

May 10, 1927.

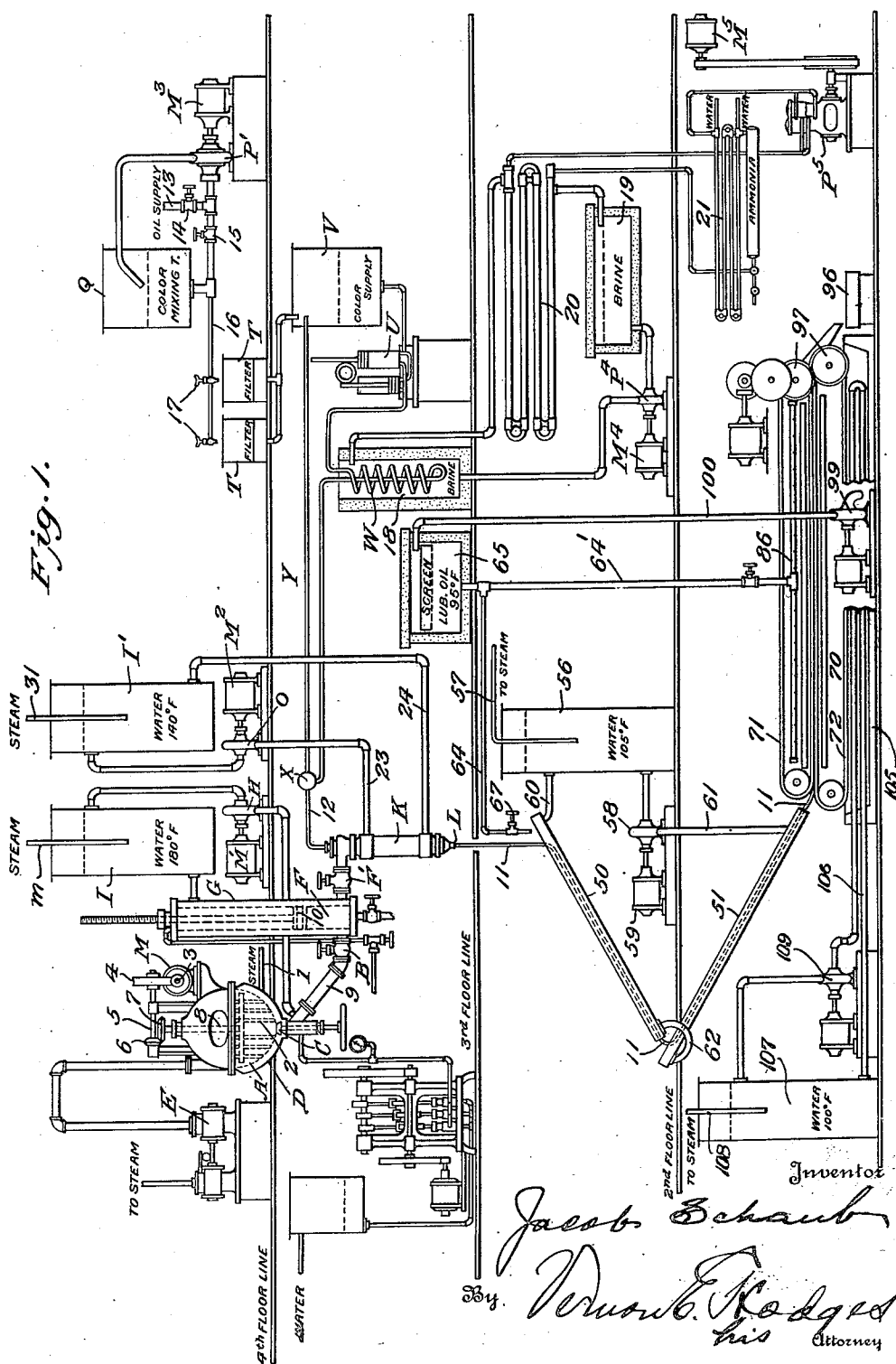
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APPARATUS FOR AND ART OF MANUFACTURE AND FILLING OF CAPSULES

Filed Jan. 9. 1924

11 Sheets-Sheet 1



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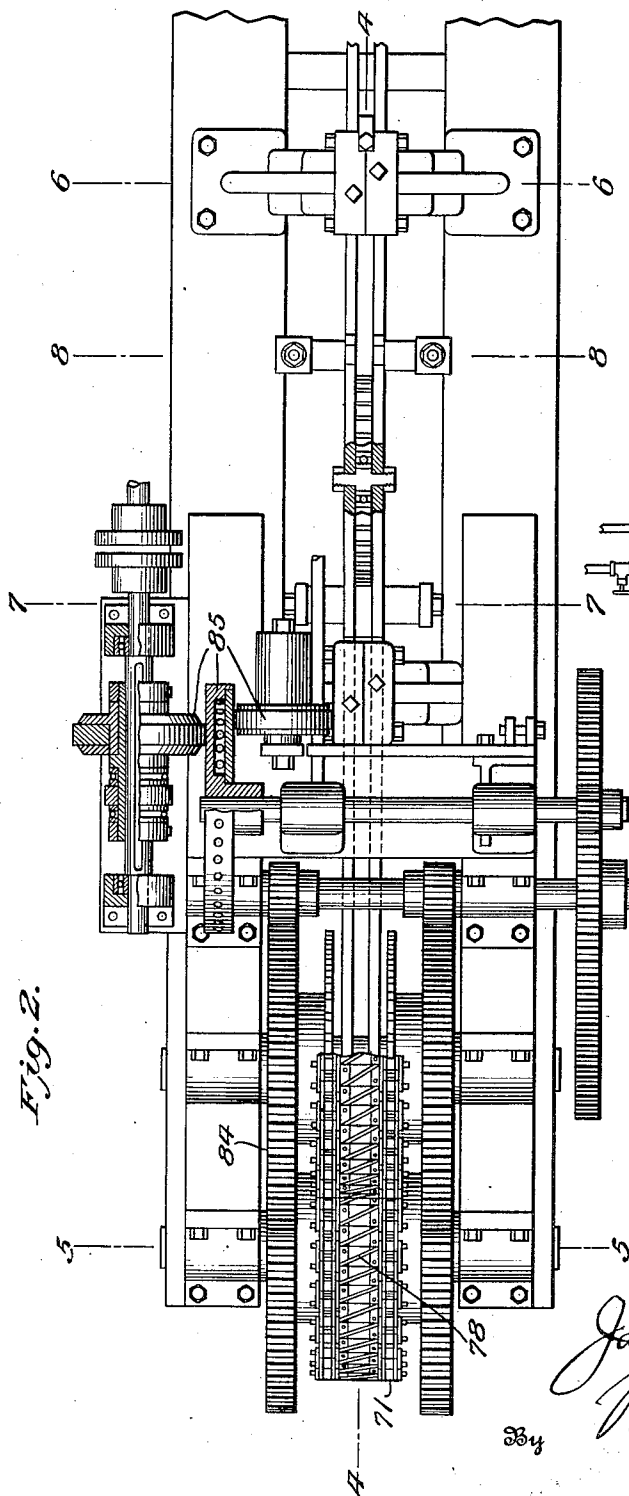


Fig. 2.

