

May 7, 1940.

O. I. WARING

2,199,425

METHOD AND MEANS FOR MAKING CAPSULES

Filed Nov. 16, 1937

5 Sheets-Sheet 1

Fig. 1.

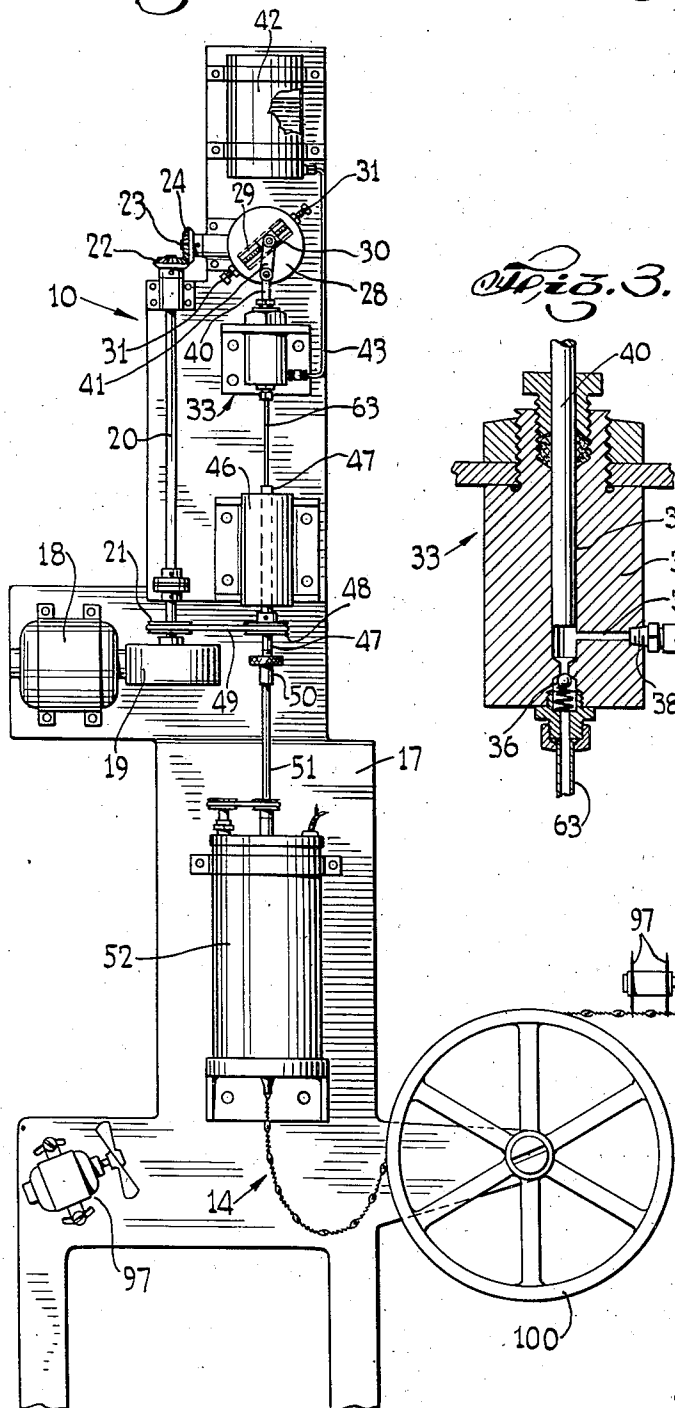


Fig. 2.

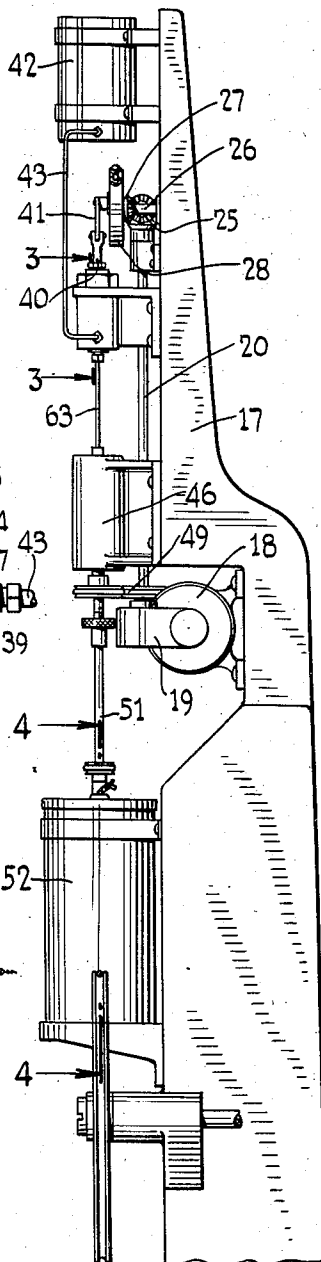
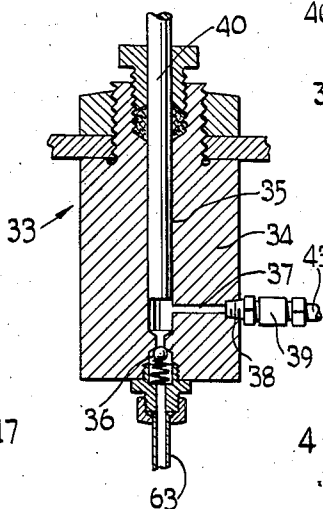


Fig. 3.



