

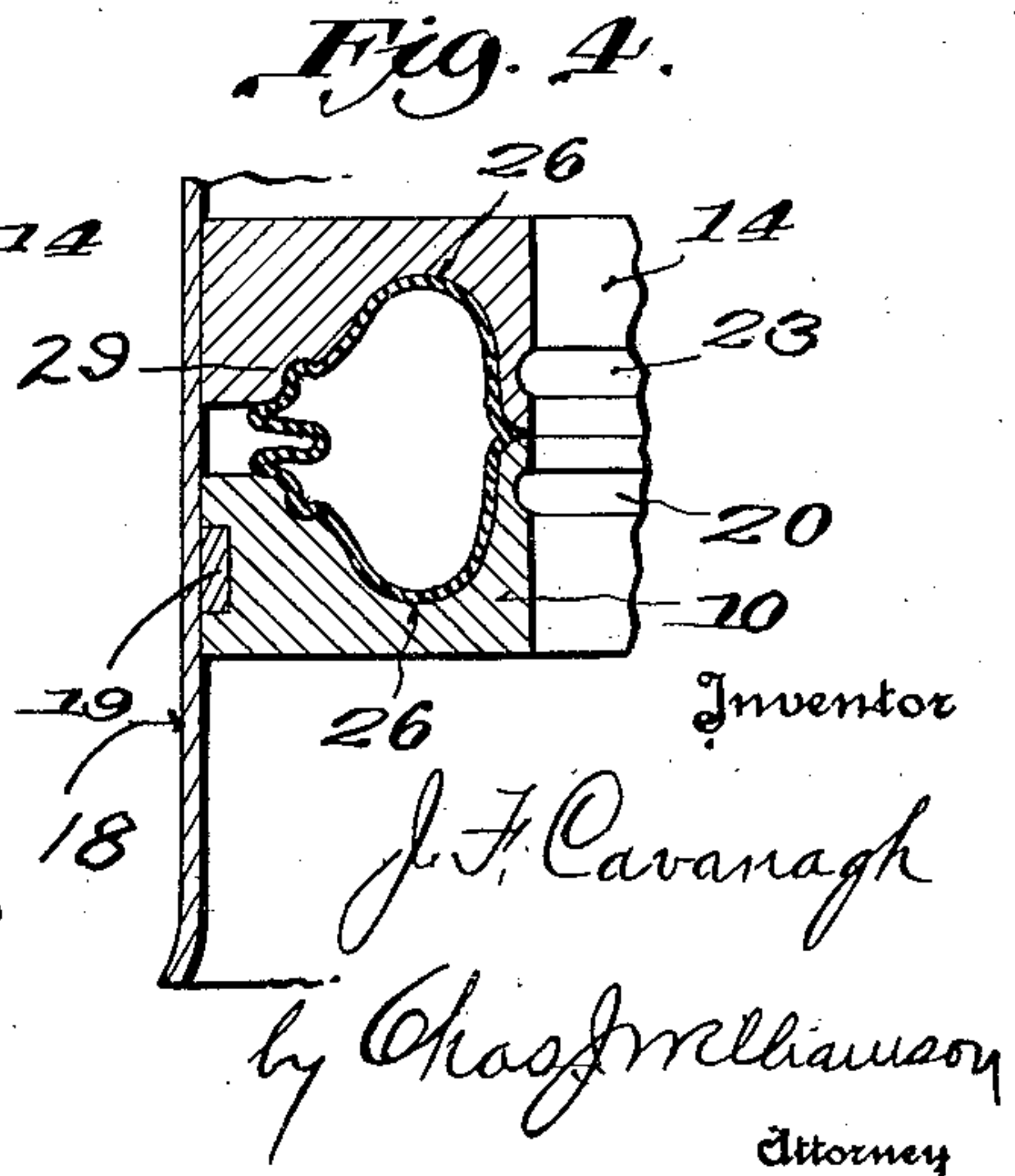
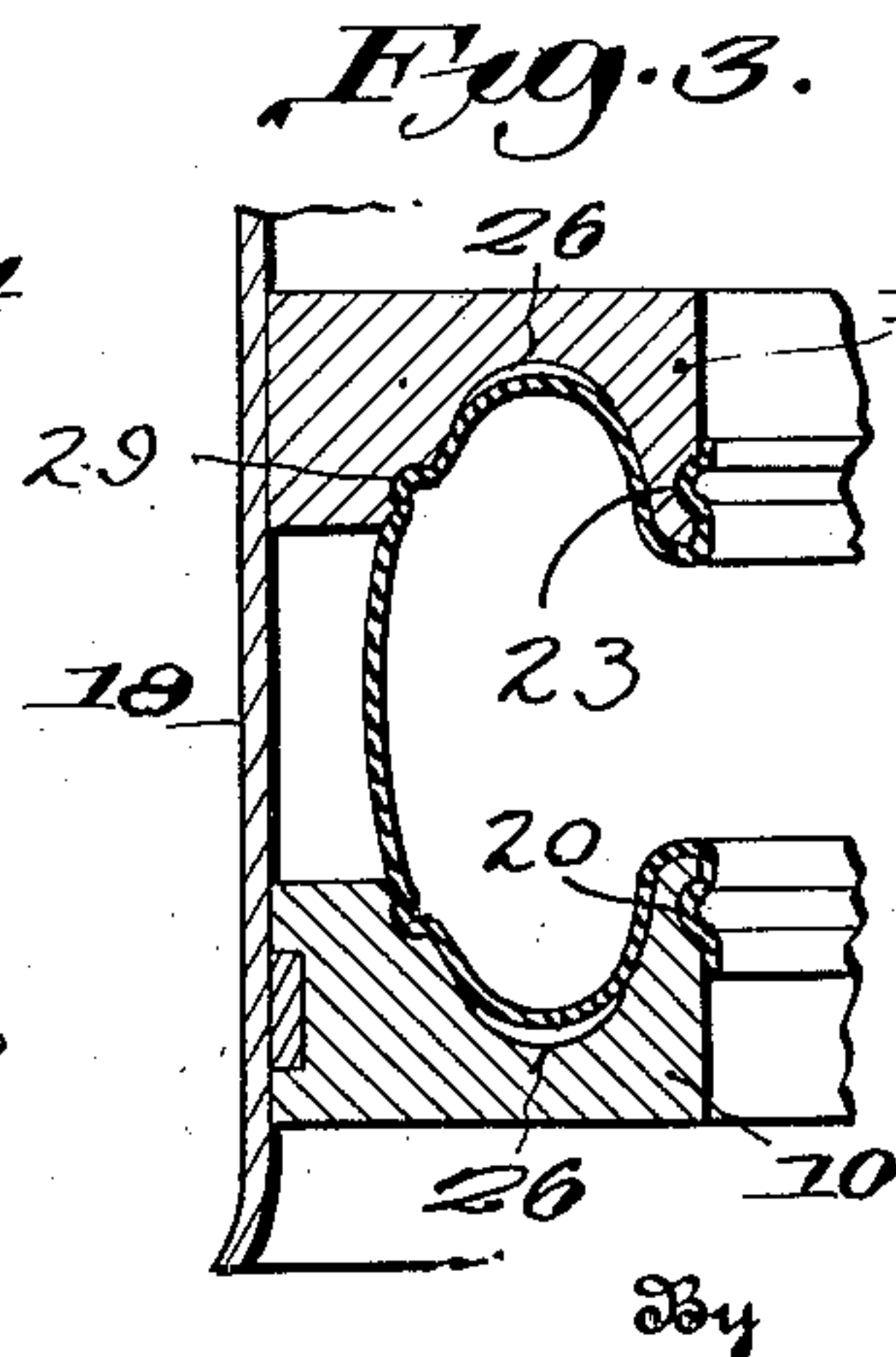