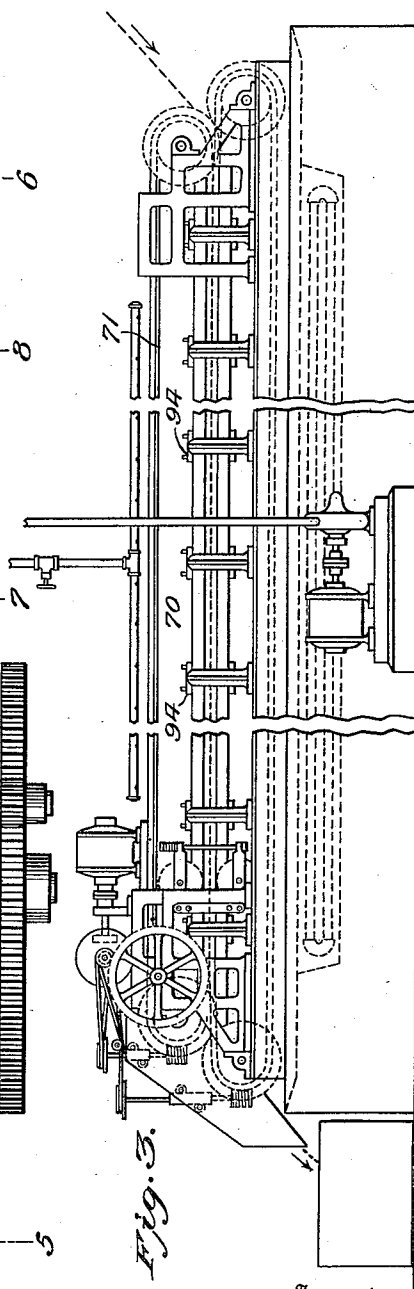


Fig. 3.

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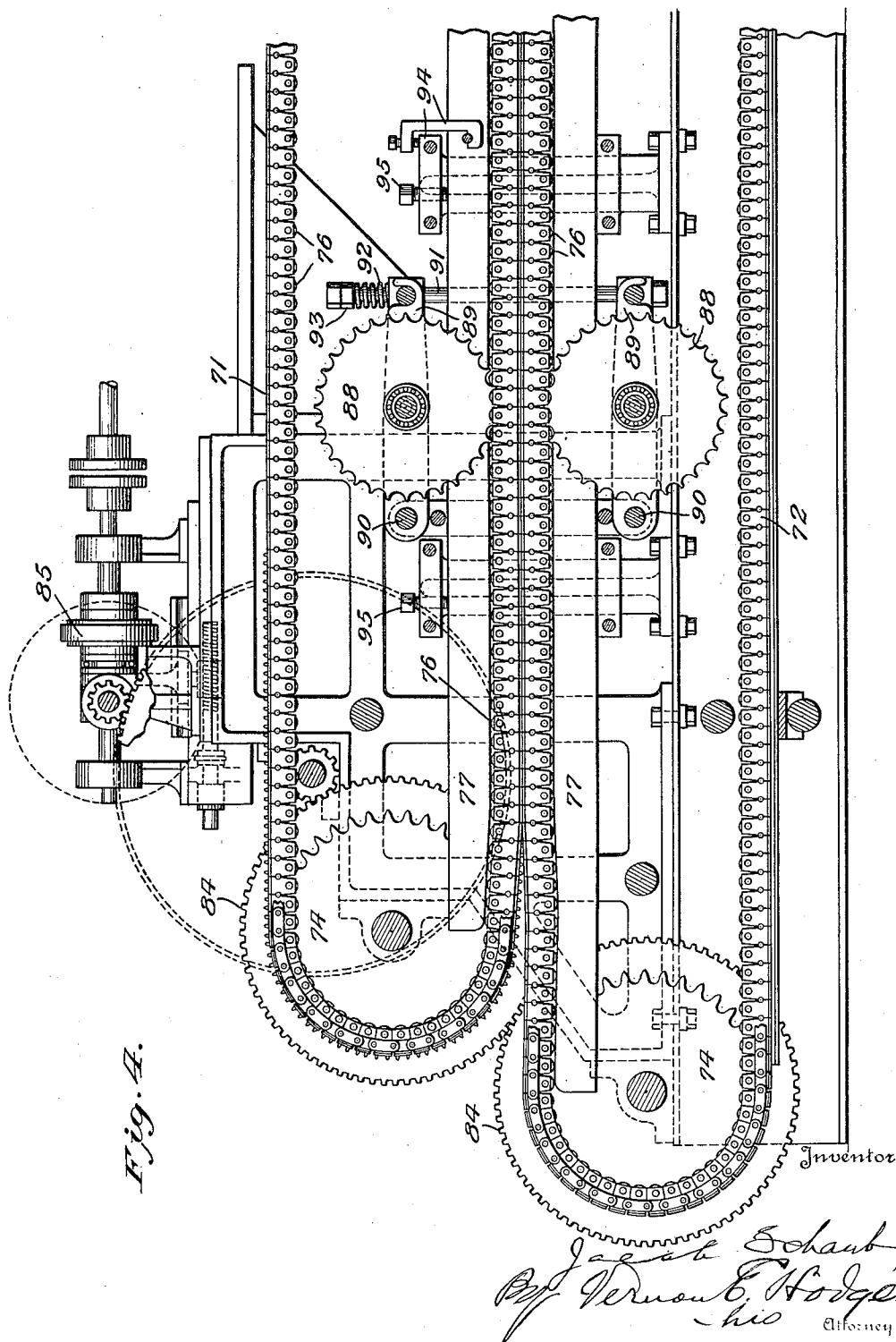
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Fig. 6.

