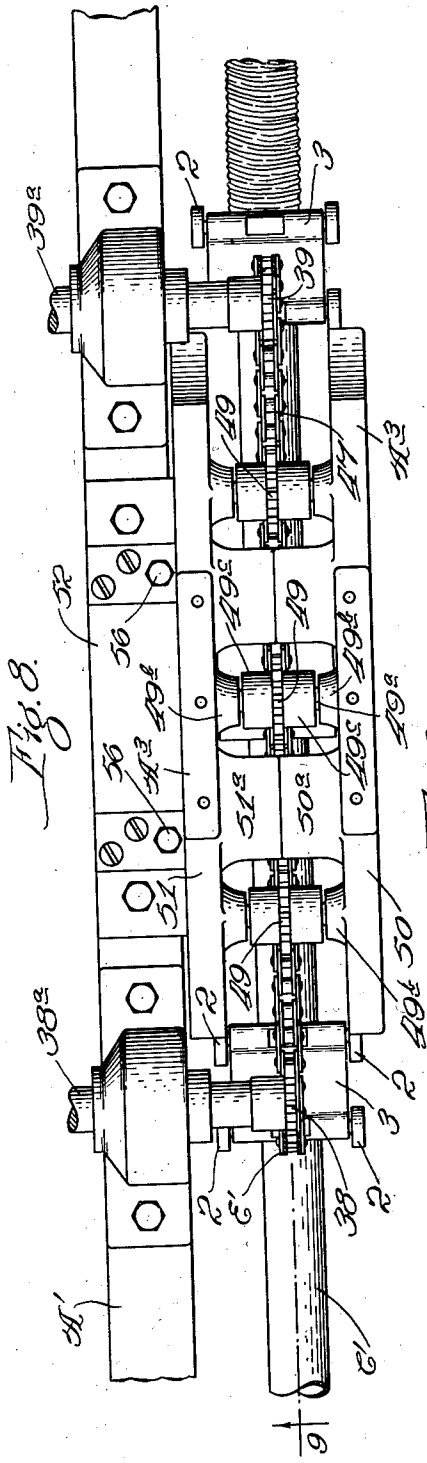

Fig. 8.

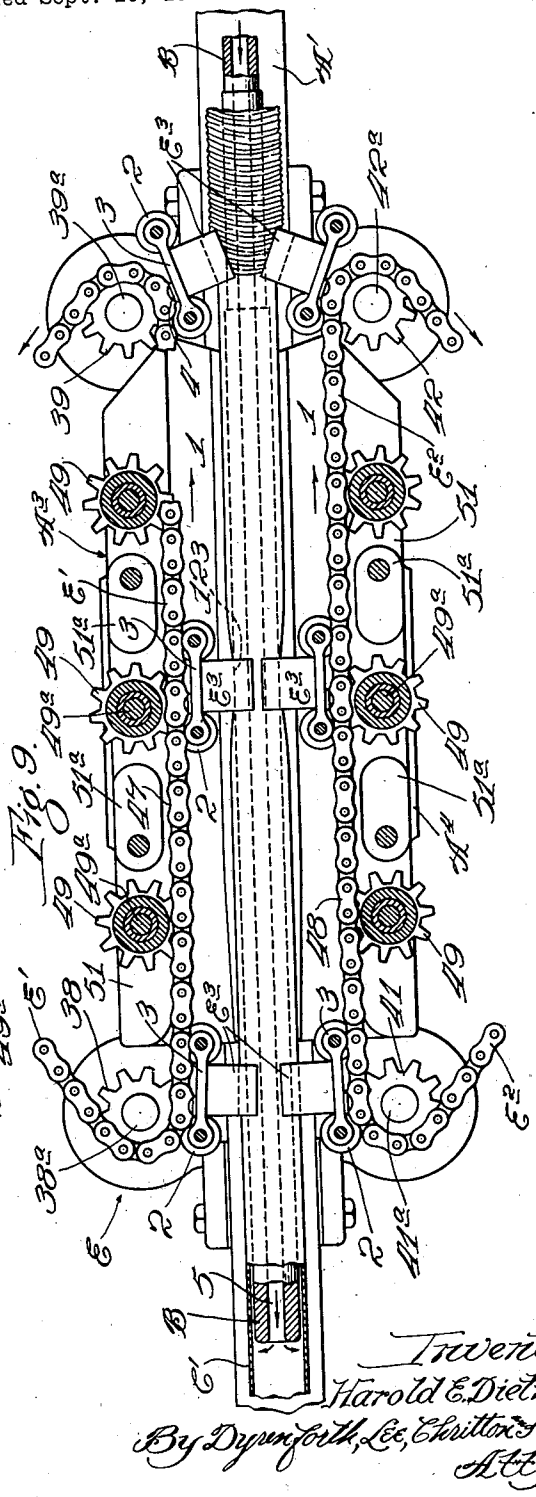

Fig. 9.

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TUBE PACKAGING MACHINE AND METHOD

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Fig. 12.

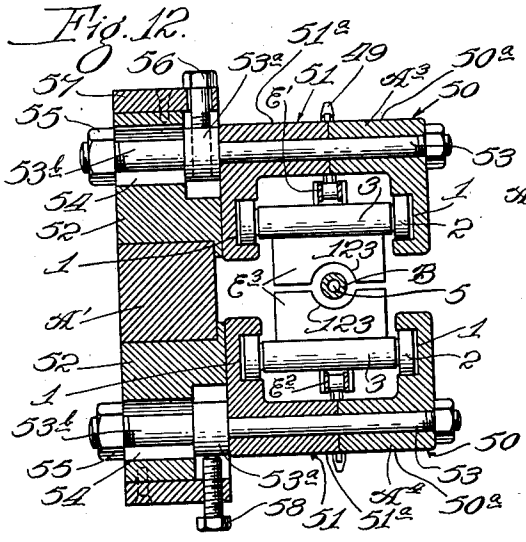


Fig. 10.

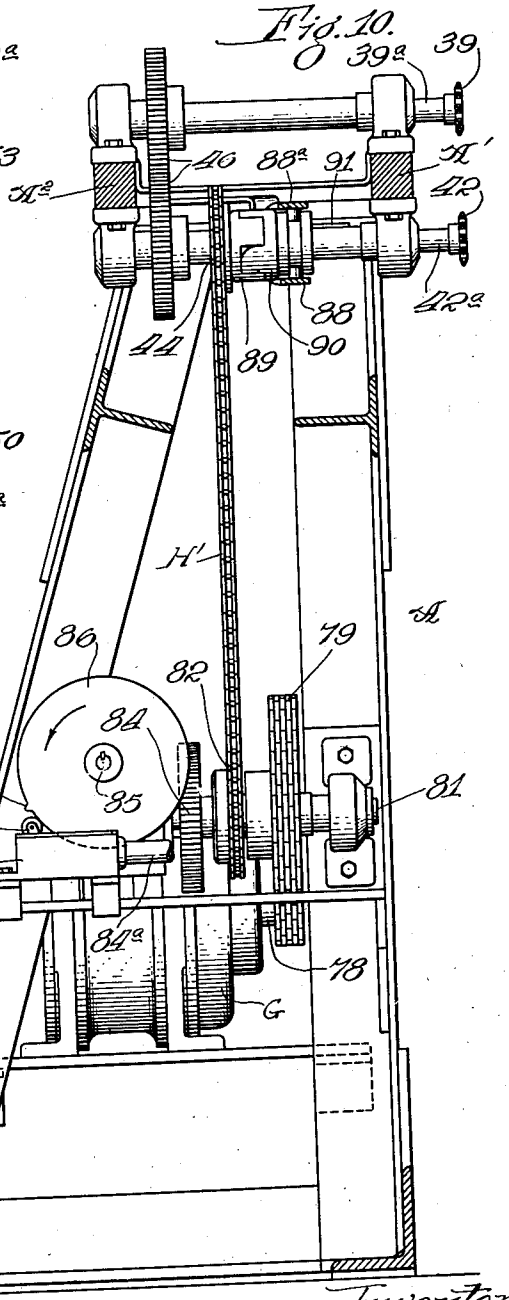
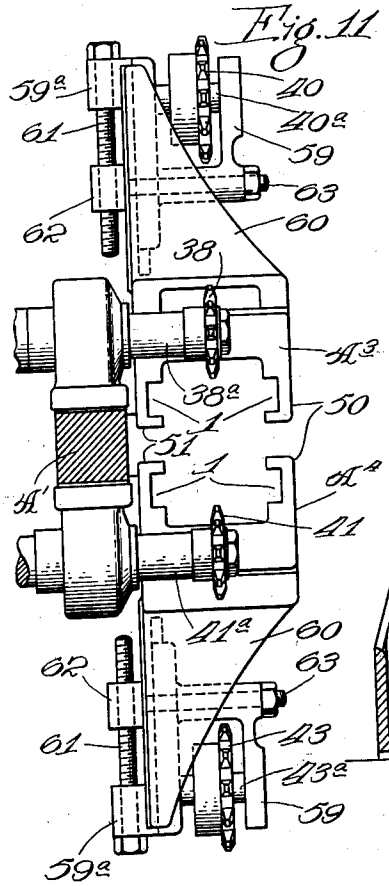


Fig. 11



Inventor:
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Aug. 6, 1935. H. E. DIETRICH 2,010,626

TUBE PACKAGING MACHINE AND METHOD

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Fig. 13.