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Fig. 4.

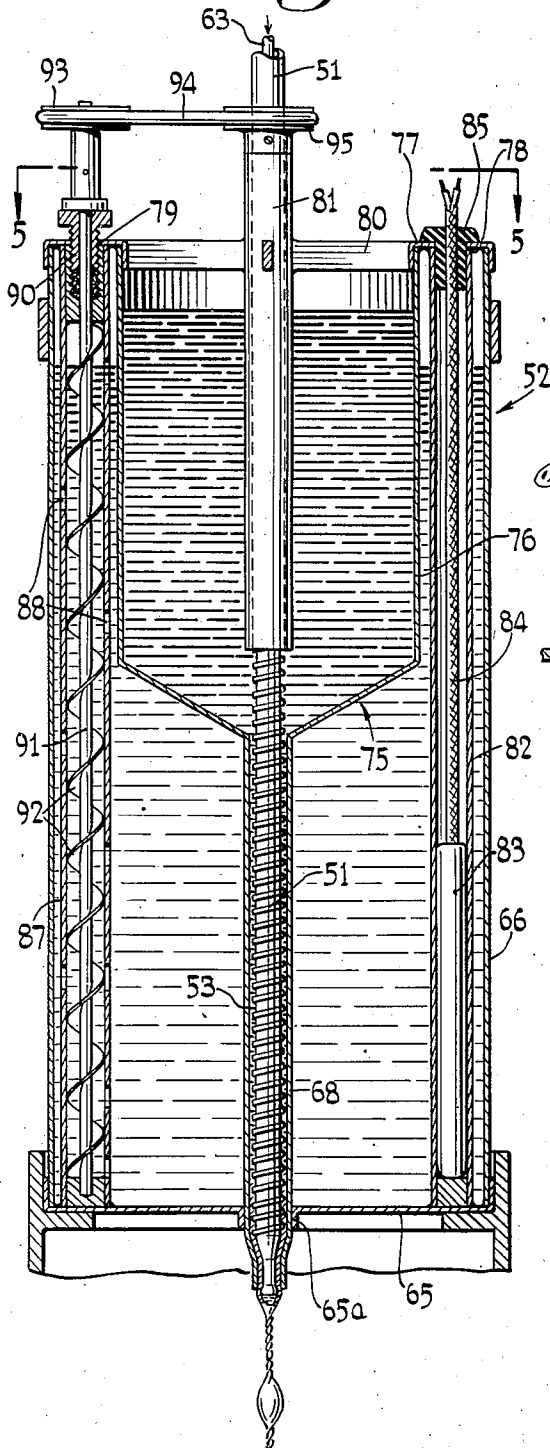


Fig. 5.

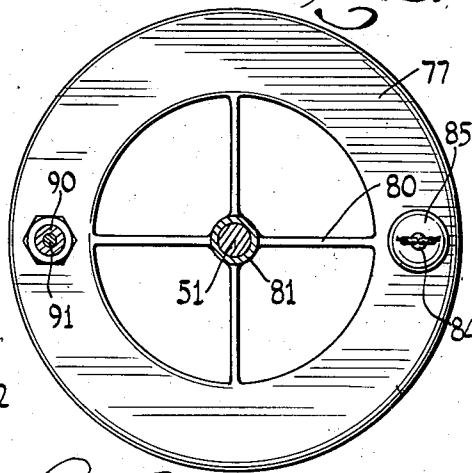


Fig. 7.

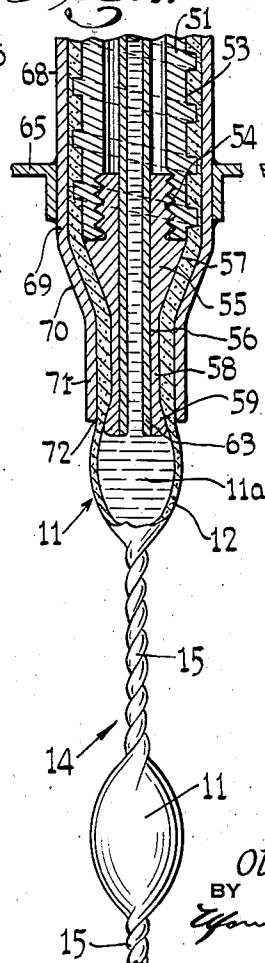
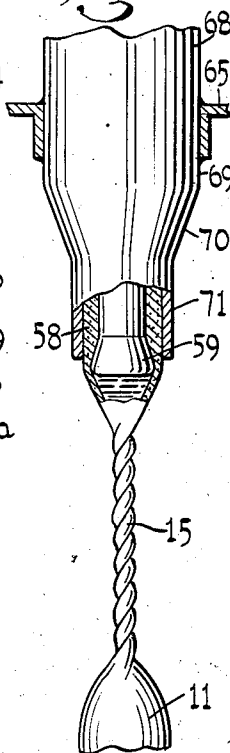


Fig. 6.