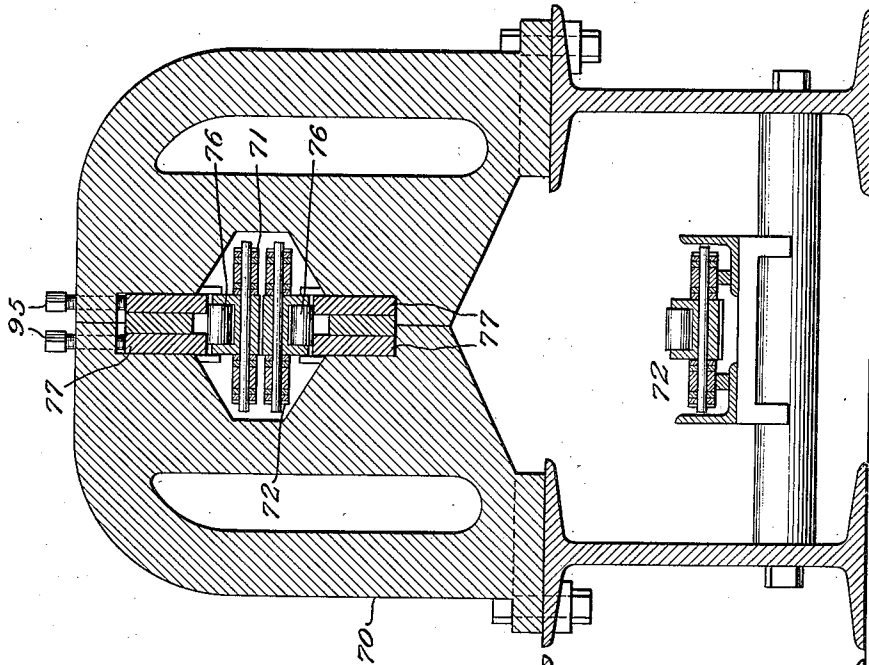
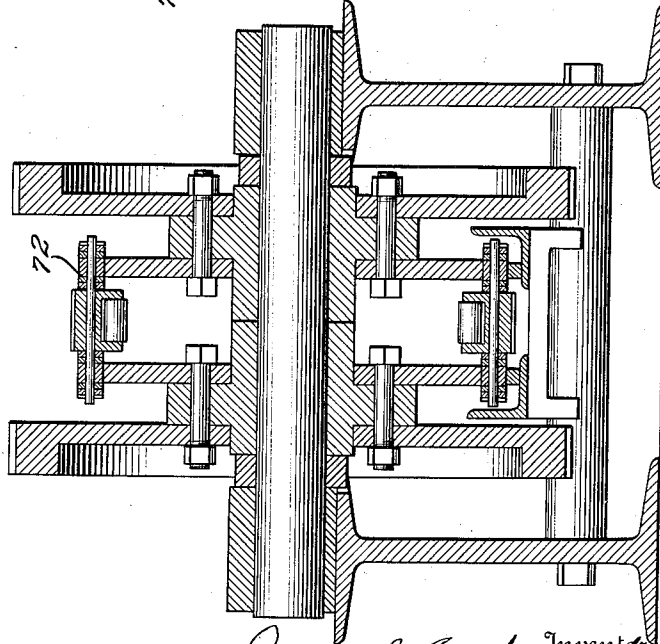


Fig. 5.



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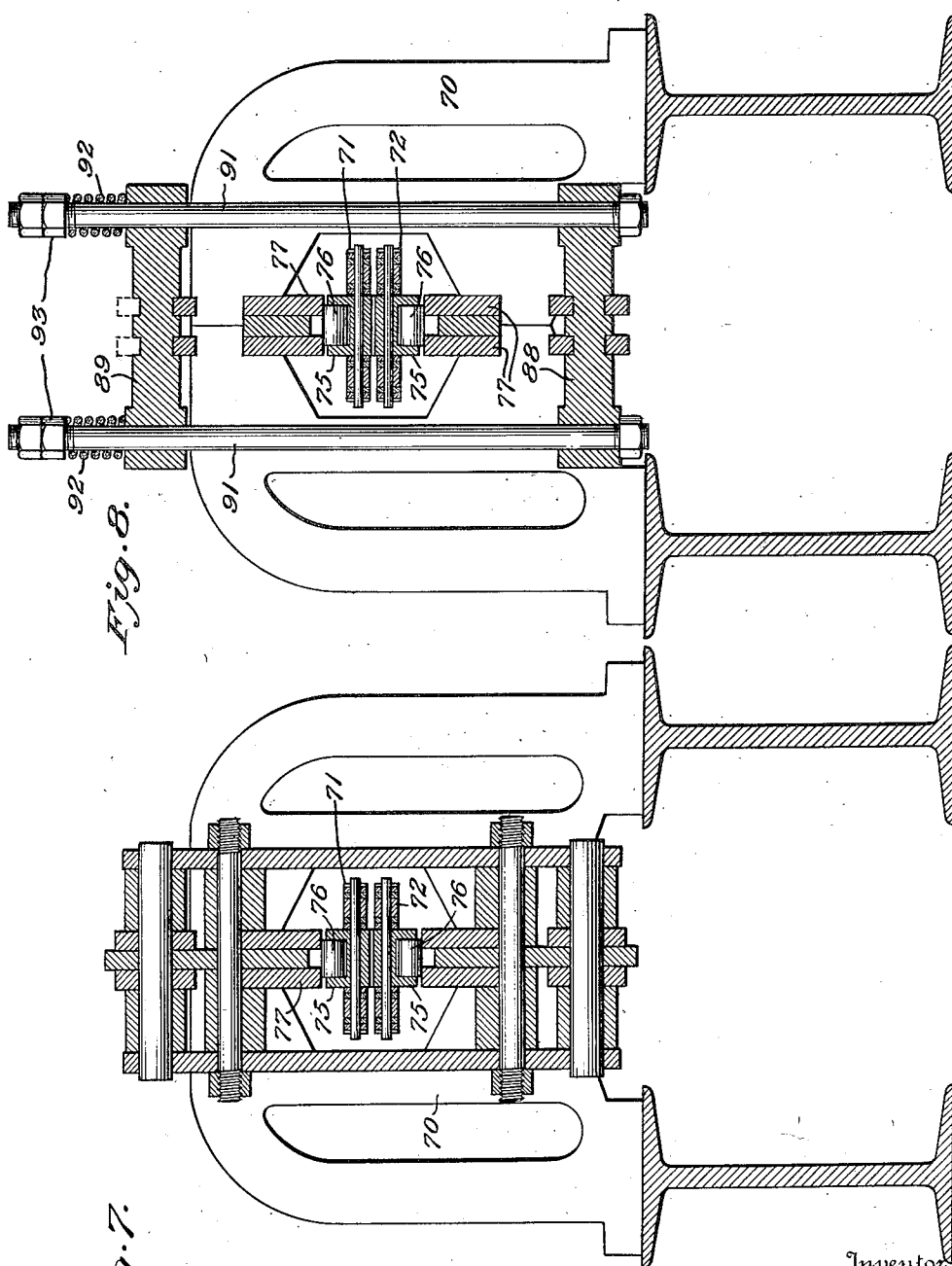
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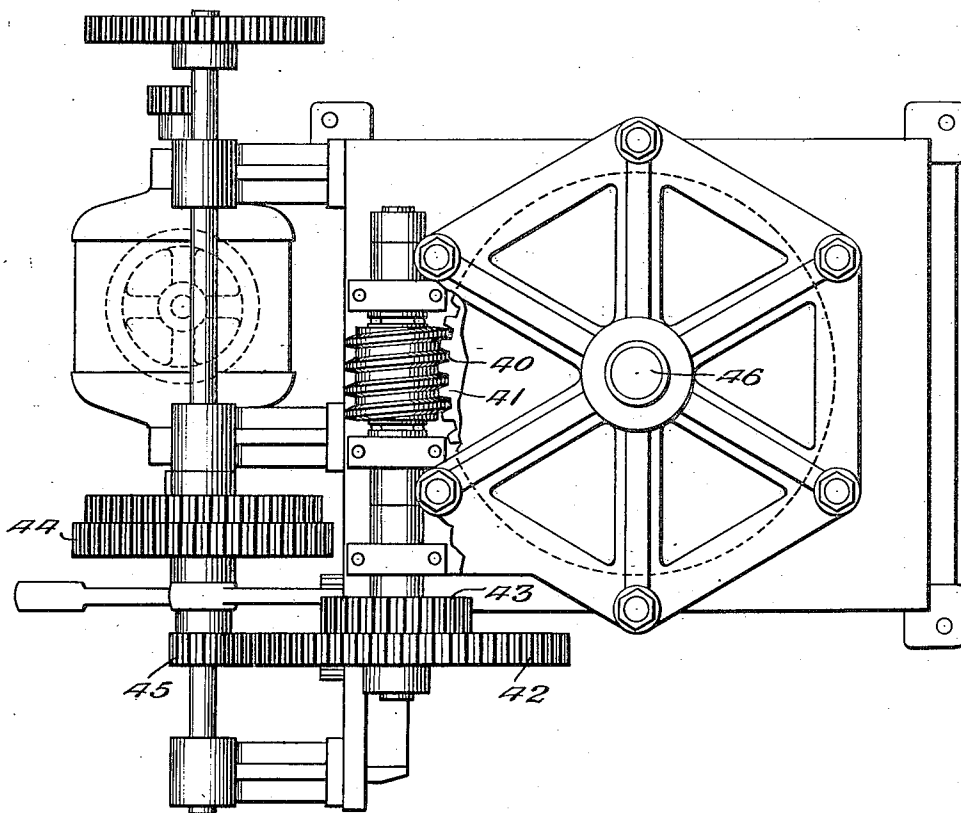
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Fig. 9.