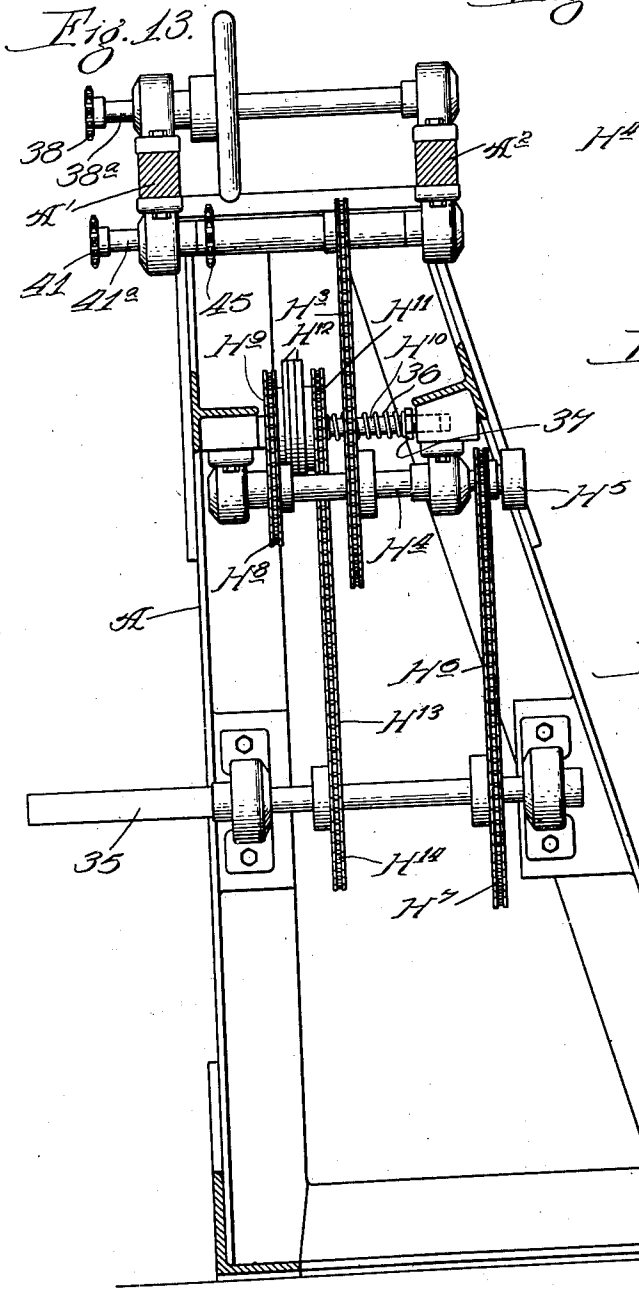


Fig. 14.

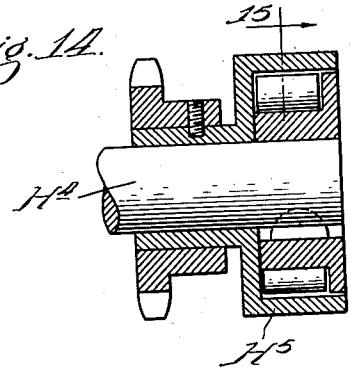


Fig. 15.

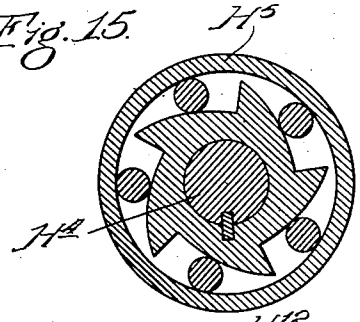
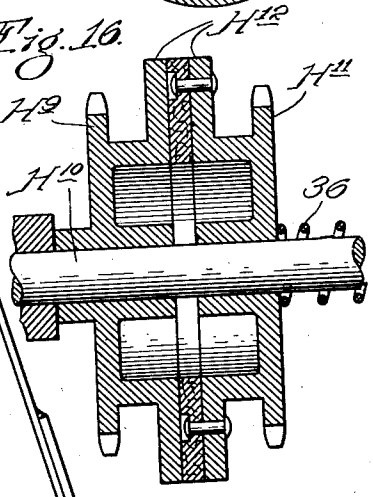


Fig. 16.



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Aug. 6, 1935. H. E. DIETRICH 2,010,626

TUBE PACKAGING MACHINE AND METHOD

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Fig. 17.

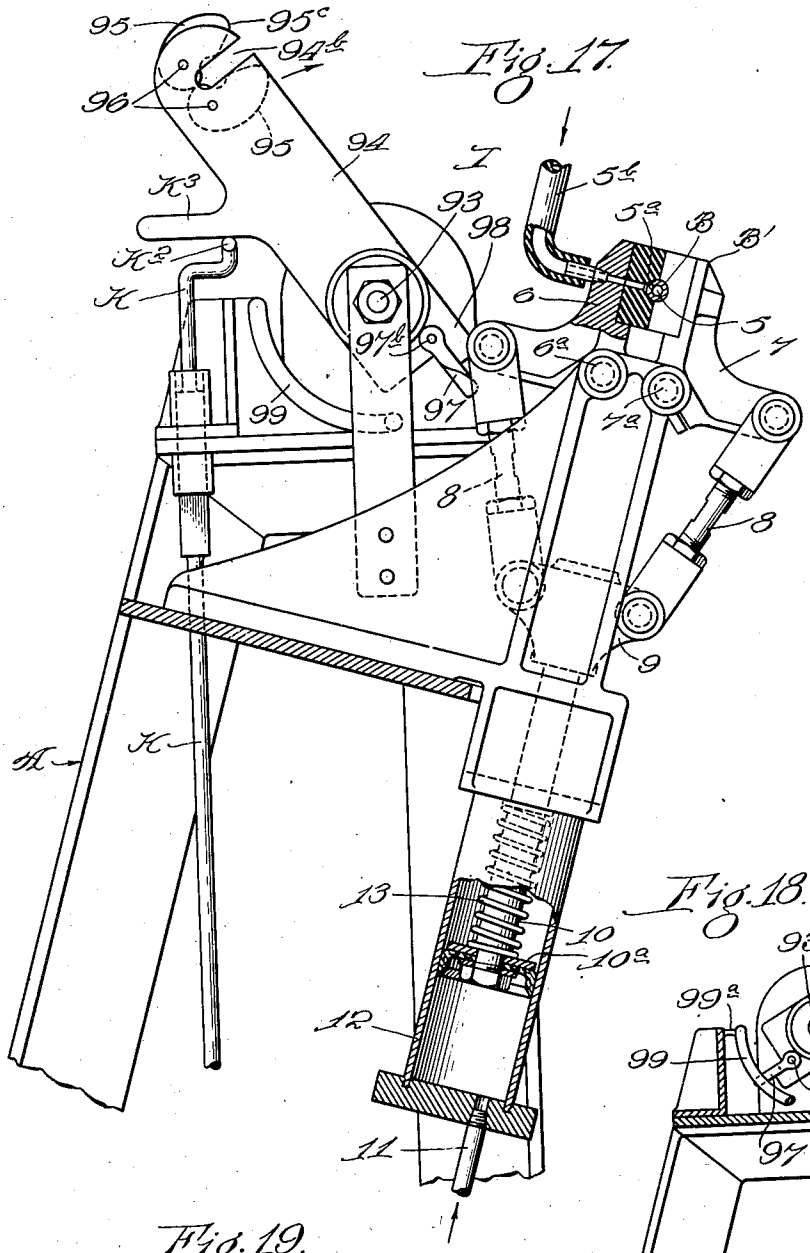


Fig. 18.

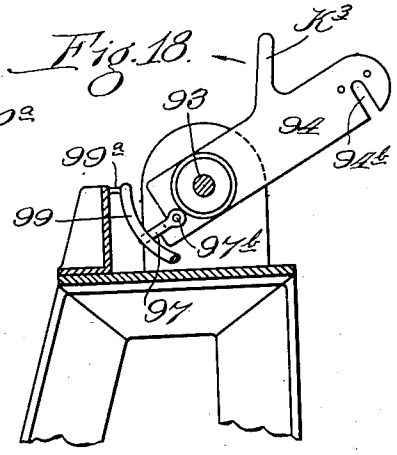
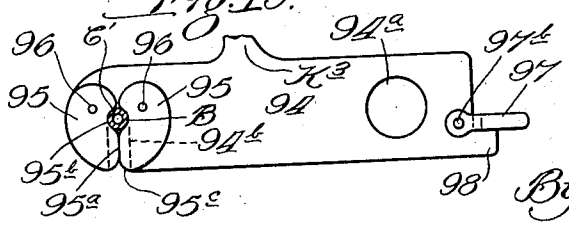


Fig. 19.



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Aug. 6, 1935. H. E. DIETRICH 2,010,626

TUBE PACKAGING MACHINE AND METHOD

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Fig. 20.

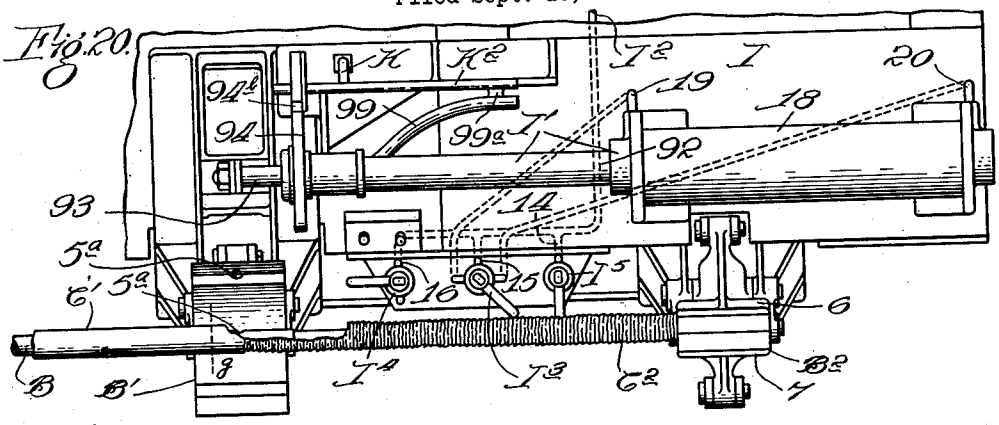


Fig. 21.