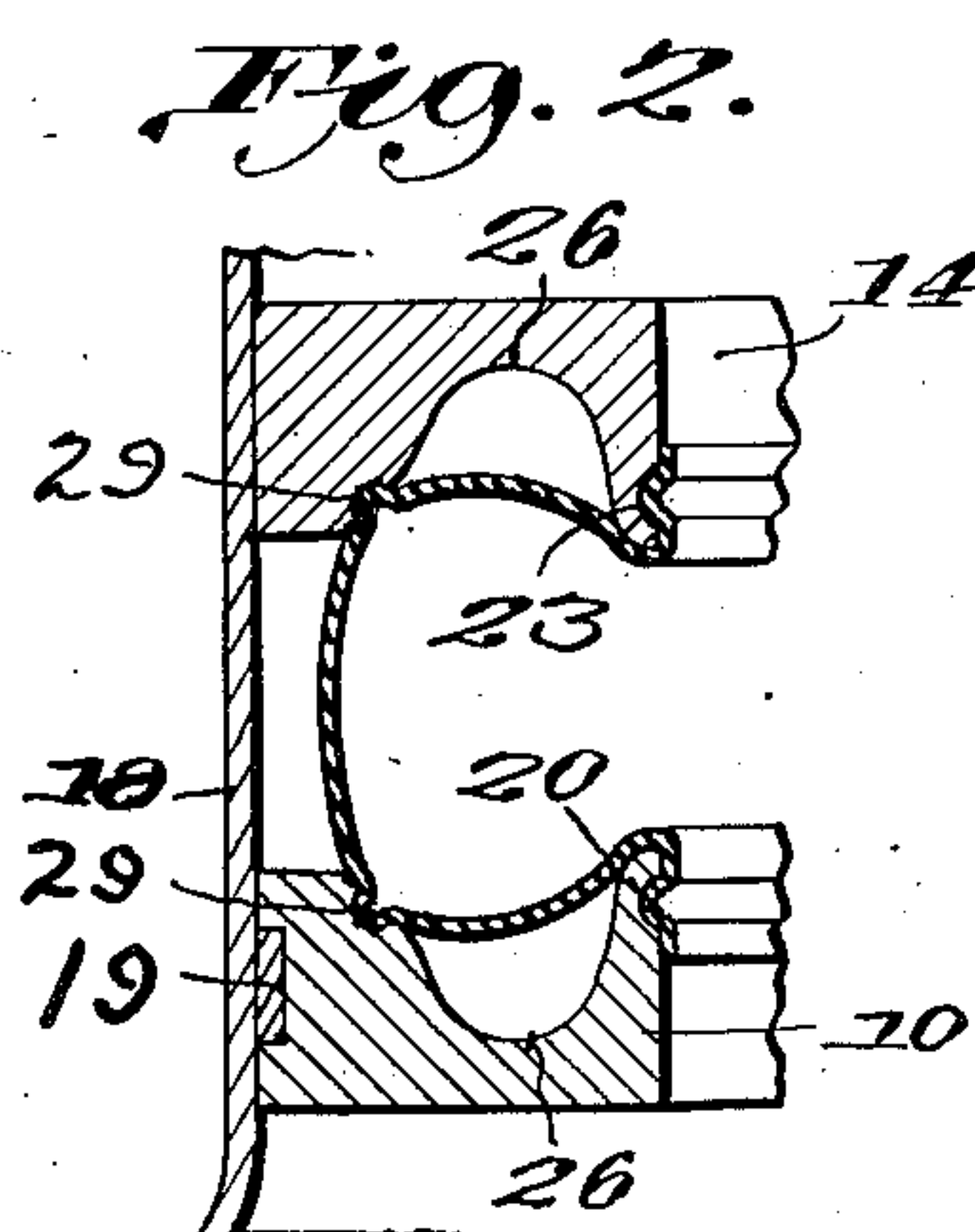
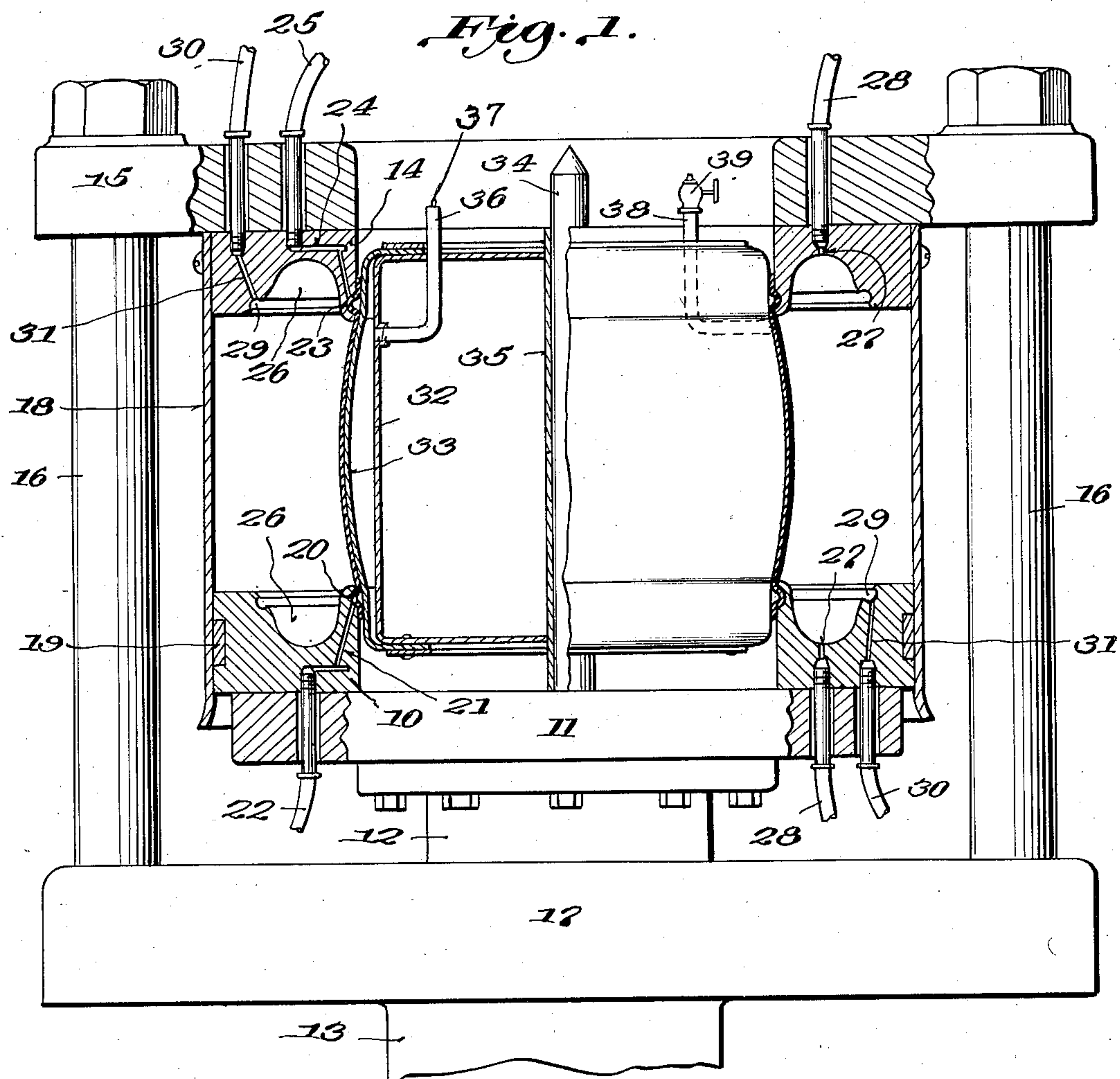
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METHOD OF AND APPARATUS FOR MAKING RUBBER TUBES