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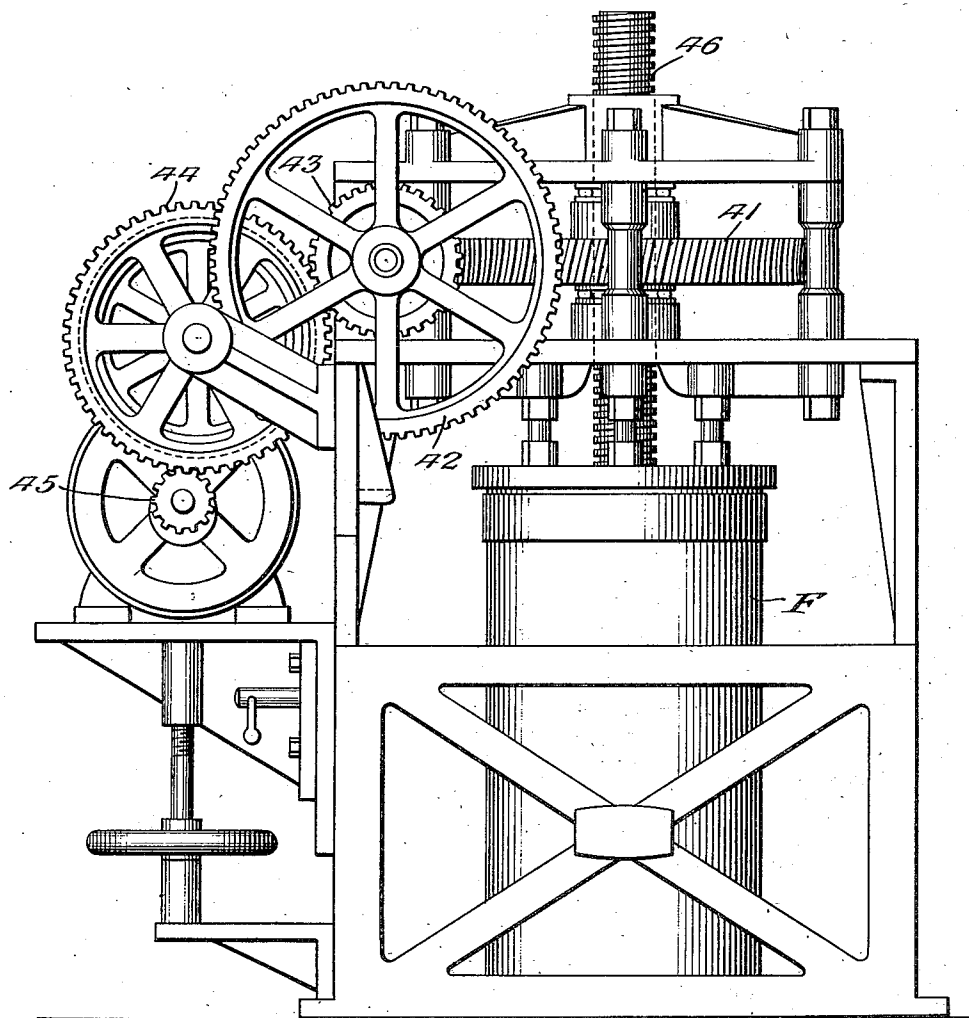
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Fig. 10.