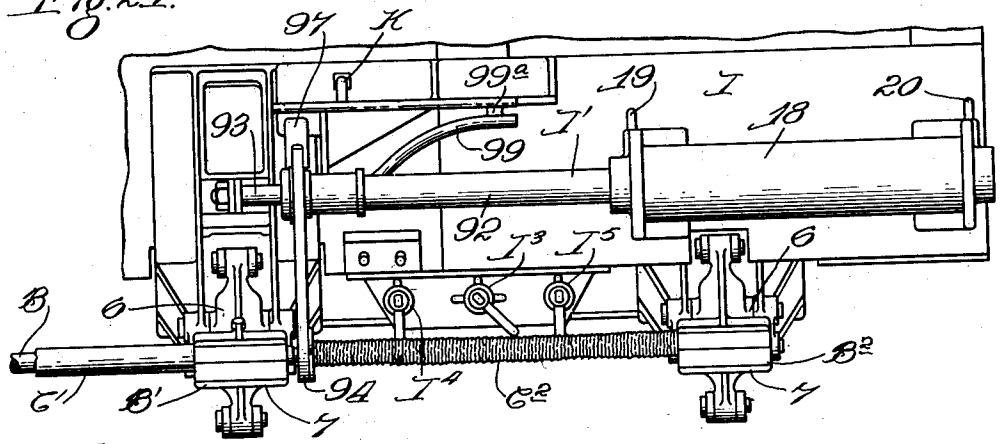
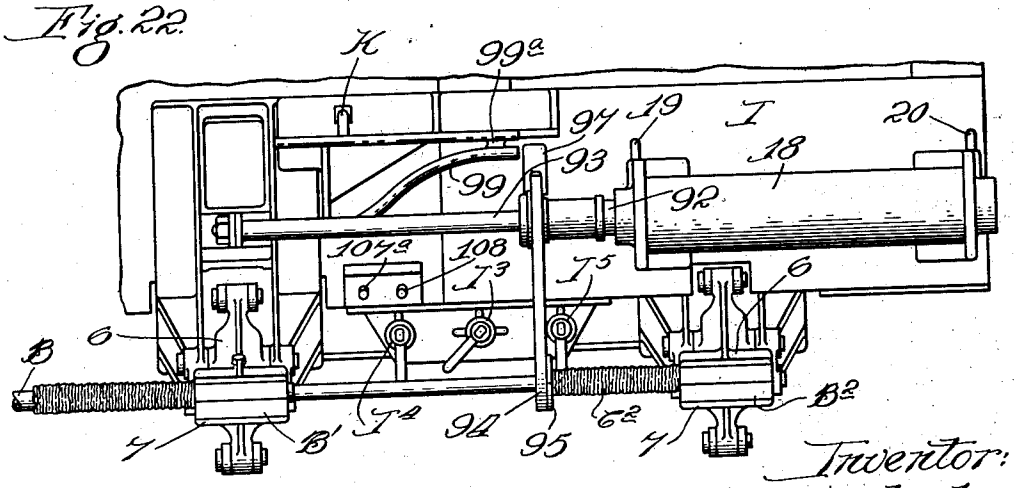


Fig. 22.



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Aug. 6, 1935. H. E. DIETRICH 2,010,626

TUBE PACKAGING MACHINE AND METHOD

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Fig. 23.

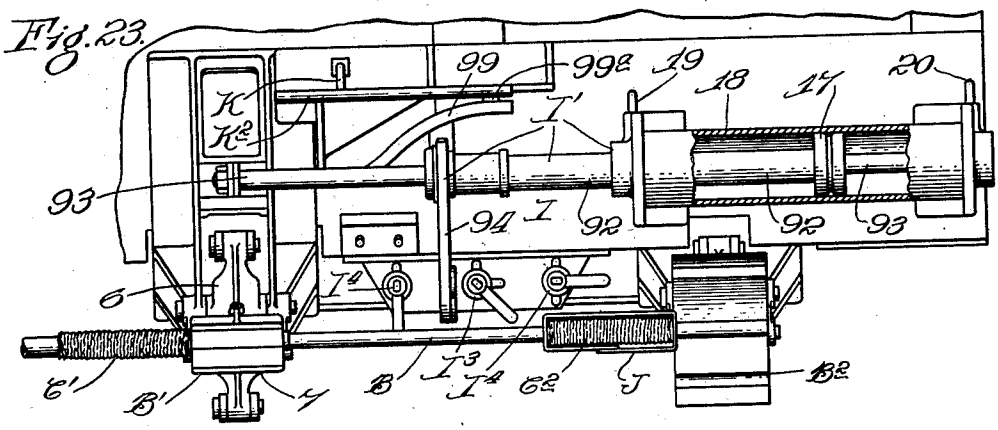


Fig. 24.

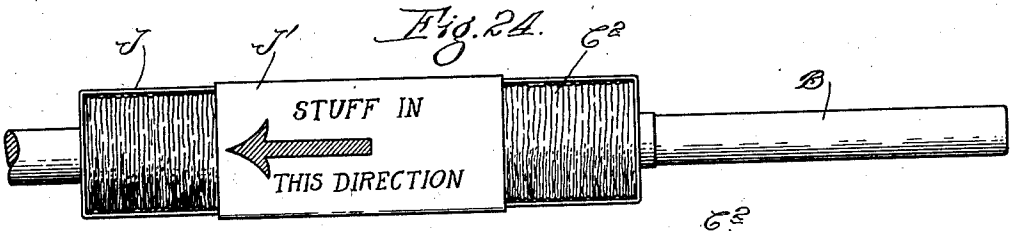


Fig. 25.

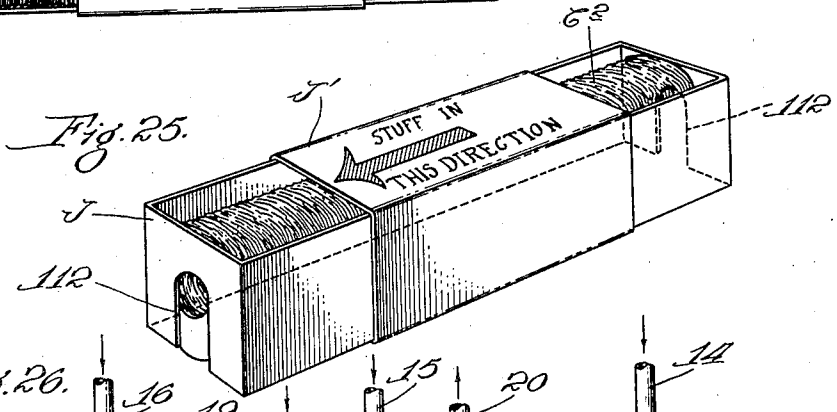
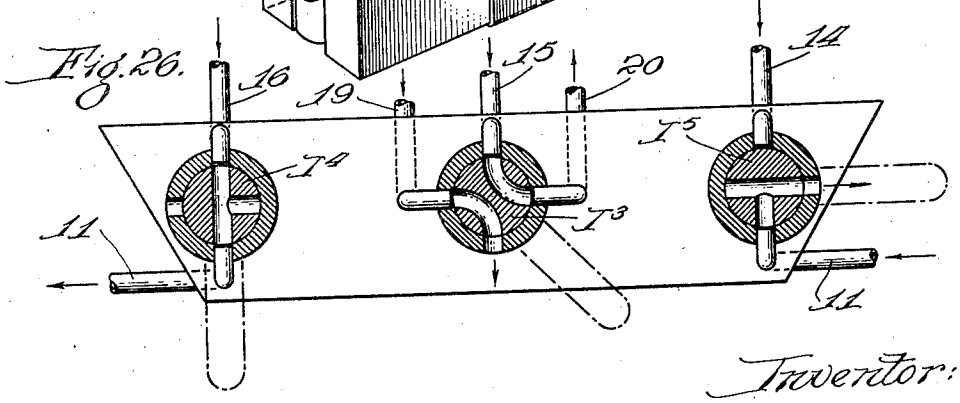


Fig. 26.



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TUBE PACKAGING MACHINE AND METHOD

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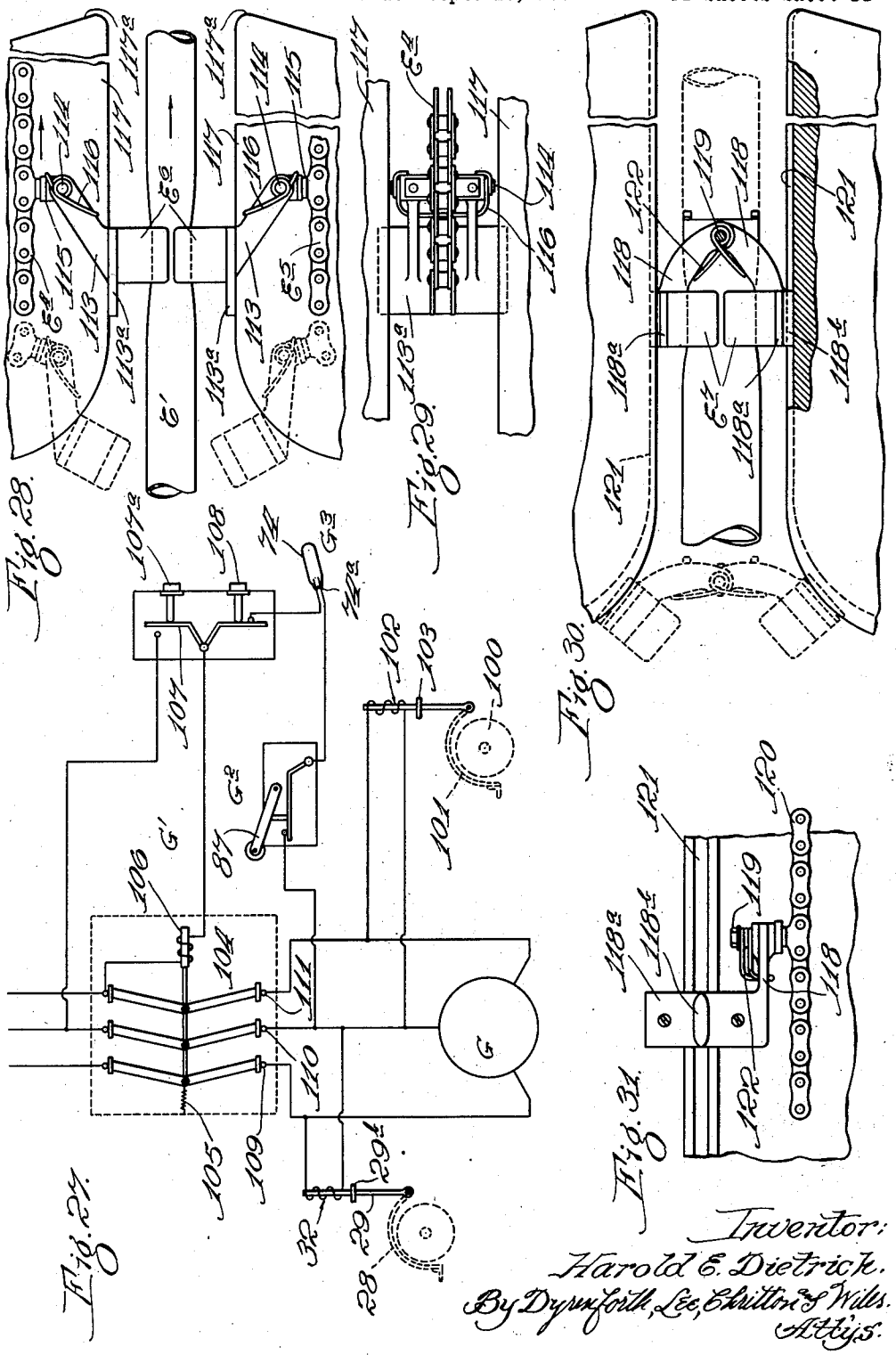