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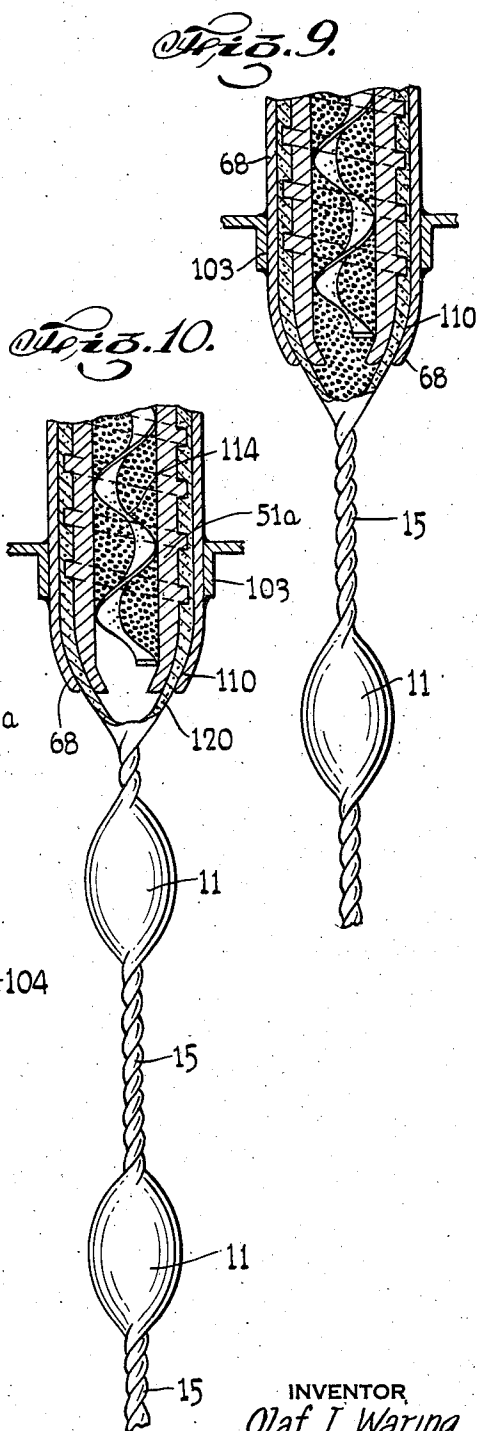
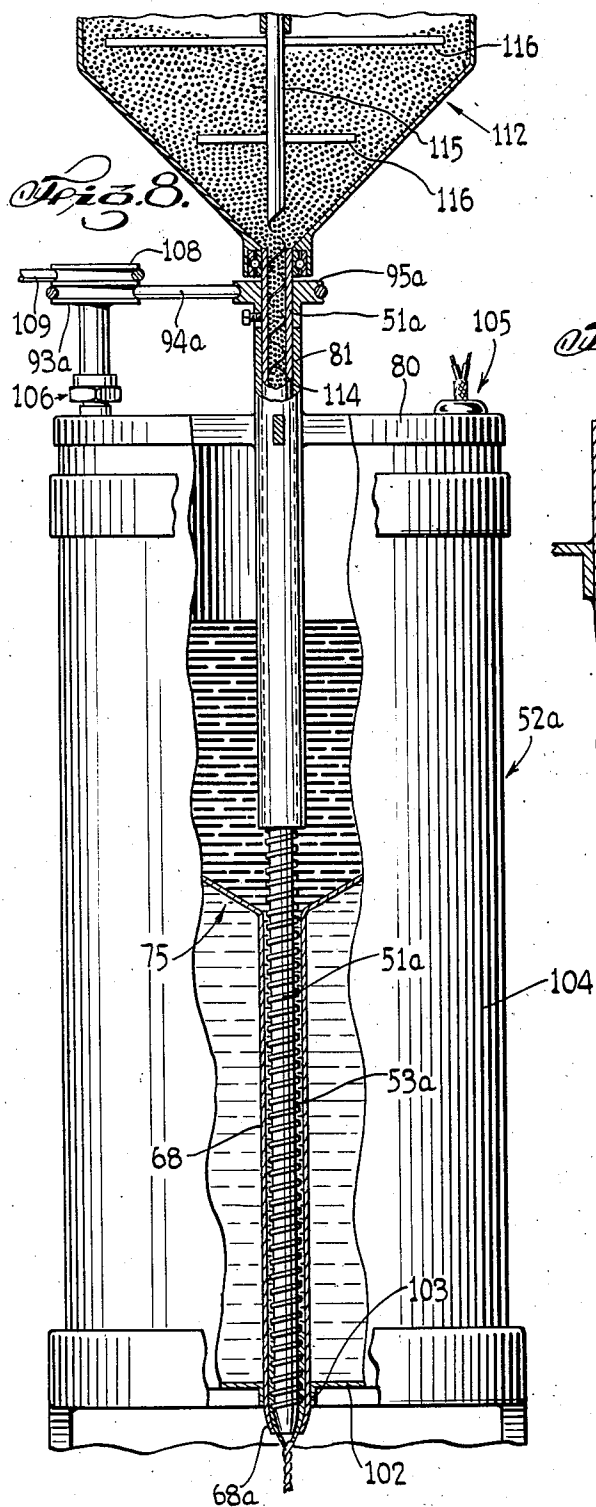
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METHOD AND MEANS FOR MAKING CAPSULES

Filed Nov. 16, 1937

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Fig. 11.