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METHOD OF AND APPARATUS FOR
MAKING RUBBER TUBESJohn F. Cavanagh, Pawtucket, R. I., assignor to
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12 Claims. (Cl. 154—14)

My invention relates to the manufacture of tubular or hollow articles of rubber and I will exemplify my invention in the case of the inner tubes for pneumatic tires. An object of my invention is to control the wall thickness of the finished article. Taking the case of inner tubes, for example, by usual methods of manufacturing, the wall, considering a cross section of the tube, is not of uniform thickness and its greatest thickness is at the rim and its greatest thinness is at the tread side of the tube which is an undesirable condition. The wall thickness in cross section tapers from the thickest to the thinnest portions. By my invention, the outer circumference of the tube, or that towards the tire tread may be of the same thickness as all other parts of the wall and if desired may be made thicker.

My invention consists in whatever is described by or is included within the terms or scope of the appended claims.

To illustrate one embodiment of my invention I shall show and describe the same in connection with a pair of concentric rings of the same diameter which have complementary annular cavities that form molds and are enclosed by an annular wall and which operate upon a blank of rubber in the form of an endless flat band or "pulley" which is applied to their inner sides, said rings being mounted in a hydraulic press so as to be movable towards and from one another in tube-forming operation within said enclosing wall.

In the drawing:

Fig. 1 is a view partly in section and partly in elevation of apparatus embodying my invention, the rings being shown separated and in the position to receive the band or pulley blank in the form of a simple cylinder;

Figs. 2, 3 and 4 are respectively detail views in section of portions of the rings showing successive stages in the operation of producing an inner tube from such a band or pulley.

Describing in detail what is shown in the drawing, the lower band edge engaging ring, 10, is secured to the upper side of a movable bed or platen, 11, which is mounted on the top of the ram, 12, of a conventional hydraulic cylinder, 13. The upper band edge supporting ring, 14, is secured to the under side of a stationarily supported bed, 15, said bed, 15, being solidly supported by a suitable number of columns or posts, 16, bolted at the bottom ends to the bed, 17, of the press which is placed upon the floor and below which the hydraulic cylinder extends.