Fig. 28.

Fig. 29.

Fig. 30.

Fig. 31.

Fig. 27.

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Patented Aug. 6, 1935 2,010,626

UNITED STATES PATENT OFFICE

2,010,626

TUBE-PACKAGING MACHINE AND METHOD

Harold E. Dietrich, Chicago, Ill., assignor to The Visking Corporation, Chicago, Ill., a corporation of Virginia

Application September 10, 1934, Serial No. 743,476

53 Claims. (Cl. 17—45)

This invention relates particularly to a tube-packaging machine and method.

The invention is particularly useful for the purpose of shirring, compressing, and packaging flexible tubes, such as cellulose tubes, which are now largely used as artificial sausage-casings.

The primary object of the invention is to provide for the rapid shirring and packaging of flexible tubes in such form that the tubes can be handled, shipped, and applied to the horn of a sausage-stuffing machine in the most expeditious and economical manner.

Seamless artificial sausage-casings of the character mentioned are now being manufactured on a large scale by a well-known method. Preferably, this is accomplished by extruding a proper viscose solution through an annular orifice into a coagulating and regenerating bath. The regeneration (conversion to cellulose or cellulose hydrate) may be accomplished in the extrusion-bath, or the tube may be drawn through a succeeding regenerating bath, or baths, thence through a purifying bath, and finally through a bath containing a small percentage of glycerine, or other hygroscopic agent. This is followed by a drying operation, and ordinarily the dried tube is wound in flat condition on a reel. According to this process, a minute percentage of glycerine remains in the walls of the tube and attracts enough moisture so that the tube is sufficiently soft and pliable, although dry to the feel.

By the method referred to, a seamless cellulose tube which is several hundred feet in length may be loaded onto a single reel. It is desirable to cut this into suitable length for use in packing houses, and package these lengths in suitable form for handling, transportation, and use in the packing houses. This purpose is accomplished by the present invention.

The invention is illustrated in a preferred embodiment in the accompanying drawings, which illustrate the method employed and the preferred embodiment of a machine well adapted to the practice of such method.

It may be stated, preliminarily, that, according to the preferred practice, a continuous tube is fed from a suitable source of supply onto a floating mandrel which is releasably supported at one or more points (preferably at two points by releasable clamping-devices); a gaseous medium is introduced through the mandrel to inflate the portion of the tube which is presently to be shirred; the shirring operation is performed on the inflated portion of the tube by means of orbitally moving shirrers which indent the inflated tube at spaced points and carry the tube forward against an abutment (one of the releasable clamps of the mandrel); the shirred-length of the tube is then moved forward by the operator (after releasing the clamp just mentioned) onto the succeeding portion of the mandrel and the tube is severed at the rear of the shirred portion; a fresh shirring operation immediately begins upon a fresh length of the tube; the advanced shirred-length, while still on the mandrel, is subjected to longitudinal compression against an abutment (the clamp at the extreme advance end of the mandrel); and the last-mentioned clamp is released by the operator and a cardboard container is applied to the shirred, compressed tube-length while it still remains on the mandrel, after which the packaged tube is removed from the advance end of the mandrel.

Preferably, the feeding-and-shirring mechanism is driven by an electric motor, and magnetically controlled brakes are employed to overcome the momentum of the reel and the motor when the circuit is broken to stop the motor. Also, preferably, the clamps mentioned are pneumatically actuated and the compressor is pneumatically actuated.

In the drawings—

Fig. 1 is a side elevational view of the improved machine, certain parts being broken away; Fig. 2, a plan view of the same; Fig. 3, an enlarged broken vertical sectional view taken as indicated at line 3 of Fig. 2; Fig. 4, a broken side elevational view, showing particularly the shirring mechanism, feed-means at the left thereof, and the first mandrel-clamp at the right; Fig. 5, an elevational view of the tube-feeding rolls and an associated circuit-controlling device; Fig. 6, a view taken as indicated at line 6 of Fig. 5; Fig. 7, a view of the mandrel employed; Fig. 8, a broken plan view illustrating the shirring mechanism; Fig. 9, a broken vertical sectional view taken as indicated at line 9 of Fig. 8; Figs. 10, 11, 12, and 13, transverse vertical sections taken as indicated at corresponding lines of Fig. 4; Fig. 14, a broken sectional view of an overrunning clutch forming a portion of one of the drives which actuates a re-wind reel; Fig. 15, a section taken as indicated at line 15 of Fig. 14; Fig. 16, a sectional view of a friction-clutch through which the re-wind reel normally is actuated; Fig. 17, a broken transverse vertical section taken as indicated at line 17 of Fig. 1, this view showing one of the mandrel-clamps and showing, in retracted position, a movable abutment which serves, when in operative position, to compress the shirred tube-length; Fig. 18, a view of the movable abutment mentioned as it is being automatically thrown away from the mandrel and into the inactive position; Fig. 19, an elevational view of the movable abutment mentioned; Fig. 20, a broken plan view showing the compressor and attendant parts and showing brokenly the shirred portion of the tube ready to be severed from the succeeding portion at the dotted line; Fig. 21, a similar view showing the movable abutment of the compressor after it

has been thrown to operative position, ready to perform the compression; Fig. 22, a similar view showing the compressed tube-length and showing also a fresh portion of the tube shirred on the preceding section of the mandrel; Fig. 23, a similar view showing the compressed shirred tube-length encased in a container; Fig. 24, a plan view of the packaged tube, while still on the mandrel; Fig. 25, a perspective view of the fully packaged tube, ready to be packed in a carton; Fig. 26, a plan sectional view, somewhat diagrammatic in its nature, showing the air-controlled valves employed; Fig. 27, a wiring-diagram illustrating the manner in which the electric motor and the electric brakes are controlled; Figs. 28 and 29, broken elevational and plan views, respectively, illustrating a modified form of tube-shirring device; and Figs. 30 and 31, broken plan and side elevational views respectively, illustrating a further modification of the tube-shirring means.

Describing the preferred construction illustrated, A designates a frame which may be of any suitable construction, but which preferably is provided at its upper portion (Figs. 4 and 10–13) with suitably strong front and rear longitudinal frame-members A′ and A^2 respectively, said front member being equipped, as shown in Fig. 12, with relatively short longitudinal guides A^3 and A^4 which serve to guide the working portions of the carriers which actuate the orbitally-moving shirring-members employed; B, a mandrel which is releasably held in position by a clamp B′ at an intermediate portion of its length and which is releasably held at its advanced end by a clamp B^2 (Fig. 1); C, a reel holding in flat, wound condition the tube C′ which is to be divided into sections of desired length and such sections shirred, compressed and packaged; D, a re-wind reel which may be employed for winding a slip-sheet, where such sheet is employed between the windings of the flat tube, as in cases where the tube has been pre-printed; E, shirring-mechanism which, in the form illustrated, comprises upper and lower endless-chains E′ and E^2, which carry in a planetary manner, shirring-members E^3 which are suitably spaced apart, a pair of opposed members being shown in working position in Fig. 12; F, tube-feeding mechanism (Figs. 1 and 4–6), adapted to feed the tube forwardly at the desired rate of speed; G, an electric motor controlled by a suitable circuit G′, such as is illustrated in Fig. 27, said circuit being controlled by a limit-switch G^2 and a tube-controlled switch G^3 (Fig. 1; see also Fig. 27), it being understood that the limit-switch G^2 is so timed as to break the motor-circuit after a section of the tube of desired length has been shirred, for example, a 34-foot length; H, transmission mechanism for transmitting power from the motor to the shirring-mechanism, the tube-feeding mechanism, and the re-wind reel; I, (Figs. 17–23 and 26) pneumatic apparatus, including a compressor I′, a high-pressure air-supply pipe I^2, a valve I^3 for actuating the compressor, a valve I^4 controlling the actuation of the first mandrel-clamp B′, and a valve I^5 controlling the actuation of the second, or final, mandrel-clamp B^2; J, an open-sided cardboard container within which is confined the compressed, shirred tube, designated C^2, which may be understood as being the shirred-tube section C^2 shown in Fig. 1, after compression of the shirred section; and J′, (Figs. 24 and 25), a retainer in the form of an endless band which is slipped onto the loaded container before the latter is removed from the mandrel.