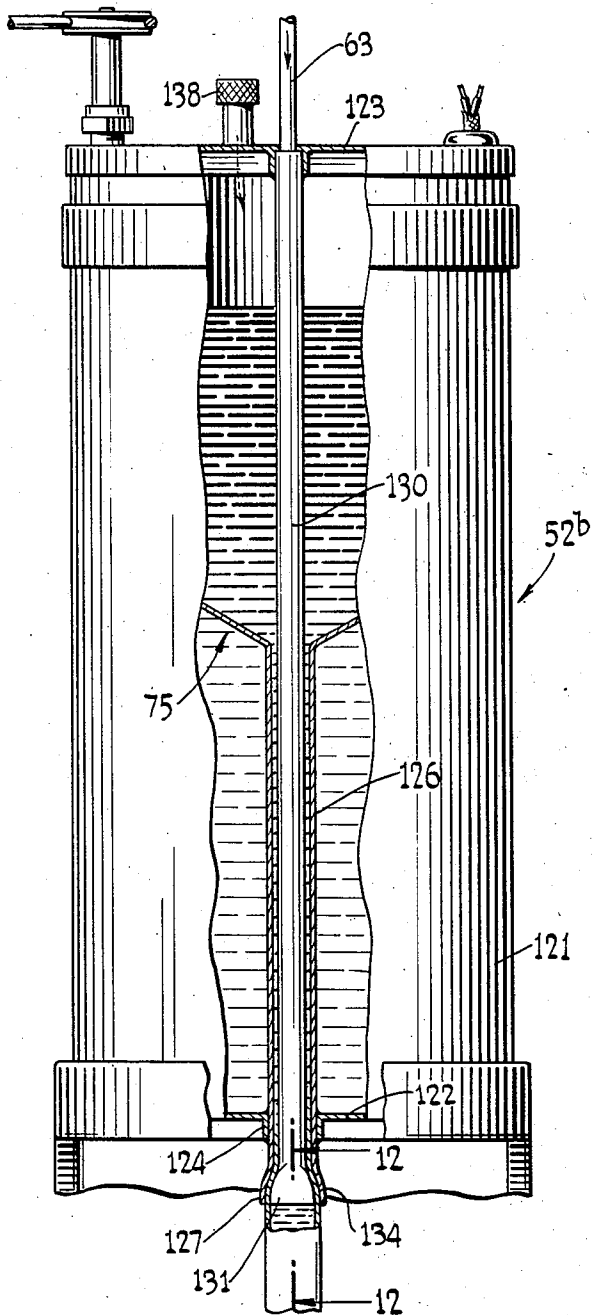


Fig. 12.

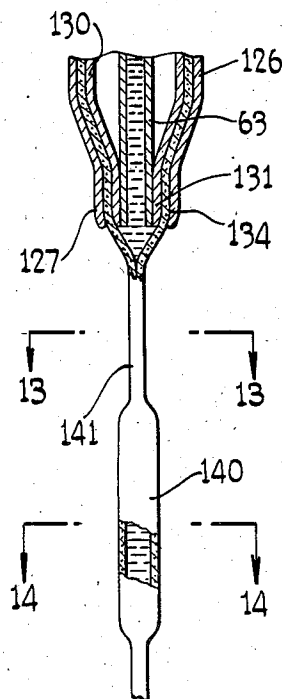


Fig. 13.

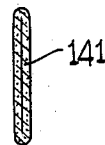
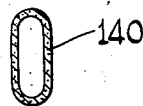


Fig. 14.



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Fig. 15.