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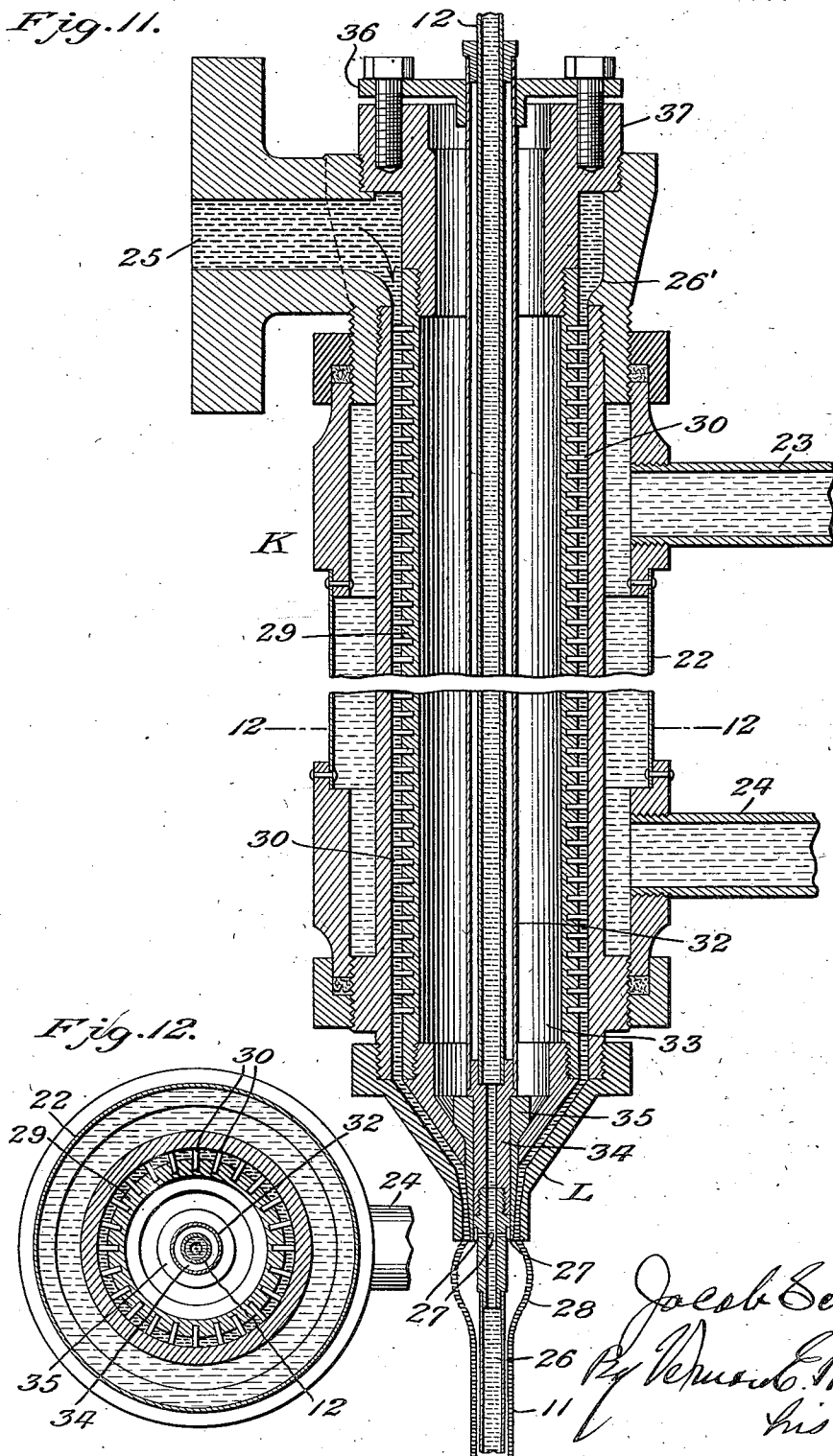
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Fig. 11.



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Fig. 13.

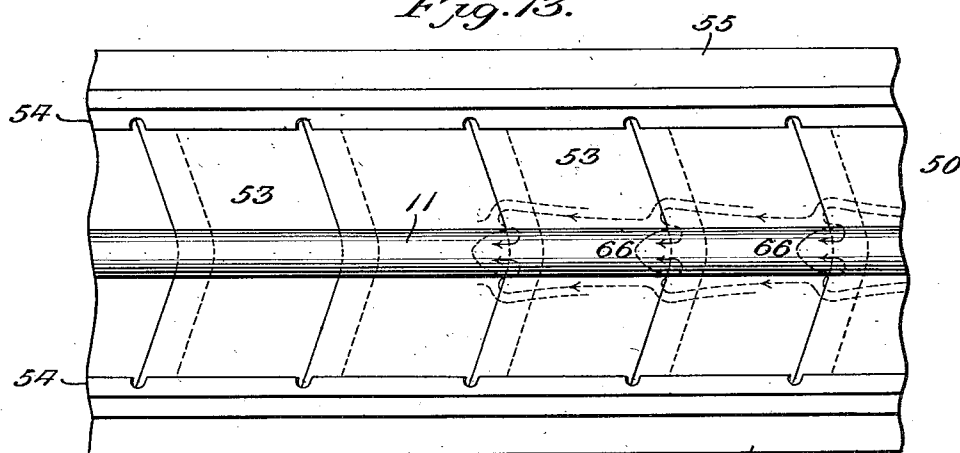


Fig. 14.

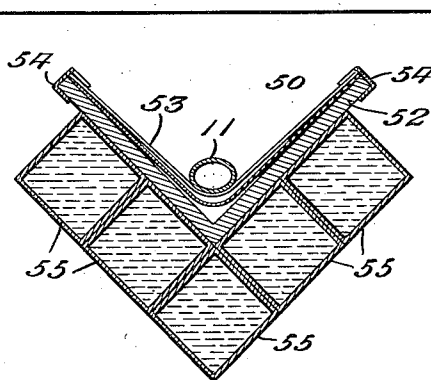
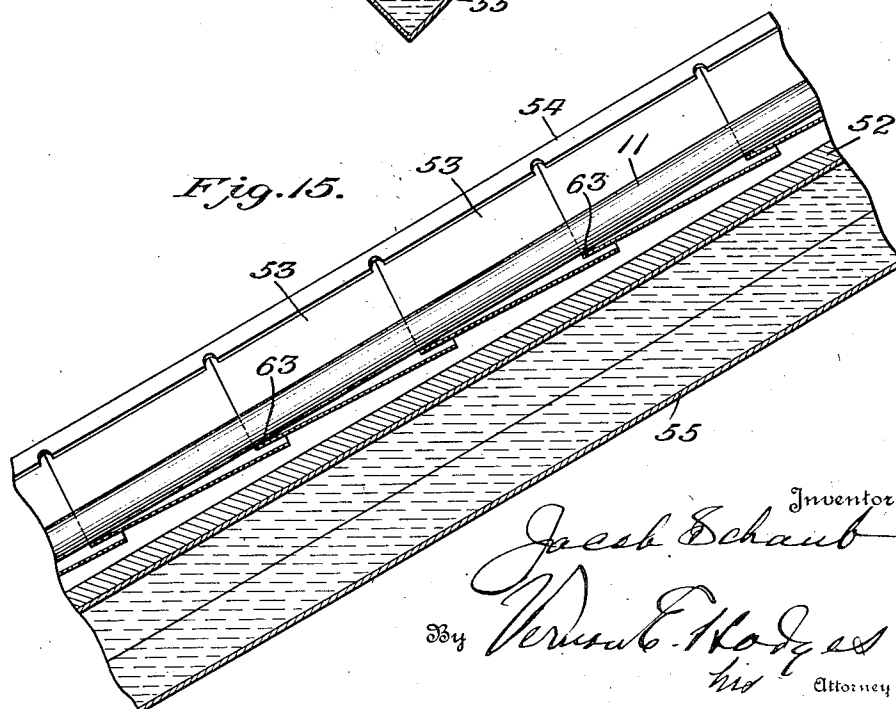