The frame A need not be described in detail, as it may be of any suitable construction. It is of suitable form to support the endless carriers E′ and E^2 in an overhanging manner, with space between the carriers for the longitudinally disposed mandrel B, as will be readily understood from Fig. 12. Adjacent lengths of the carriers travel in approximately parallel position, as appears from Fig. 9, but preferably converge slightly towards the advance end of the mandrel. The guides A^3 and A^4 are provided with guide-grooves 1 (Figs. 9 and 12) within which travel, during the working portion of the movement, the guide-rollers 2 of members 3 which carry the shirring-blocks E^3. Each member 3 is secured to a link of the corresponding chain by means of a bracket-clip 4 which is riveted to the member 3 and which may be formed integrally with the link.

The mandrel B may be termed a floating mandrel, in the sense that it is possible to release it from its clamps to enable the tube to be forwarded as desired and finally slipped off the advance end of the mandrel. It is desirably of integral construction, preferably comprising a series of sections of successively reduced cross-section as the forward end of the mandrel is approached. This is illustrated in Fig. 7, the rear section being between the points *a* and *b*, the next (a short) section between the points *b* and *c*, the next section being between the points *c* and *d*, the next between the points *d* and *e*, and the extreme advance section being a short section between the points *e* and *f*. A general reduction in cross-section from the rear portion of the mandrel to the advance end of the mandrel is highly desirable, and preferably this is accomplished by employing a stepped diameter, as illustrated. The longitudinal location of corresponding sections of the mandrel in the machine is indicated by the dotted line at the upper portion of Fig. 1.

Referring to Fig. 7, that portion of the mandrel immediately at the left of the point *d* is the portion which is gripped by the first mandrel-clamp B′; and the extreme advance end-portion between the points *e* and *f* is the portion which is gripped by the mandrel-clamp B^2. The mandrel is provided (Figs. 7, 9 and 17) with a bore or air-passage 5 which extends from the rear end of the mandrel to the point which is held by the clamp B′, at which point there is provided a laterally-open air-inlet passage 5^a which, as appears from Fig. 17, is supplied with air through a hose 5^b attached to one jaw of the clamp. The pressure admitted at this point is moderately high for inflation purposes, being preferably about 4 pounds per square inch. It is sufficiently high to withstand the force exerted by the grippers of the shirring device and cause a forwarding movement of the tube during the shirring operation, while the tube is isolated from the mandrel by an interposed layer of air disposed between the indented walls of the tube and the mandrel. After the severed shirred length of tube has been compressed, the clamp B^2 is released, the packaging is effected, and the packaged tube slipped off the end of the mandrel. At a time while the extreme end of the mandrel is being held by the clamp B^2, the clamp B′ is released and a freshly shirred tube-length is advanced from the section *cd* of the mandrel onto the section *de* of the mandrel, thus leaving the tube in the condition illustrated in Fig. 20. The

dotted line *g* in Fig. 20 indicates a point where the shirred portion of the tube is to be severed from the succeeding portion. This preferably is accomplished by puncturing the tube at that point, whereupon the separation is effected by a slight jerking action exerted by the fingers of the operator.

The mandrel-clamps B′ and B^2 are pneumatically actuated. A detail of the clamp B′, for example, is shown in Fig. 17. The clamp comprises jaws 6 and 7 pivotally supported at 6^a and 7^a respectively; and links 8 connecting the arms of said jaws with a cross-head 9; and a plunger 10 equipped with a piston 10^a. The piston is actuated upwardly to close the jaws by means of air-pressure admitted through a pipe 11 connected with the lower end of the cylinder, designated 12. A spring 13 serves to return the piston to the lower end of this cylinder when the air pressure is released, by turning the valve i^4 to the proper position (see Fig. 26) to effect such release. Referring to Figs. 20 and 26, the high-pressure air-supply pipe I^2 has branches 14, 15 and 16 through which air is led to the valves I^5, I^3 and I^4 respectively. The piston 17 (Fig. 23) in the cylinder 18 of the compressor I′ is double-acting. The ends of the cylinder are connected by pipes 19 and 20 with the valve I^3. This valve is of such form that pressure can be admitted to either end of the cylinder 18 and the other end of the cylinder may be vented.

The mandrel-clamp B^2 is actuated in the same manner as is the mandrel-clamp B′. Similar parts are similarly designated.

The tube-supply reel C is fixedly mounted on a shaft 21 (Figs. 1–3) which is journaled in a bearing 22 normally held against idle turning by a wooden pressure-block 23 carried by a member 24 which is pivotally supported at 24^a and is provided with an extension 24^b upon which is supported a spring 25 which encircles a stud 26, equipped at its upper end with nuts for adjusting the friction upon the shaft 21.

The shaft 21 is equipped also with a brake-wheel 27 engaged by a brake-band 28 which has one end secured at 28^a and has the other end equipped with an extension 28^b. A plunger 29 is secured to the member 28^b and is equipped with a weight 29^b. The plunger works through a guide 30. Mounted on a standard 31 which carries the guide 30 is a solenoid 32 having a core 32^a which is connected by a pin 33 to the upper end of the weighted plunger 29. Normally, the solenoid 32 holds the brake-band in non-braking position. When the solenoid is de-energized, the weight 29^b causes the brake-band to instantly stop the movement of the reel C. The solenoid 32 and the brake-band 28 are diagrammatically illustrated in Fig. 27.

The take-up reel D is actuated through the medium of the transmission-mechanism H in a manner which will be described later. It operates to re-wind a paper strip 34 (Fig. 1) which has served the purpose of a slip-sheet, employed at the time of printing the cellulose tube and winding it upon the wheel C. It may be stated here that the re-wind reel D is initially started, when the motor is energized, by means of a positive drive in which is employed an over-running clutch (shown in Figs. 14 and 15), and thereafter the re-wind reel is driven through the medium of a friction-clutch (Fig. 16) whose slowest speed is faster than that of the speed of the drive employing the over-running clutch. In other words, the positive drive becomes inoperative immediately after the starting operation.

The shirring-mechanism E is actuated through the medium of a sprocket-chain H′ (Figs. 1 and 4). From one shaft of the shirring mechanism, the tube-feeding mechanism F is actuated through the medium of a sprocket chain H^2; from the same shaft a sprocket chain H^3 drives a counter-shaft H^4, upon which is mounted an over-running clutch H^5 (Figs. 13–15), through the medium of which is driven a sprocket chain H^6 which actuates a sprocket-wheel H^7 on a shaft 35 of the re-wind reel D.

From the shaft H^4, a sprocket-chain H^8 drives a sprocket-wheel H^9 journaled on a counter-shaft H^{10}, and the sprocket-wheel H^9 actuates another sprocket-wheel H^{11} through the medium of friction-clutch members H^{12}, it being noted that the clutch-members are formed integrally with the sprocket-wheels. Suitable tension is applied through the medium of a spring 36 which encircles the shaft H^{10} and which may be adjusted by means of a nut 37, as shown in Fig. 13. From the sprocket-wheel H^{11}, a sprocket-chain H^{13} drives a sprocket-wheel H^{14} which is fixed on the shaft 35 of the re-wind reel. When the motor is started, the inertia of the re-wind reel is overcome by the positive drive through the over-running friction-clutch. Then the transmission through the friction-clutch H^{12} picks up the drive and continues it at a more rapid rate than the drive through the over-running clutch device. As the windings accumulate on the re-wind reel, it is necessary for the re-wind reel to turn correspondingly more slowly and this is accomplished through the medium of the friction clutch. However, the slowest drive through the medium of the friction-clutch is somewhat faster than the positive drive through the over-running clutch.

The shirring mechanism E will best be understood from Figs. 4 and 8–13. The upper carrier-chain E′ is mounted on sprockets 38, 39 and 40, carried, respectively, by shafts 38^a, 39^a and 40^a. Similarly, the carrier-chain E^2 is mounted on sprocket-wheels 41, 42 and 43 carried respectively by shafts 41^a, 42^a and 43^a.

As appears from Fig. 4, the shaft 42^a is equipped with a sprocket-wheel 44 which is driven by the sprocket-chain H′. By the arrangement shown, the sprocket-wheels associated with the shirring-mechanism are all positively actuated. The sprocket-chain H^2 is driven from the shaft 41^a through the medium of a sprocket-wheel 45 which appears in Fig. 13. Spur gears 46 connect the shaft 38^a to the shaft 41^a, as shown in Fig. 10.

The relation of the operating-lengths of the sprocket-chains E′ and E^2 appears from Fig. 9, where these lengths are designated 47 and 48 respectively. To guide the working portions of the chains so as to hold them properly spaced with relation to each other and also to prevent lateral deflection, the chains engage idler sprockets 49 journaled on short shafts 49^a supported in bearings 49^b. Spacing collars 49^c are shown in Fig. 8.

Each of the guides A^3 and A^4, as appears from Figs. 8 and 12, is composed of two members 50 and 51, provided with spacing bosses 50^a and 51^a respectively. These members are clamped together and secured to frame-members 52 by means of bolts 53 which have enlargements 53^a and have portions 53^b which extend through slots 54 in the frame-members 52 and are equipped with clamping nuts 55. The upper bolts 53 may be adjusted up and down in the slots 54 by means

of screws 56 which pass freely through openings in frame-members 57 and are screwed into tapped openings with which the enlarged portions 53a are provided. The lower bolts 53 are adjustable in the slots 54 by means of set-screws 58.

The direction of travel of the working portions of the chains E' and E2 is indicated in Fig. 9. Preferably, the working portions converge slightly in the direction of movement. It will be noted in Fig. 9 that the bar 3 which carries the shirring-block E3 is secured off-center by means of the clip 4 to a link of the chain. It is the rear edge portion of the bar which is secured to the chain, the purpose being to effect a quick disengagement of the gripper-member E3 from the tube at the end of the shirring operation. Good results require the quick withdrawal of the shirring-block when it reaches the advance end of its working movement.