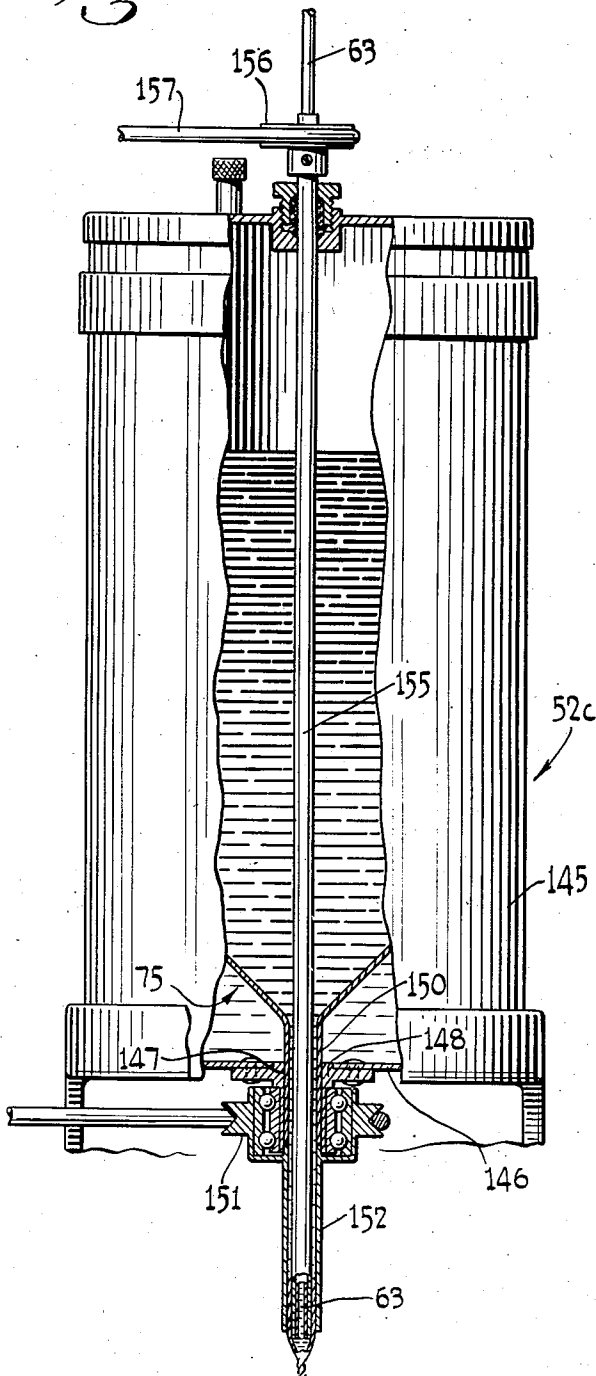


Fig. 16.

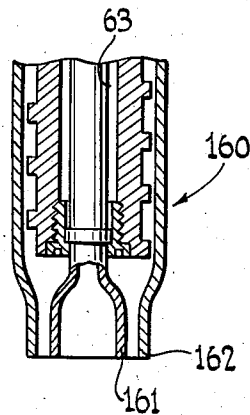
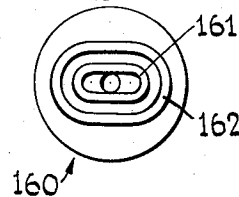


Fig. 17.



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2,199,425

METHOD AND MEANS FOR MAKING CAPSULES

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Application November 16, 1937, Serial No. 174,833

11 Claims. (Cl. 18-5)

This invention relates to improved methods of, and apparatus for making capsules filled with medicaments or the like substances such as fluids, semi-fluids, or substances in powder, crystalline or granular form.

An object of this invention is to provide improved means and method for making capsules filled with oil, fluids, semi-fluids or substances in powder, crystalline or granular form, and having a relatively thin seamless wall which will melt or dissolve quickly to release its contents when taken internally or placed in warm water or when otherwise heated or ruptured, and which shall at the same time be strong enough to permit ordinary handling without rupture.

Another object of this invention is to provide highly improved apparatus of the character described for making a continuous string of connected capsules whereby the portions connecting the capsules may be severed to give individual capsules.

Still another object of this invention is to provide a highly improved and economical method of making capsules consisting in extruding capsule wall forming material, while in a liquid or semi-liquid state, and injecting into the extruded material at intervals, charges of capsule filling material to form a continuous string of seamless capsules connected by the wall forming material and which may be readily cut to separate the capsules from one another.

Yet another object of this invention is to provide apparatus of the character described which shall be relatively inexpensive to manufacture, simple and positive in operation, and yet practical and efficient to a high degree in use.

Other objects of this invention will in part be obvious and in part hereinafter pointed out.

The invention accordingly consists in the combination of steps, features of construction, combinations of elements, and arrangement of parts which will be exemplified in the construction and method hereinafter described, and of which the scope of application will be indicated in the following claims.

In the accompanying drawings, in which is shown one of the various possible illustrative embodiments of this invention,

Fig. 1 is an elevational view of apparatus embodying the invention for making my improved capsules;

Fig. 2 is a side elevational view of the apparatus shown in Fig. 1;

Fig. 3 is an enlarged cross-sectional view taken on line 3-3 of Fig. 2;

Fig. 4 is an elevational cross-sectional view taken on line 4-4 of Fig. 2;

Fig. 5 is a cross-sectional view taken on line 5-5 of Fig. 4;

Fig. 6 is an enlarged elevational view of the capsule forming nozzle illustrating one step in the formation of the capsule;

Fig. 7 is a view similar to Fig. 6, but showing parts in cross-section, and illustrating a later period in the formation of the capsule;

Fig. 8 is an elevational view of a portion of apparatus for forming capsules filled with powder; and

Fig. 9 is an enlarged cross-sectional view of the capsule forming nozzle of the apparatus shown in Fig. 8, and illustrating one step in the process of the formation of the capsule.