Concentric with and enclosing the rings, 10

and 14 is a shell or cylinder, 18, which extends from its top downward from the bed, 15, and with whose interior wall the ring, 10, makes an air-tight fit as by means of a suitable packing, 19. Thus a box or chamber of ring form is provided so that when the upper and lower edge portions of the band that forms the blank from which the tube is to be made are secured air-tight against the inner peripheries of the rings, 10 and 14, and such blank reaching across from one ring to the other closes the space between them, the air may be exhausted from within the shell, 18, with the result that the band or blank will be bellied laterally outward into the hermetically sealed space within the shell, 18.

The lower ring, 10, has on its inner periphery an annular groove, 20, over which lies one edge portion of the blank or band from which leads an air hole or passage, 21, through the ring which by suitable hose or piping, 22, is connected with a vacuum pump. Thus a partial vacuum may be produced on the outer side of the rubber band overlying the annular groove, 20, and thereby that edge portion of the band is securely held with an air-tight seal to the lower ring, 10. The upper ring, 14, has on its inner periphery an annular groove, 23, from which leads an air hole or passage, 24, which by suitable pipe or hose, 25, is connected with the vacuum pump so that the edge portion of the band applied to the inner periphery of the ring, 14, may in like manner be pneumatically secured to the ring.

Each ring 10 and 14 has on its side towards the other concentric and nearer its inner periphery an annular mold cavity or depression 26, with a rounded surface, from the bottom of which leads outward an air hole, 27, with which is connected the vacuum pump by a suitable pipe or hose connection, 28. By the action of the vacuum pump exhausting air from the annular depression within each ring, the band or pulley blank held at its top and bottom edges to the respective rings will belly outward towards the enclosing shell or cylinder, 18, as simultaneously the two rings are moved towards one another. As indicated in Fig. 2 and as shown in Fig. 2 with the rings still a substantial distance apart the partially bellied blank will come in contact with the outer corner or edge of each depression or recess, 26, whereat is an annular concentric groove, 29, from which air is exhausted by the vacuum pump through a suitable pipe or hose connection, 30, from which a port, 31, leads to the groove and thereby the partially bellied blank will be seated at two separated points so that

what corresponds to the tread portion of the inner tube extending between them will no longer be subjected to the suction from the annular depressions or cavities, 26, and only those parts of the blank extending across the depressions or cavities, 26, will be then exposed to the vacuum and stretching will be drawn into and conform to the contour of such cavities or depressions as indicated in Figs. 3 and 4. As shown in Fig. 4 as the approach of the rings continues and proceeds until the inner edges of the blank are brought together and seamed, the outer peripheral or tread portion of the tube held between the ring grooves, 29, will simply fold or double over as indicated in Fig. 4. It will thus be seen that no stretching and thinning down of the tread portion of the inner tube extending between the grooves, 29, takes place but such stretching or thinning down as does take place occurs on the side and rim portions of the tube.

The formation of the seam by the coming together of the inner edges of the rings is accompanied by the pinching off of the excess material of the blank that consists of the amount of lap of the band blank edges on the inner peripheries of the rings.

The width of the pulley or band blank in its cylindrical form or the distance from edge to edge thereof is less than the circumference of the cross section of the completed tube, the difference being made up by the stretch of the rubber in the forming operation. By varying the width of the sheet forming the pulley or band blank and by varying the degree of vacuum applied to the annular depressions or recess, 29, obviously I can control the stretch and thickness of the wall of the inner tube making it of uniform thickness should it be desired or thicker at one place and thinner at another.

The band which forms the blank from which the inner tube is to be made is, of course, inherently flimsy and lacking in enough rigidity to be self-supporting. I, therefore, provide means that constitute a temporary support for placing it in the press and with its opposite edges in contact with the inner peripheries of the rings 10 and 14. Such means comprise a cylindrical drum, 32, having a peripheral cover or envelope, 33, preferably of rubber secured at opposite ends to the drum heads in an air-tight manner so that by the introduction of air pressure on the inner side of the cover or envelope, it will bulge or expand convexly outward and having a corresponding action or effect upon the annular band or blank from which the tube is to be made that is placed over the drum in a loose or relaxed state. The blank will thus be supported and by placing the drum through a central opening in the supporting bed of the upper ring 14 and so that the upper and lower edges of the blank are opposite the inner peripheries of the respective rings 10 and 14, the band may be placed in position for the action of the press. When placed in such position, the band edges are in contact with the inner peripheries of said rings and upon the production of the vacuum between the band edges and the rings, such edges will be tightly held in contact with the ring surfaces and the band bellied slightly outwards will extend across between the two now widely separated rings. The positioning and securing of the band or blank being thus accomplished, the air pressure is removed from the interior of the envelope and thereby the drum is released from the band or blank and is removed from the press so that the

ensuing operations of producing the vacuum within the vacuum box and causing the approach of one ring to the other may be carried on.