It will be understood from Figs. 4 and 9 that each of the endless carriers E'' and E2 follows a triangular course. The upper apex of the carrier E' is at the sprocket-wheel 40, and the lower apex of the carrier E2 is at the sprocket-wheel 43. The shafts carrying these sprocket-wheels are vertically adjustable. This is shown in Figs. 4 and 11. from which it appears that the shafts 40a and 43a are journaled in vertically adjustable members 59 which are vertically adjustable in frame-members 60 mounted upon the horizontal guides A3 and A4. Each member 59 is equipped with a perforate lug 59a through which extends an adjusting bolt 61 having screw connection with a fixed tapped lug 62. Thus, the carrier-chains can be suitably tensioned. After proper adjustment, the members 59 are clampingly secured in position by bolts 63.

The tube-feeding mechanism F will be understood from Figs. 1, 2, and 4–6. It comprises a frame 64 in which are mounted a lower feed-roll 65 and an upper feed-roll 66, which may be of rubber. The lower feed-roll is secured on a shaft 65a journaled in the frame 64, said shaft being equipped with a sprocket-wheel 65b, which, as shown in Fig. 4, is driven by the sprocket-chain H2. The feed-roll 66 is provided with a shaft 66a which is journaled in a yoke 67 which is connected by a pivot-shaft 67a with the upper portion of the frame 64. The yoke is equipped with an adjustable bearing 68 which is engaged by a cam lever 69 mounted on a rock-sleeve 70 which is supported by a bolt 71 carried by upward extensions of the frame 64. The cam 69 is so shaped that it will hold the yoke 67 in any desired position of adjustment.

The frame 64 is equipped with a pair of vertical members 72 which are spaced apart to accommodate between them the inflated tube C', thus forming a guide for the tube. The members 72 are secured in position by bolts 72a which are laterally adjustable in slots 73 formed in a a bracket-member 73a with which the frame 64 is equipped. The upper-feed roll 66 can be moved to inoperative position to enable the tube to be threaded between the feed-rolls. The rolls preferably have true cylindrical surfaces, so that the inflated tube is flattened at the bite of the rolls, as shown in Fig. 5. Initially, some air-pressure is admitted to that portion of the tube C' which is between the feed-rolls and the reel C. The inflation in this manner aids in the feeding of the tube. The feed-rolls are so geared to the shirring-mechanism that the tube will be fed to the shirring-mechanism at a proper rate of speed.

The circuit-controlling device G3 will operate to stop the motor in the event the tube C' should be deflated, as by a puncture. Preferably, this device is located near the feed-rolls. As shown, it comprises a mercury bulb 74 having electric contacts 74a which normally are immersed in mercury, so that the circuit shown in Fig. 27 is normally closed at this point; and a bulb-carrying lever 75 pivotally mounted at 76 and equipped with a weighted roller 75a which is supported by the inflated tube C'. Below the tube is a coacting roller 77 which is journaled in the frame 64. Should the tube become deflated, the roller 75a will tilt the bulb-carrying lever 75 and cause the mercury to uncover one of the switch-points in the bulb, thus breaking the circuit.

The motor G, as appears from Figs. 1, 4 and 10, preferably is mounted in the lower portion of the frame. The shaft 78 is connected by a sprocket-chain 79 to a sprocket-wheel 80 on a counter-shaft 81, which shaft is equipped with a sprocket-wheel 82 which drives the sprocket-chain H'. The shaft 81 is equipped also with a spur gear 83 which drives a spur gear 84 secured on a shaft 84a, which, through the medium of suitable gearing (not shown) actuates the shaft 85 which carries a cam-wheel 86 equipped with a tooth 86a which is adapted to actuate, through the medium of a roller-equipped lever 87, the limit-switch G2 (Figs. 1, 10 and 27). It is the limit-switch G2 that determines the length of the tube-section which will be shirred, that is, the motor will be automatically stopped after a tube of predetermined length has been fed to the shirring-mechanism.

The transmission-means H for driving the shirring-mechanism and the tube-feeding mechanism has been sufficiently described, except that it should be mentioned that the operation of these mechanisms is controlled by a clutch-lever 88, shown in Figs. 2, 4, and 10. The sprocket-wheel 44 which is driven by the sprocket-chain H' is journaled freely on the shaft 42a and is provided with a clutch-member 89 which coacts with a clutch-member 90 connected by a spline 91 with the shaft. The clutch-lever 88 is equipped with a fork 88a which engages a groove with which the clutch-member 90 is provided, as appears in Fig. 10. When the clutch-members are in engagement, the shaft 42a is driven.

The relation of the pneumatic apparatus I to the shirring-mechanism E is shown in Fig. 2. The shirred-casing-compressor I' operates upon the shirred casing in the space between the clamps B' and B2 (Fig. 2). The compressor, as stated above, includes a cylinder 18 and a double-acting piston 17. The piston forms a part of a reciprocable sleeve 92 moving on a fixed longitudinal guide-shaft 93, as shown in Fig. 23. The rear end of the sleeve-like plunger 92 has pivotally mounted thereon an abutment 94 which is constrained to move with the plunger, but which may be thrown either to the operative position shown in Fig. 21 or to the inoperative position shown in Fig. 17. In Fig. 18, the member 94 is shown midway in its movement away from the mandrel (to idle position). The pivot-hole of the member 94 is designated 94a, and the slot which is adapted to engage the mandrel is designated 94b. The free end of the member 94 is equipped with slot-closing members 95 which are pivotally supported at 96. These members are adapted to be opened or separated automatically when the member 94 is lifted from the mandrel C' (Fig. 19) and swung to the position shown in Fig. 17. The members 95 are provided at their meeting edges

95[a] with half-circular recesses 95[b] adapted to engage the mandrel. It is evident that the members 95 will close automatically and grip the mandrel when brought again into engagement therewith, as shown in Fig. 19. Said members are held frictionally in the open position during the transition period. Preferably, their tips are cut away or rounded as indicated at 95[c].

The member 94 is equipped at its end which is towards the back side of the machine with a yoke-like cam-member 97 which is connected with the member 94 by a pivot 97[b]. The member 97 rests upon a shoulder 98, as shown in Fig. 19. During the return idle stroke of the movable abutment 94 (after the compressing operation), the cam-member 97 is engaged by an overlying curved fixed cam-member 99 and automatically thrown, as shown in Fig. 18, to the idle position shown in Fig. 17. When the working stroke of the movable abutment 94 occurs, the pivoted cam-member 97 rides over the fixed cam-member 99 without influencing the member 94. The front end of the fixed cam-member 99 is the high point of said member, and is secured at 99[a] to a frame-member, as shown in Figs. 18 and 20.

As will be understood from Figs. 1 and 17, the movable abutment 94 of the compressor is thrown to the operative position by means of a device K comprising a rod actuated through the medium of a foot-treadle K', this rod having at its upper end a horizontal member K[2] which is engaged by an arm K[3] with which the member 94 is equipped. By stepping quickly upon the treadle, the rod K is elevated and throws the member 94 to the right (Fig. 17), the momentum being sufficient to carry it past the dead center, whereupon its drops to the operative position.

Fig. 21 shows the shirred casing-section C[2] prior to the compressing operation; and Fig. 23 shows it after the compressing operation and after the container J has been slipped in position to hold the compressed casing against undue expansion. In Fig. 23, the mandrel-clamp B[2] is open to permit removal of the boxed, compressed casing-section. It will be understood that during the compressing operation, the mandrel-clamp B[2] serves as a fixed abutment, while the member 94 serves as the movable abutment of the compressor.

In the shirring operation, as will be best understood from Fig. 9, the shirring-blocks E[3] tend to curve the folds of the tube-section forwardly. Accordingly, it is desirable that in the sausage-stuffing operation the shirred tube should be fed from the stuffer-horn in the opposite direction. In Figs. 24 and 25, the endless retainer-band J' bears an arrow and appropriate legend indicating the direction in which the casing is to be fed during the stuffing operation. This band is slipped onto the package with the arrow pointing in a direction opposite that in which the tube was fed during the shirring operation.

Reverting to the motor G, the motor shaft 78 is shown equipped with a brake-wheel 100 which is engaged by a brake-band 101 which is normally held in non-braking position by an electromagnet 102 (Figs. 4 and 27). A weight 103 serves to set the motor-brake instantly when the solenoid 102 is de-energized.

Any suitable circuit for controlling the operation may be employed. In the diagram shown in Fig. 27, the main switch 104 is adapted to be opened by a spring 105 when a solenoid 106 is de-energized. The motor is indicated at G. The diagram shows the circuit in the operating condition, in which all of the solenoids are energized and current is being supplied to the motor. The circuit was placed in this condition by closing the switch 107 through the medium of a push-button 107[a]. A stop-switch 108 serves to break the circuit at will. It will be noted, also, that the limit-switch G[2] and the mercury-switch G[3] are so located in the circuit that when either one of these switches is opened, the solenoid 106 will be de-energized and the main switch will be thrown by the spring 105 so as to open the contacts at the points 109, 110, and 111.

The operation may be stated briefly. The motor is started by closing the circuit through the medium of the push-button 107[a] (Fig. 27). Power is transmitted to the shirring-mechanism E and the tube-feeding mechanism F through the medium of the sprocket-chain H'. However, to start the operation it is necessary to throw the clutch-lever 88 so as to cause engagement of the clutch-members 89 and 90 (Fig. 10). Assuming the initial end of the tube C' to have been threaded into the machine, pressure is admitted from a suitable source through the hose shown in Fig. 17 and through the mandrel-clamp B' to the interior of the mandrel. Thus, a rather strong inflating pressure (say about 4 pounds per square inch) is introduced into the tube. At this time, some air is admitted to that portion of the tube which is located between the tube-feeding mechanism F and the reel C, after which the upper feed-roll 66 is lowered so as to suitably compress or flatten the tube.