Fig. 15.



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Fig. 16.

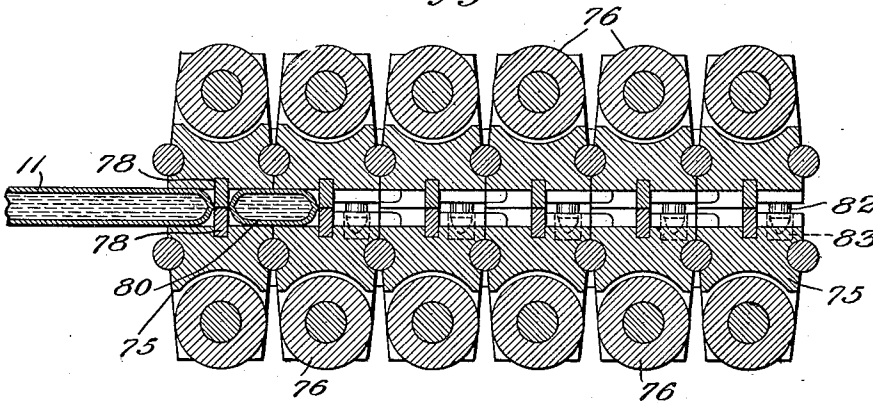


Fig. 17.

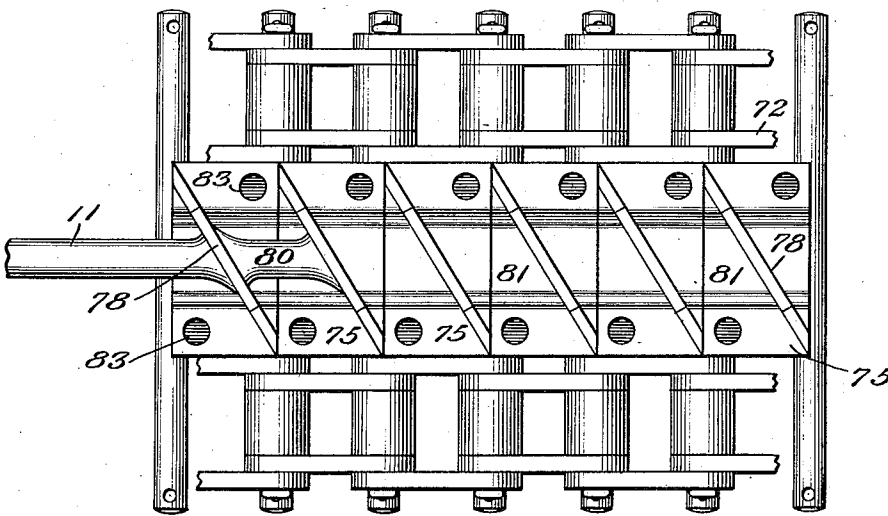
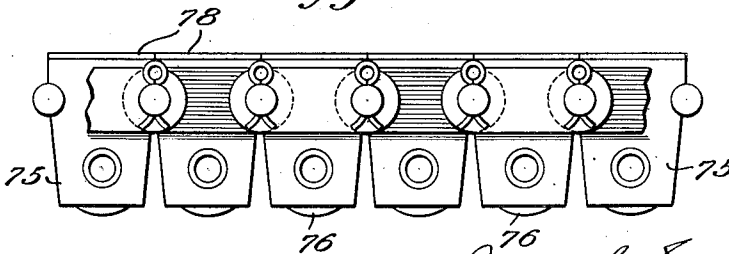


Fig. 18.



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Fig. 19.

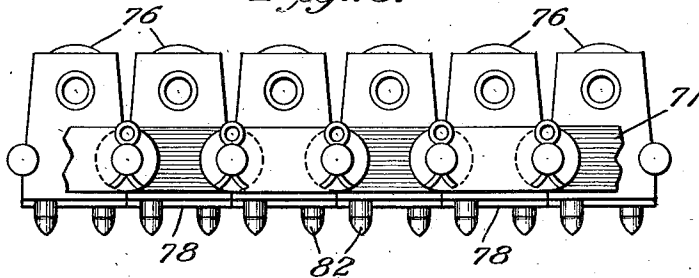


Fig. 20.

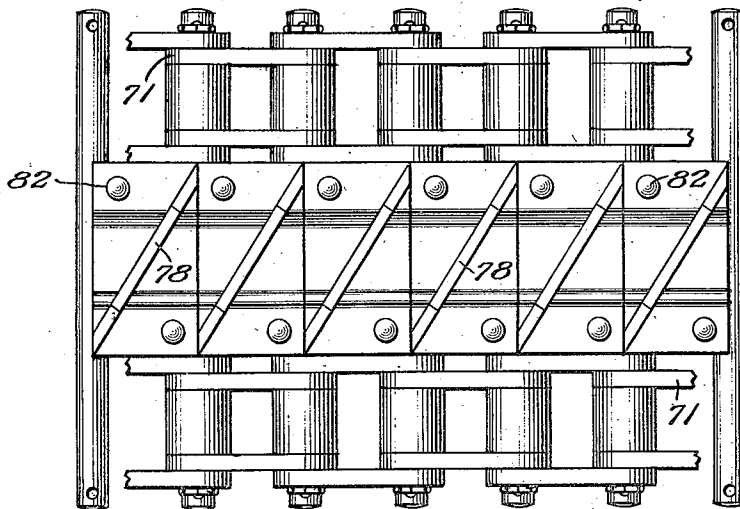


Fig. 21.