Referring now in detail to the drawings, 10 designates apparatus embodying the invention, for forming and filling seamless capsules 11 containing medicaments or the like materials such as oil, powder, pulverized or plastic substances 11a.

The capsule 11 made in accordance with my improved method and with my improved apparatus has a relatively thin, seamless encasing wall 12 of gelatinous or the like substance. It has sufficient strength to permit ordinary handling without rupture, and yet quickly melts, dissolves or ruptures when taken internally or otherwise heated.

The apparatus 10 forms a continuous string 14 of said capsules 11, connected by portions 15 of the encasing material. Said apparatus comprises a vertical frame 17 supporting the various parts of the apparatus described hereinafter. On frame 17 is an electric motor 18 rotating, through suitable reduction gearing 19, a vertical shaft 20. On shaft 20 is a pulley 21, and a beveled gear 22. Journalled on said frame 17 is a horizontal shaft 23 carrying at one end, a bevel gear 24 meshing with said gear 22, and also carrying, at its other end, a bevel gear 25. Journalled on frame 17 is a horizontal shaft 26 perpendicular to the shaft 23 and carrying a bevel gear 27 meshing with gear 25. On shaft 26 is a disc 28 formed with a diametric slot 29 in which is slidably mounted a block 30. The position of block 30 in slot 29 may be adjusted by aligned, diametric screws 31 at opposite ends of the slot.

Fixed to frame 17, below disc 28, is a pump 33 comprising a member 34 having a vertical through bore 35, provided with a check valve 36 adjacent its lower end to prevent upward flow. Member 34 also has a horizontal passage 37 com-

municating with bore 35 above said check valve. Screwed to the member 34 at one end of said passage 37 is a nipple 38 provided with a check valve 39.

5 Within bore 35 is a plunger 40 connected by link 41 to block 30. The stroke of plunger 40 may be regulated by properly adjusting screws 31.

Supported by frame 17, above disc 28, is a tank 42 or container for the material to form and fill 10 the capsules, such as castor oil or any other plastic or liquid material. A pipe 43 connects the bottom of said tank with check valve 39. Said check valve prevents flow of filling substances upwardly through pipe 43.

15 Supported on frame 17, below pump 33 is a vertical bearing 46 rotatably supporting a hollow vertical pipe 47. Said pipe carries a pulley 48 aligned with pulley 21 and connected thereto by belt 49. Detachably attached to the lower 20 end of pipe 47, by coupling 50, is a vertical hollow pipe 51 extending axially through a cylindrical container 52 supported on frame 17. The major portion of the pipe 51 within the container 52, is formed with a helical groove 53 whereby said pipe has an external screw thread, 25 for the purpose hereinafter appearing.

At its lower end, pipe 51 has an internal screw threaded portion 54 to which is screwed a nozzle member 55 having an axial through opening 30 56 of less internal diameter than pipe 51. Nozzle member 55 has a downwardly converging, outer conical surface 57, a cylindrical surface 58 extending from said conical surface, and a downwardly and outwardly flaring surface 59 extending 35 from said cylindrical surface.

Attached to pump 33 at the lower end of bore 35, and communicating therewith, is a pipe 63 passing through and telescoping within pipe 51 and nozzle 55 and terminating at the lower end 40 of said nozzle.

Container 52 has a horizontal bottom wall 65 and a vertical cylindrical wall 66. Said bottom wall has a central opening through which the lower end of pipe 51 projects. Fixed within the 45 container 52 is an axial sleeve 68 surrounding and telescoping with substantially the lower half of pipe 51. The lower end 69 of sleeve 68 projects through opening 65a and closes said opening. Said lower end 69 of said sleeve has a conical 50 portion 70, concentric with conical surface 57, and a downwardly projecting cylindrical lower end portion 71 surrounding portions 58, 59 of the nozzle 55, and forming therewith, an annular orifice 72 at the lower end of the nozzle. Capsule 55 wall forming material is extruded through said orifice continuously, as will be explained hereinafter.

Fixed to the upper end of sleeve 68 is a hopper 75, having a cylindrical wall 76, concentric with 60 and spaced inwardly of wall 66 of the container 52.

The upper rim edges of walls 66, 76 are at the same level and are interconnected by an annular ring 77 closing the space therebetween. Said ring 77 has a pair of diametrically spaced openings 78, 79, and is provided with a spider 80 supporting an axial vertical sleeve 81 serving as a bearing for pipe 51. Sleeve 81 projects above container 52, and also projects into hopper 75, terminating short of the upper end of sleeve 68. 70

Fixed within container 52 and extending the length thereof is a vertical pipe 82 registering with opening 78. Within said pipe is an electric heater 83 of any suitable construction, the wiring 84 whereof, extends through said pipe and 75

through a bushing 85 at the upper end of said opening 78.