The tube is fed by the shirring-mechanism at a desired rate of speed and the tube, in inflated condition, is periodically engaged by opposite shirring-blocks of the co-acting carriers E' and E[2]. Preferably, the arrangement is such that these shirring-blocks will not force the walls of the tube into contact with the mandrel at the point where the tube is gripped. Each opposed set of gripper-blocks, in turn, grips and indents the tube and carries the gripped portion forwardly, thus causing the shirring action to take place. It is noted that the first mandrel-clamp serves as a fixed abutment for the shirring operation. The shirring operation continues until a predetermined length of tube, say 34 feet, has been shirred, whereupon the limit-switch G[2] operates to break the motor circuit. Instantly, the brakes at 28 and 101 are set, thus stopping the momentum of the reel C and motor G.

The operator now manipulates the valve I[4] (Fig. 26) to release the mandrel-clamp B', which thereupon opens under the pressure of the spring 10 (Fig. 17), thus releasing the mandrel B at this point. The operator then grasps the shirred tubing at the left-hand end and advances it from the sections *bc*—*cd* of the mandrel onto the section *de*, as will be understood from Fig. 20. By means of a conveniently located puncturing instrument (not shown) the operator then punctures the tube at about the line *g* shown in Fig. 20, severs the tube and moves the shirred portion to the right of the clamp B'. The operator then steps on the treadle K' and thus throws the pivotally mounted head, or abutment 94, of the compressor I' to the position shown in Fig. 21. The operator then manipulates the valve I[4] to admit air to the cylinder and close the clamp B', the clamp gripping the advance end of the next section of the tubing, as shown in Fig. 21. By means of the valve I[3] (Fig. 26) pressure is then admitted through the pipe 19 to the cylinder 18, thus causing the

compressor to make its working stroke and compress the shirred tube-section to the condition shown in Fig. 22. The operator then manipulates the valve I^5 and causes the mandrel clamp B^2 to be released. In the meantime, upon a second manipulation of the valve I^3, the idle stroke of the plunger **92** occurs, thus carrying the abutment **94** back to its starting position, the cam **99** returning it to the inoperative position shown in Fig. 17.

The compressed shirred tube which is now free on the mandrel has the container J quickly applied by the operator. Preferably this container is an elongated cardboard band whose ends are provided with inverted U-slots **112** which enable the container to be applied by a lateral movement to the mandrel. The retainer G' is then slipped onto the shirred package; or, this may be done later. The packaged casing is then slipped off the free end of the mandrel, after which the operator causes the mandrel clamp B^2 to be closed.

In the meantime, the shirring of a fresh section of the tube is progressing on the sections *bc* and *cd* of the mandrel (Fig. 7). The portion *ab* of the mandrel, while it is not gripped by the shirring-blocks as they perform their function of advancing the gripped-portions, does serve the purpose of guiding the crinkling tube onto the succeeding section. The graduated reduction in diameter of the mandrel as the advance end is approached is important, because it facilitates the slipping of the shirred portions of the tube as the shirring operation progresses. The final bore of the shirred tube is determined by the diameter of the section *de*, such diameter corresponding rather closely with the diameter of the stuffing horn upon which the tube eventually must be mounted. The portion *ef* of the mandrel which is gripped by the mandrel-clamp B^2 is smallest in cross-section, and may be the same for all sizes of mandrels.

The invention may be employed in connection with the shirring and compressing of artificial sausage-casings of varying diameters. It has proven very useful in connection with casings ranging in diameter from about $\frac{23}{32}$'' to $1\frac{1}{8}$''. Without intending to unduly limit the invention, it may be stated that it is important to employ a mandrel which is considerably smaller in diameter than the tube and to carefully graduate the diameter of the mandrel. It is desirable to have the diameter of the rear or left-hand end of the mandrel from about 70% to about 80% of the diameter of the tube and to make very slight reductions in diameter as the advance or right-hand end of the mandrel is approached. Examples of suitable proportions for casings of the size of about $\frac{23}{32}$'' to about $\frac{24}{32}$'' are:

Section	Length	Diameter
	Inches	*Inch*
ab	$19\frac{1}{4}$	.496
bc	4	.460
cd	$16\frac{1}{2}$	.425
de	$15\frac{15}{16}$	.402
ef	$4\frac{1}{16}$	.390

For other casings of the range mentioned above, the lengths of the mandrel-sections may remain the same. For casings having a diameter of about $\frac{22}{32}$'' to about $\frac{30}{32}$'' suitable diameters for the sections, in the order named above, are .660''; .615''; .575''; .550''; .390''.

In view of what has been stated, it will be easily possible for those skilled in the art to properly design mandrels for shirring and compressing various-sized tubes. It may be stated that the tube-walls of casings of different diameters usually vary in thickness from about .001'', or somewhat less, to .003'', or higher. Notwithstanding the rather delicate texture of the tubes, they can be readily shirred in a very rapid manner, and may be compressed without injury. It is easily possible to reduce a tube to about $\frac{1}{400}$ (or less) of its original length. In practice, it is preferred not to compress to quite so short a length. It has been found desirable in practice, for example, to compress a 34' length to a length of about $5\frac{1}{2}$'', and then permit it to expand to about 7'' in a container.

The mechanisms employed in the machine are capable of being varied greatly without departure from the invention. In Figs. 28 and 29, there is shown a modification of the shirring mechanism, Fig. 28 being a broken side elevational view and Fig. 29 being a broken plan view. The upper carrier-chain is designated E^4 and the lower carrier-chain is designated E^5. The gripper-blocks are designated E^6. They are carried by arms **113** connected with pivots **114** carried by clips **115** with which certain links of the chains are equipped. Springs **116** tend to throw the gripper-blocks away from the gripping position. The arms **113** carry plates **113a** which engage fixed guides **117**. The advance end of the guide is indicated at **117a**. When the plates **113a** ride off the ends of the guides, the gripper-blocks E^6 are quickly withdrawn from engagement with the tube.

A further modification is shown in Figs. 30 and 31, the former a broken plan view and the latter a broken elevational view. In this instance, the gripper-blocks are designated E^7, carried respectively, by arms **118** which are connected with a pivot **119** carried by a chain **120**. Each arm is equipped with a wing **118a** having thereon a guide-member **118b** which engages a longitudinal guide-groove **121**. Springs **122** tend to throw the blocks E^7 from the tube-gripping position. When the extremities of the guides are passed, this action is permitted to occur. The springs effect quick disengagement of the shirring-blocks from the tube.

It may be mentioned that, as shown in Figs. 9 and 12, the gripper-blocks E^3 are provided at their adjacent surfaces with longitudinal grooves **123**. These blocks may be of any suitable material. Preferably, they are of soft vulcanized rubber.

The foregoing detailed description has been given for clearness of understanding only, and no unnecessary limitations should be understood therefrom, but the appended claims should be construed as broadly as permissible in view of the prior art.

What I regard as new and desire to secure by Letters Patent is:

1. A tube-preparing method which comprises: maintaining a tube in inflated condition; applying external indenting pressure and forwarding force at spaced points along the tube, the internal pressure being sufficient to support the walls of the tube and cause a forwarding movement at the points where force is exerted; and holding the advance end of the tube to cause a shirring action to occur.

2. A method as specified in claim 1, as practiced by effecting the shirring action upon an internal mandrel which is engaged by and gages the diameter of the inner edges of the folds of the tube as the shirring progresses but is iso-

lated from the tube by a gaseous medium at the indented points.

3. A method as specified in claim 1, as practiced by effecting the shirring upon an internal mandrel which has a forwardly diminishing diameter and which is engaged by and gages the diameter of the inner edges of the folds of the tube as the shirring progresses but is isolated from the tube by a gaseous medium at the indented points.

4. A method as specified in claim 1, as practiced by effecting the shirring upon an internal mandrel which comprises stepped sections of successively smaller diameter as the advance end is approached and which is engaged by and gages the diameter of the inner edges of the folds of the tube as the shirring progresses but is isolated from the tube by a gaseous medium at the indented points.

5. A tube-preparing method which comprises: feeding a continuous tube from a source of supply onto a mandrel; introducing a gaseous medium through said mandrel into and inflating said tube; shirring a length of the inflated tube on a portion of the mandrel while supporting the mandrel in advance of the shirring-zone; advancing the shirred length and drawing the advance end of a succeeding length into the shirring-zone and severing the shirred section from the succeeding section; and repeating the cycle on successive lengths of the tube.

6. A method as specified in claim 5 as practiced by employing a floating mandrel which has a releasable support immediately in advance of the shirring-zone, and freeing the mandrel from said support to permit the shirred length to be advanced beyond the shirring-zone.

7. A method as specified in claim 5, supplemented by subjecting the successive shirred-lengths to longitudinal compression to bring the folds into closely-compacted, mutually-supporting relation while still on said mandrel.

8. A method as specified in claim 5, supplemented by subjecting the successive shirred-lengths to longitudinal compression to bring the folds into closely-compacted, mutually supporting relation while still on said mandrel; and applying an expansion-resisting container to the compacted product while still on said mandrel.

9. A method as specified in claim 5, supplemented by subjecting the successive shirred-lengths to longitudinal compression to bring the folds into closely-compacted, mutually supporting relation while still on said mandrel; and freeing the compacted tube from the compacting elements and applying an expansion-resisting packaging-device to the compacted tube while still supported by said mandrel.

10. A tube-preparing method which comprises: drawing a continuous tube from a source of supply; shirring successive sections of the tube on one section of a mandrel and severing the shirred sections successively; advancing the shirred sections seriatum onto another section of the mandrel; and compressing the shirred sections after such advancement.

11. A machine of the character set forth comprising: a mandrel arranged and supported to permit a tube to be drawn thereover; and shirring-mechanism equipped with means for gripping unshirred portions of the tube successively at spaced points and advancing the gripped portions and thus causing the portions in advance of the gripped portions to be shirred on the mandrel.

12. A machine of the character set forth comprising: means for inflating a tube; means for gripping the tube at spaced successive points and advancing the gripped portions; and an abutment for holding an advance portion of the tube, whereby shirring of the tube is effected by the carrying forward of the gripped portions.

13. A machine of the character set forth comprising: a mandrel and an abutment associated therewith; and orbitally moving tube-grippers serving to grip the tube at spaced points and advance the gripped portions and effect shirring of the tube against said abutment.