Fig. 22.



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1,628,333

UNITED STATES PATENT OFFICE.

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APPARATUS FOR AND ART OF MANUFACTURE AND FILLING OF CAPSULES.

Application filed January 9, 1924. Serial No. 685,209.

My invention relates to the art of manufacture and filling of capsules, and includes an apparatus for and a method or process of forming, filling and completing the capsule starting with the raw material and concluding with the completed capsule, all in one continuous operation and without handling.

My present invention consists in forming a tube from a supply of melted gelatine over a former, filling the tube as it leaves the former, conveying the formed and filled gelatine tube away as fast as it is formed and filled, and finally dividing the tube into filled and completed capsules.

A fundamental idea of this invention therefore is the formation of a gelatinous container and the filling and sealing of the same in the shape of individual units or capsules, in a single, continuous, automatic process and passage through the machine.

In the accompanying drawings:

Fig. 1 is a view of a typical layout for the successful promotion of my improved method or process;

Fig. 2 is a top plan view of the lower section of the molding unit with parts broken away;

Fig. 3 is a side elevation of the molding unit;

Fig. 4 is an enlarged vertical section on line 4—4 of Fig. 2;

Figs. 5, 6, 7 and 8 are enlarged vertical transverse sections on the lines 5—5, 6—6, 7—7 and 8—8, respectively, of Fig. 2;

Fig. 9 is a top plan view of the screw pressure cylinder;

Fig. 10 is a side view of the same;

Fig. 11 is an enlarged vertical sectional view through the regulating tube;

Fig. 12 is a horizontal section on the line 12—12 of Fig. 11;

Fig. 13 is a fragmentary plan view of one of the channels;

Fig. 14 is a cross section of the same;

Fig. 15 is a longitudinal section through the same;

Fig. 16 is an enlarged longitudinal section through the molding chain;

Fig. 17 is a plan view of the lower section of the same;

Fig. 18 is a side view of the portion shown in Fig. 17;

Fig. 19 is a corresponding side elevation of the upper section of the molding chain;

Fig. 20 is a bottom plan view of the same;

Fig. 21 is a view of one of the completed capsules;

Fig. 22 is a similar view with a corner removed to permit the contents of the capsule to drop or flow from the capsule.

In the particular machine illustrated, the mechanism is located for convenience on four different floors, and comprises a number of different units, for instance, one for preparing and treating the gelatine; another for preparing, supplying and regulating the temperature of the color, all located on the upper floors; and a refrigerating unit, a channel conveyor for the formed gelatine tube and a molding unit located on the two lower floors.

It is understood that other mechanical means than that illustrated and about to be described in detail might be employed, the present means, however, answering the requirements for illustration and its operativeness having been fully demonstrated.

A, represents a vacuum pan or cooker. This has a steam-jacket D, it being supplied with steam from a pipe 1. Within the vacuum pan or cooker is located a rotary stirrer 2.

M, is a motor which has a worm 3 on its shaft which drives the worm-gear 4 on a horizontal shaft 5, which in turn has a bevel-gear 6 which transmits motion to the bevel-gear 7 on the vertical shaft 8 of the stirrer 2 for rotating the latter.

E, indicates a vacuum pump which withdraws the air from the cooker.

C, represents the vacuum pan or cooker valve, it being stationed at the bottom of the vacuum pan or cooker A for regulating the discharge or gelatine from the pan or cooker.

F, is the discharge cylinder, into the bottom of which the melted gelatine flows from the vacuum pan A through a pipe 9, and B is a pressure valve for controlling the flow from the pipe 9 to the cylinder F. A piston 10 in the discharge cylinder F regulates the pressure of the gelatine in the cylinder and determines the flow therefrom into the regulating tube K, and the discharge of the formed gelatinous tube 11, through the nozzle L.

The discharge cylinder F is surrounded by a water-jacket G, which keeps the gelatine at the required temperature. Water is supplied to the jacket G from the water

tank I above. This water is kept in circulation by means of a pump H operated by a motor M', and the water in tank I is maintained at the required temperature of say preferably 180° F. by a steam jet *m* discharging thereinto.

Another pump O operated by the motor M² supplies circulating water from the tank I', through pipe 24 to the water jacket 22 surrounding the regulating tube K, and it is possible to get a quick and almost instantaneous regulation of the viscosity of the gelatine by the control of the steam from steam pipe 31 in this water tank. The normal temperature of the water in tank I' is usually kept at about 140° F.

Q, represents a color mixing tank. The oil supply enters through a pipe 13 which is controlled by a valve 14, it being forced into the tank Q by the pump P' driven by the motor M³. The pump P' percolates, agitates and mixes the coloring material, and the valves 14 and 15 are opened and closed to regulate the flow of the oil. After the mixture is right, the pump P' is stopped, the valve 15 is closed and the oil is permitted to flow out through pipe 16, and the pet-cocks 17 are opened to permit it to drop into the color filters T below. From these filters the color supply goes into the color supply tank V below, and a measuring pump U both measures and forces the color forward through a cooling coil W in the brine tank 18 where the color becomes more or less coagulated by the sudden chill it sustains, and thence it is forced on, to the fourway valve X. A pipe 12 conveys the color mixture from the fourway valve X into the upper end of the regulating tube K. (See Figs. 1 and 11.) From the fourway valve X and the pipe 12 the color discharges into the metal tube 26 over which the gelatine tube is formed and thence into the gelatine tube. A return pipe Y from the four-way valve X returns any excess butter color or oil to the color supply tank V.

Brine is circulated from the brine tank 19 by a pump P⁴ driven by the motor M⁴ through the double pipe brine cooler 20 and thence into the brine tank 18, the ammonia tank 21 being located preferably on the lower floor, and water being forced through the double pipe brine cooler 20 from the pump P⁵ operated by the motor M⁵.

Returning now to the regulating tube K, it is preferably of special construction, as is illustrated somewhat in detail in Figs. 11 and 12. A water-jacket 22 substantially surrounds the entire regulating tube, and water is circulated through this jacket from water-tank I' by means of pump O as previously described, through the pipes 23 and 24. The gelatine from the discharge cylinder F upon entering through the inlet 25 of the regulating tube K at the top fills the annu-

lar chamber 26' formed therein throughout the entire length of the regulating tube to the tapering nozzle L at the lower end, which reduces the diameter of the gelatine tube being formed in the regulating tube to substantially the size desired before issuing therefrom.