There also extends through container 52, a vertical pipe 87 registering with opening 79. Said pipe 87 is formed with a plurality of longitudinally and peripherally spaced perforations 88, for the purpose hereinafter appearing. At the upper end of pipe 87 is a bearing 90 in which is journaled a rod 91 carrying a helically twisted bar 92. The upper end of rod 91 projects above container 52 and carries a pulley 93 connected by belt 94 to a pulley 95 on pipe 51, and at the upper end of sleeve 81. 10

Helical groove 53 is opposite to the twist of helical bar 92, for the purpose described below. 15

The operation of my improved apparatus will now be described:

The container is filled with water to surround the sleeve 68 and hopper 75. Hopper 75 is filled with a capsule wall forming material such as gelatin or any suitable plastic material. 20

The water in the container is kept warm by the heater to keep the gelatin in liquid condition; and hot water is carried upwardly in perforated pipe 87 to keep the water at an even 25 temperature. The heated water keeps the gelatin in liquid form to flow between pipe 51 and sleeve 68.

Motor 18 is started to rotate disc 28 and hence reciprocate plunger 40. The filling material within tank 42 passes through pipe 43, valve 39, into bore 35, and is forced downwardly through valve 36 and pipe 63. Pipe 51 is rotated by belt 49 to feed the gelatinous substance in the hopper downwardly to the orifice 72. Due to rotation 35 of pipe 51 and nozzle 55 fixed thereto, the emerging gelatin twists to make the connecting portions 15, while plunger 40 moves upwardly. When the plunger comes down however, material from pipe 63 distends the gelatin to form a bulb or capsule, the twisting operation being interrupted, until the plunger starts moving up again, at which time, the formed capsule drops due to its weight, and the gelatinous material again starts twisting. 40

Means may be provided to harden the capsules as soon as they are formed. To this end, there is supported on frame 17, an electric fan 97 adapted to blow air at the orifice 72 where the capsules emerge from the apparatus. The fan 97 blowing on each capsule as it emerges from the nozzle 50 hardens the same.

The gelatin being in a semi-liquid state when it leaves the nozzle is therefore plastic and forms itself into a solid homogeneous mass except when distended by a substance injected into it. Thus 55 no seam results at either end of the formed capsule.

The flared surface 49 of the nozzle helps shape the capsule when filling material is forced through pipe 63. 60

It will now be understood that the pump intermittently forces measured amounts or charges of filling material at intervals through pipe 63 into the extruded gelatin. The amounts of material in each charge may be adjusted by manipulating screws 31 to change the stroke of the plunger. 65

The lengths of the connectors may be regulated by adjusting the speed of motor 18.

A wheel 100 rotatably supported on frame 17 below, and at one side of container 52, is adapted to carry away the string 14 of capsules as the string comes out of said container 52. 70

If desired, the connecting portions 15 may be severed to form individual capsules. Any suit- 75

able cutting means may be employed such as for example rotary cutter blades 97a shown in Fig. 1 of the drawings.

It will now be understood that the walls of the capsules are seamless and hence may be made relatively thin to dissolve or rupture quickly for releasing the medicament when taken internally or otherwise heated, and yet have the requisite strength to permit ordinary handling without rupture.

It is also seen from the above described operation of the formation of my improved seamless capsules that the capsules so formed will also be entirely free from air. This is of extreme importance when it is desired to fill the capsule with any substance which would deteriorate or lose its vital properties in the presence of air.

Figs. 8 and 9 show apparatus embodying the invention for forming capsules filled with powder or pulverized material. In said figures there is shown a container 52a comprising a bottom wall 102 formed with a central opening 103, and an upstanding cylindrical wall 104. Within the container 52a, furthermore, is a hopper 75 provided with a downwardly extending sleeve 68 projecting through the central opening 103 in the bottom wall 102. The upper end of the hopper may be interconnected to the cylindrical wall 104 by an annular ring 80 supporting a vertical axial sleeve 81 projecting above the container and also down into the hopper 75. The lower end 68a of the sleeve 68 is constricted or curved inwardly, as shown in the drawings.

Journalled within the sleeve 81 is a tubular member 51a having an external, helical groove 53a substantially throughout the major portion thereof. The upper end of the tubular member 51a projects somewhat above the sleeve 81 and carried by said projecting portion is a pulley 95a connected by belt 94a to pulley 93a at the upper end of the rotary water circulating member 106. On said rotary member is another pulley 108 connected by belt 109 to any suitable drive member for rotating the member 106 and the tubular member 51a simultaneously in the same direction.

The member 51a telescopes within the sleeve 68 and the lower end of said tubular member is constricted inwardly at the bottom end thereof to form a tapering passage 110 at the lower end of the nozzle edges below the bottom wall 102. The gelatinous substance within the hopper 75 may thus pass between the tubular member 51a and the sleeve 68, being fed downwardly by rotation of the member 51a. The water in the bottom of the container 52a and surrounding the hopper keeps the gelatinous substance warm while the capsules are being formed.