14. A machine as specified in claim 13, in which the tube-grippers are carried by endless members.

15. In combination: a mandrel; a releasable mandrel-clamp adapted to serve as an abutment; and tube-shirring mechanism comprising tube-gripping means adapted to engage the tube at successive spaced points and advance the gripped portions, in turn, thus effecting shirring of the tube against said clamp.

16. A machine as specified in claim 15, in which said mandrel has a section extending in advance of said clamp and said clamp is of a character to permit a shirred tube-length to be advanced on the mandrel beyond said clamp.

17. A machine as specified in claim 15, in which said mandrel has a section extending in advance of said clamp which is adapted to receive thereon the shirred tube-length; and a shirred tube compressor coacting with the section of the mandrel in advance of said clamp.

18. A machine of the character set forth, comprising: a mandrel having an air-passage therethrough; mandrel-supporting means equipped with means for admitting air-pressure through the mandrel into a tube enveloping the mandrel; and tube-shirring mechanism associated with said mandrel comprising gripping-members adapted to grip the tube at spaced points and advance the gripped portions longitudinally of the mandrel to effect shirring of the tube.

19. In combination: a source of supply for a continuous tube; tube-feeding mechanism; a mandrel in advance of said tube-feeding mechanism; means for supplying through the mandrel a gaseous medium and inflating the tube enveloping the mandrel; and tube-shirring mechanism adapted to engage the tube at successive spaced points and carry the engaged portions of the tube forward in succession; and opposed means for holding an advance portion of the tube whereby shirring of the tube is effected by the carrying forward of the engaged portions.

20. In combination: a mandrel; means for admitting compressed air through the mandrel into a tube enveloping the mandrel; and tube-shirring mechanism, including grippers adapted to advance along the mandrel without causing the inflated tube to engage the mandrel at the points gripped.

21. In combination: a reel upon which a continuous tube is supported; non-shirring tube-feeding mechanism in advance of said reed; tube-shirring mechanism in advance of said tube-feeding mechanism acting on unshirred portions of the tube; and a mandrel over which the tube may pass, said mandrel cooperating with said tube-shirring mechanism.

22. A machine as specified in claim 21, in which the tube-shirring mechanism embodies tube-grippers having a forward movement along the

mandrel, said tube-grippers being spaced to grip the tube at a succession of points.

23. A machine as specified in claim 21, in which said tube-shirring mechanism comprises a pair of endless chains equipped with spaced tube-grippers which engage the tube in pairs.

24. A machine as specified in claim 21, in which the mandrel has a section of one diameter in the zone where the shirring mechanism operates and an advance section of smaller diameter in the zone where the shirred tube accumulates.

25. A machine comprising: a mandrel, a clamp supporting said mandrel near its advance end; a second clamp supporting said mandrel at an intermediate point; and tube-shirring mechanism coacting with said mandrel in the rear of said second-mentioned clamp.

26. A machine comprising: a mandrel; a clamp supporting said mandrel near its advance end; a second clamp supporting said mandrel at an intermediate point; shirring-mechanism coacting with a portion of the mandrel in the rear of said second-mentioned clamp; and a shirred-tube compressor coacting with the portion of the mandrel between the two clamps mentioned.

27. A machine comprising: tube-feeding means adapted to feed a continuous tube; tube-shirring means in advance of the tube-feeding means; a mandrel and means for introducing compressed air into the tube being advanced over the mandrel; and an abutment in advance of the tube-shirring means against which shirring of the tube is effected.

28. In a machine of the character set forth: a mandrel and means for introducing air under pressure into a tube enveloping said mandrel; and tube-shirring mechanism comprising a pair of opposed adjustably mounted endless carriers, and gripper-blocks mounted at spaced intervals on said carriers.

29. A machine comprising: a mandrel and means for introducing compressed air into a tube enveloping said mandrel; means associated with the mandrel for shirring said tube; an electric motor for actuating said last-mentioned means; and an electric switch controlled by said tube and controlling the circuit of said motor.

30. A machine comprising: a source of supply for a continuous tube; tube-feeding mechanism; a mandrel and associated means for introducing compressed air into the tube; tube-shirring mechanism associated with said mandrel; an electric motor serving to actuate said tube-feeding mechanism; and a tube-controlled switch controlling the circuit of said motor.

31. In combination: a mandrel; tube-shirring mechanism associated with one portion of said mandrel; shirred-tube-compressing mechanism coacting with another portion of said mandrel; and withdrawable mandrel-supporting means interposed between the mentioned portions of said mandrel.

32. A machine as specified in claim 31, supplemented by a second withdrawable support for the advance end of said mandrel.

33. In combination: a mandrel; tube-shirring mechanism associated with one portion of said mandrel; a compressor associated with another portion of said mandrel; and a pneumatically actuated clamp engaging said mandrel.

34. In combination: a mandrel; tube-shirring mechanism associated with one portion of said mandrel; a compressor associated with another portion of said mandrel; and a pair of pneumatically actuated clamps, one of which supports an intermediate portion of the mandrel and the other of which supports the advance end of the mandrel.

35. In combination: a mandrel; tube-shirring mechanism coacting with one portion of said mandrel; and compressing mechanism coacting with another portion of said mandrel and comprising a plunger carrying a movably related abutment adapted to be thrown into and out of engagement with said mandrel.

36. A machine as specified in claim 35, having means for effecting automatic disengagement of said abutment from said mandrel during the idle stroke of said plunger.

37. A machine as specified in claim 35, having means for effecting automatic disengagement of said abutment from said mandrel during the idle stroke of said plunger, and a device for throwing said abutment to mandrel-engaging position.

38. In a machine of the character set forth: a mandrel having an air-passage therethrough; a clamp having an air-passage communicating with said first-named passage and equipped with means for supplying air under pressure; and tube-shirring mechanism associated with said mandrel.

39. A machine comprising: a continuous-tube source of supply; a mandrel; tube-feeding and shirring mechanism; a motor serving to actuate the tube-feeding and shirring mechanism; and a limit-switch actuated by said motor and serving to stop the motor after a predetermined length of tube has been shirred.

40. A machine comprising: tube-feeding mechanism; a mandrel; tube-shirring mechanism associated with said mandrel; a motor serving to actuate the tube-feeding mechanism and the tube-shirring mechanism, said motor being provided with an electric circuit; means for breaking said circuit and stopping the operation of said motor; and a motor-brake normally held in inoperative position by an electromagnet which is de-energized upon the breaking of the motor-circuit.

41. In combination: a tube-supply reel; tube-feeding mechanism; a mandrel; tube-shirring mechanism associated with said mandrel; an electric motor operating said tube-feeding mechanism and said tube-shirring mechanism; means for breaking the circuit of said motor; and brakes for said reel and motor normally held in non-braking position by electromagnets which are de-energized upon the breaking of the motor circuit.

42. A machine comprising: a tube-holding reel adapted to support a tube and slip-sheet in wound condition; a mandrel; tube-feeding and shirring means coacting with said mandrel; a re-wind reel for receiving the slip-sheet; a motor; transmission-mechanism for actuating the tube-feeding and shirring means from said motor; and transmission means for actuating the re-wind reel provided with a slip-clutch.

43. A machine as specified in claim 42, in which the transmission means for actuating the re-wind reel is provided al[illegible] with a positive drive through the medium of an over-running clutch which serves to initiate the movement of the re-wind reel.

44. A machine comprising: a frame equipped with longitudinal guides; endless carriers having longitudinally moving portions engaging said guides, said carriers being equipped with spaced tube-shirring members; and a mandrel interposed

between the longitudinally moving portions of said carriers.

45. A machine as specified in claim 44, in which the mandrel extends forwardly beyond the carriers to provide a portion on which the shirred tube may accumulate, said mandrel having associated therewith an abutment for engaging a forward portion of the tube.

46. In a machine of the character set forth: an endless carrier equipped at intervals with tube-shirring blocks, said blocks being attached off-center to links of said carriers.

47. A machine comprising: a frame equipped with longitudinal guides; endless carriers equipped with guide-members movable through said guides; gripper-blocks mounted on said guide-members adapted to effect shirring of a tube; and a mandrel upon which shirring of the tube is effected.

48. In a machine of the character set forth: shirring mechanism comprising endless carriers having opposed longitudinally-moving portions; plates attached to said carriers, said plates being equipped with guide-members; gripper-blocks mounted on said plates in advance of their points of attachment to the carriers; a frame equipped with longitudinal guides through which said guide-members travel; and a mandrel ccacting with said gripper-blocks.

49. In a machine of the character set forth, a frame equipped with longitudinal guides; endless carriers having longitudinal portions near said guides; and spring-retracted mountings connected with said carriers, carrying gripper-blocks adapted to engage a tube to be shirred and having means engaging said guides while said gripper-blocks engage the tube; and a mandrel coacting with said gripper-blocks.

50. In a machine of the character set forth: a frame equipped with longitudinal guides; a mandrel interposed between said guides; and shirring-mechanism comprising a pair of endless chains, carrier-plates, each secured off-center to a link of the corresponding carrier-chain, said carrier-plates being equipped with guide-members traveling through said longitudinal guides; and gripper-blocks mounted on said carrier-plates and having tube-engaging grooves.

51. In a machine of the character set forth: a frame equipped with longitudinally-extending, vertically adjustable guides which are spaced apart; a mandrel extending into the space between said guides; and a tube-shirring mechanism comprising a pair of endless carrier-chains equipped with spaced gripper-blocks adapted to grip and carry forward the gripped portions of an inflated tube enveloping said mandrel.

52. A machine of the character set forth, comprising: a mandrel arranged and supported to permit a tube to pass thereon at one end and be removed from the other end; and shirring-mechanism equipped with means for gripping unshirred portions of the tube successively at spaced points and advancing the gripped portions and thus causing the portions in advance of the gripped portions to be shirred on the mandrel.

53. A method as specified in claim 1, as practiced by physically supporting the inner edges of the folds produced by the shirring action.

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