For the convenient placing and accurate positioning of the drum in the press the latter has a central post or vertical pintle 34, concentric with the rings which is secured at its lower end to the platen, 11, and the drum has a central tubular shaft, 35, to fit slidably over the pintle.

For inflating or expanding the flexible drum envelope, a pipe 36, extends at one end through the drum periphery and at the other end is carried through one of the heads of the drum and is provided thereat with a check valve, 37, such as the ordinary tire inflating valve with which an air hose connection can be made to supply air under pressure. To take the pressure from within the envelope, a pipe, 38, at one end opens through the drum periphery and at its other end emerges through the drum head where it is provided with a valve, 39, which is opened to take off the air pressure.

What I claim is:—

1. A method of making hollow elastic articles which includes the acts of subjecting a blank of elastic material that forms the article walls to outwardly stretching force over only a limited area thereof, maintaining the portion of the blank beyond the limited area in which stretching takes place in a readily foldable state while the opposing edge portions of the blank are being brought together, and retaining the unstretched portion in the finished article and bringing together and uniting opposing edge portions of said blank to close the article walls.

2. A method of making inner tubes for pneumatic tires which includes the acts of supporting an annular band of elastic material at opposite edges, causing a bellying movement of said blank in directions radial and axial of said annular band, maintaining the portion of the band that is subjected to bellying movement in a readily foldable state during the axial movement of the band, such bellying movement being accompanied by stretching of limited areas of said blank and then bringing in the blank edges together and joining them.

3. A method of making annular elastic tubes which includes the acts of supporting an annular band of elastic material at opposite edges with the portion between such edges unsupported causing radial movement of the unsupported portion to belly the band and then subjecting marginal portions of the band only to pressure to stretch such marginal portions and bringing such edges together and joining them while such marginal portions are in a stretched condition.

4. Hollow elastic wall article making apparatus comprising members with opposing cavities each member having blank holding means at opposite sides of the cavity and means to stretch the portion of the blank extending between said holding means into the cavity.

5. Hollow elastic wall article making apparatus comprising members with opposing cavities each member having blank holding means at opposite sides of the cavity and means to stretch the portion of the blank extending between said holding means into the cavity and means to move said members towards one another.

6. Hollow elastic wall article making apparatus comprising means for bellying and stretching a blank and means to localize the area that is stretched to a marginal portion of the blank.

7. A method of making an inner tire tube which

includes the acts of subjecting a blank of elastic material that forms the tube walls to outwardly stretching force restricted to an area at the sides of what corresponds to the tread portion of the tube.

8. A method of making an inner tire tube which includes the acts of subjecting a blank of elastic material that forms the tube walls to outwardly stretching force restricted to an area corresponding to the sides of the tube, and collapsing the portions of the blank that form the tread portion of the tube, concurrently with movement of the opposite side portions of the blank towards one another.

9. Hollow elastic wall article making apparatus comprising opposite members with opposing cavities, each member having blank-holding means at opposite sides of the cavity, means to stretch the portion of the blank extending between said holding means into the cavity and means to subject that portion of the blank between the opposite members to a force that moves said blank into the space between such opposite members.

10. A method of making hollow articles of

stretchable material, which includes the acts of placing a blank of stretchable material over a cavity at opposite edges of the cavity, leaving a portion of such blank beyond one of such edges free to collapse, subjecting the portion of such blank over said cavity to stretching pressure and causing collapsing movement of said free portion of the blank without stretching the same.

11. A method of making hollow elastic articles which includes the acts of subjecting a blank of elastic material that forms the article walls to outwardly stretching force over only a limited area thereof and retaining the unstretched portion in the finished article, the area other than the limited area not being subjected to the stretching force acting on the limited area.

12. A method of making inner tubes for pneumatic tires which includes the acts of supporting at opposite edges a blank of elastic material and stretching a limited area thereof only while so supported and retaining the unstretched portion in the finished tube, the area other than the limited area being free from stretching action.

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