Means is provided to feed a powder or pulverized substance through the tubular member 51a for filling the capsules. To this end, a hopper 112 receives the upper end of the tubular member 51a. Extending through the tubular member 51a is a helically twisted bar 114 carried by a rod 115 disposed within the hopper 112. The helically twisted bar 114 serves to feed the powder downwardly upon rotation. On the rod 115 are agitating projections or arms 116. Any suitable means (not shown) may be provided for intermittently rotating the rod 115. When the rod 115 and the bar 114 rotate, the powdered material will distend the mass 120 of gelatinous substance emerging from the passage or orifice 110 to form a capsule. When the rod 115 and its bar 114 are at rest, the formed capsule will

drop by gravity and rotation of the tubular member 51a will cause the tube of gelatinous material to twist. The pressure of the powdered material downwardly below the bottom end of the tubular member 51a, while the bar 114 is rotated, will interrupt the twisting movement of the gelatinous mass 120.

As shown in the drawings, there emerges from the apparatus 52a a continuous string of capsules 11 interconnected by twisted portions 15 adapted to be severed in any suitable manner to separate the capsules.

It will thus be seen that there is provided a device in which the several objects of this invention are achieved, and which is well adapted to meet the conditions of practical use.

As various possible embodiments might be made of the above invention, and as various changes might be made in the embodiments above set forth, it is to be understood that all matter herein set forth or shown in the accompanying drawings is to be interpreted as illustrative and not in a limiting sense.

Having thus described my invention, I claim as new and desire to secure by Letters Patent:

1. In apparatus of the character described for forming seamless capsules, a hopper adapted to contain a material for forming capsule walls, a tube extending therefrom and communicating therewith, a second tube extending through said first tube, means for intermittently supplying charges of capsule filling material through said second tube, and means for rotating said second tube.

2. In apparatus of the character described for forming seamless capsules, a hopper adapted to contain a material for forming capsule walls, a tube extending therefrom and communicating therewith, a second tube extending through said first tube, means for intermittently supplying charges of capsule filling material through said second tube, said second tube having an external helical groove, and means for rotating said second tube about its axis.

3. In apparatus of the character described for forming seamless capsules, a hopper adapted to contain a material for forming capsule walls, a tube extending therefrom and communicating therewith, a second tube extending through said hopper and first tube, means for intermittently supplying charges of capsule filling material through said second tube, said means comprising a helical member within said second tube, and means for rotating said helical member.

4. In apparatus of the character described for forming seamless capsules, a hopper adapted to contain a material for forming capsule walls, a tube extending therefrom and communicating therewith, a second tube extending through said hopper and first tube, means for intermittently supplying charges of capsule filling material through said second tube, said means comprising a helical member within said second tube, means for rotating said member, said second tube being formed with an external helical groove, and means for rotating said second tube.

5. Apparatus for forming seamless capsules comprising, a pair of concentric tubes having adjacent ends, means for supplying capsule wall forming material to the space between said tubes, means for forcing said material through the annular orifice at the adjacent ends of said tubes to continuously extrude said material, means for intermittently feeding charges of capsule filling material through the inner of said spaced tubes

and into said wall forming material, to form a string of capsules connected by connectors of wall forming material, and means for axially rotating the inner of said tubes.

- 5 6. A process for making seamless capsules comprising extruding through an orifice, plastic capsule wall forming material in fluid state, injecting into said fluid wall forming material, at intervals, charges of capsule filling material and immediately thereafter setting the wall forming material whereby a continuous string of connected seamless capsules is formed.
- 10 7. A process for making seamless capsules comprising extruding through an orifice, plastic capsule wall forming material in fluid state, injecting into said fluid wall forming material a charge of capsule filling material and immediately thereafter setting the wall forming material whereby a seamless capsule is formed.
- 15 8. Apparatus for forming seamless capsules comprising an inner tube having a discharge opening at one end and an outer tube surrounding said inner tube and spaced therefrom, means for feeding fluid capsule wall forming material into and discharging the same from the space between said tubes, said outer tube having a discharge opening for said material terminating in substantially the same plane as the discharge opening of the inner tube, and means for intermittently feeding charges of capsule filling material from the discharge opening of the inner tube.
- 20 25 30

9. A process for making seamless capsules comprising continuously extruding through an orifice, plastic capsule wall forming material in fluid state, injecting into said extruded wall forming material at intervals, under pressure sufficient to distend the same, charges of capsule filling material and immediately thereafter setting the wall forming material whereby a continuous strip of connected seamless capsules is formed.

10 10. A process for making seamless capsules comprising extruding through an orifice, plastic capsule wall forming material in fluid state, injecting into said extruded wall forming material under pressure sufficient to distend the same, a charge of capsule filling material and immediately thereafter setting the wall forming material whereby a seamless capsule is formed.

15

11. Apparatus for forming seamless capsules comprising an inner tube having a discharge opening at one end and an outer tube surrounding said inner tube and spaced therefrom, means for feeding fluid capsule wall forming material into and continuously discharging the same from the space between said tubes, said outer tube having a discharge opening for said material terminating in substantially the same plane as the discharge opening of the inner tube, and means for intermittently feeding charges of capsule filling material from the discharge opening of the inner tube into the extruded wall forming material.

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