The color mixture is being conveyed to the discharge end of the regulating tube K through the pipe 12 extending lengthwise through the center of the regulating tube, so that the gelatine tube is filled with the color at the lower end of the metal nozzle tube 26 just as fast as it leaves the latter. Small outlet ports 27 permit a limited amount of the oil to exude at the lower end of the tube 12 and flow over the metal nozzle tube 26 to cover the external surface of the latter and form a film of oil between it and the gelatine tube keeping it constantly lubricated so that the gelatine tube slides on over as it is formed and is prevented from sticking. Due to the sudden release in pressure upon the viscous gelatine when it emerges from the orifice of the nozzle L, it assumes the form of a button or enlargement 28 as shown in broken lines at the lower end of Fig. 11, or rather it swells out and at once begins to flow down over the metal nozzle tube 26, and by increasing in speed at this point it stretches out into the form of a completed tube.

The supply of filling medium or oil contained in tube 12 having been previously cooled, absorbs the heat from the gelatine through the metal wall of the nozzle tube 26, and the gelatine tube thus newly formed becomes set at a certain point and will not stretch out further during its travel down the metal tube 26. Herein lies a very important feature of the invention, and it is desired to repeat that by the apparatus, method and temperature control of the gelatine as described in the discharge cylinder F and regulating tube K it is possible to create at will a certain thickness of the wall of the gelatine tube.

Furthermore, it should be stated here that the quantity of gelatine exuded from the discharge cylinder F for a given time is also controlled by a system of worm and other gearing 40, 41, 42, 43, 44 and 45, and a screw 46 connected with the plunger 10 in the cylinder F, as viewed in Figs. 9 and 10, whereby the plunger 10 is moved downward at a positive and predetermined fixed rate so as to discharge the required quantity of gelatine in a given length of time which of course will be different for the various sizes of capsules made.

The flow of gelatine from the discharge cylinder F into the regulating tube K is controlled by a valve F'.

The heat regulation of the gelatine is of great importance, for on it depends the correct formation of the gelatine tube. The

viscosity of the gelatine mixture cannot be the same for all batches made; also there is a variation in different lots of gelatine. Other conditions affecting the viscosity may be inherent in the gelatine. Thus it is essential to have an apparatus that will quickly adjust the temperature of the gelatine in the flow toward the outlet nozzle L. The discharge cylinder is so constructed as to conduct the gelatine through the narrow annular chamber 26'. The inner wall 29 of this annular chamber has a great multiplicity of small pins 30 studded therein, these pins protruding into the gelatine chamber across the gelatine path until they touch the outer wall of the annular chamber. This affords a large area of contact in the path of the flowing gelatine and the heat regulation is controlled by raising or lowering the temperature of the water in the tank T' by means of steam from the pipe 31 as previously mentioned.

Another important consideration is the desirability of having the filling medium, that is to say the color mixture or oil, of a low temperature; and it is intended that this medium should have the function of chilling or setting the gelatine at the required point, namely its point of contact with the gelatine tube which is at its point of issue from the lower end of the regulating tube K. All of this is accomplished through the refrigerating plant 19, 20 and 21 as hereinbefore described.

Precautions are taken to insulate the cold medium pipe 12 from the hot cylinder by avoiding all metallic contact and hence the outer pipe 32 and the air space 33 extending throughout the length of the regulating tube K. Furthermore, an insulating sleeve 34 preferably of bakelite is employed in the nozzle assembly. This bakelite sleeve 34 is held in place by a metal plug 35 held down in place by the tube 32 connected with the cross-bar 36 at the top of the regulating tube. The assembly of the regulating tube is preferably constructed substantially in the manner shown to facilitate taking it all apart for cleaning, and it will be seen that the inner tube to which the pins 30 are permanently fastened can be drawn upward and out by simply unscrewing the follower 37 at the top of the regulating tube K.

After the gelatine tube 11 has been generated as hereinbefore described, it naturally continues to flow downwardly by gravity. An inclined trough or channel 50 receives this gelatine tube, as shown in Fig. 1.

This is V-shaped in cross-section, as viewed in Fig. 14. From this channel the tube falls into a second channel 51 inclined in the opposite direction, and turning the formed tube over at an angle on leaving the first channel or trough 50 and entering the second channel or trough 51.

Great difficulty was encountered in working out this machine, and process, due to the fact that the gelatine tube would naturally cling and stick to everything with which it came in contact, and it would do the same in this channel or trough, even though a liberal supply of oil was allowed to flow down with it, were it not for its special construction. I discovered that if the channel were built up of a series of steps or overlapping plates, the tendency to stick would be entirely eliminated. I have therefore found it desirable to construct the channel or trough of a brass angle 52 to which the thin steel plates 53 are attached or held down by means of clips 54 at their edges. These plates overlap one another, as shown in dotted lines in Fig. 13, and in full lines in Fig. 15.

Beneath the trough are the square sections 55 of brass tubing, soldered to the angle 52; these serve as ducts for the passage of hot water from one end of the trough to the other, constituting a cellular water-jacket, and the water is supplied from tank 56, and kept to the proper degree of heat, say 105 F. by the steam supply pipe 57. The pump 58 driven by a motor 59 circulates water through pipes 60 and 61 connected with the upper and lower ends of channels or troughs 50 and 51, respectively. The U-shaped connecting-pipe 62 connects the adjacent ends of the upper and lower troughs or channels 50 and 51 for conveying water from the jacket of one trough or channel to the other.

Returning to the overlapping plates, the function is as follows: At points 63 (see Fig. 15) the plates are slightly separated. This causes the flow of oil supplied from pipe 64 and oil-tank 65 to be temporarily arrested, and by capillary action a portion of the oil is held under the plates, and the gelatine tube in its gliding motion from plate to plate creates a small vacuum chamber, as it were, at points 66 shown in dotted lines in Fig. 13. This vacuum chamber automatically extracts the accumulated supply of oil that has worked its way under the blades at points 63 by the capillary action explained. In this way a supply of lubricant is afforded at all times for the gliding gelatine tube. This operation repeats itself, as shown by the dotted lines at each overlap of the plates, and thus effectually keeps the gelatine tube flowing on a film of oil, and prevents it from actually touching the metal plates of the trough or channel.

But for this device and physical phenomenon, the gelatine tube would tend to displace the lubricant in a very short distance of travel, which would result in its clinging to the bottom of the channel, and, in consequence, the ruination of the formed tube. The speed of the gliding action of the tube is also more or less controlled by the flow

of oil through the regulation of the valve 67 in the oil supply pipe 64.

The lower trough or channel 51 leads to, and delivers the formed gelatinous tube to the molding machine 70 located on the lower floor. The function of the molding machine is to receive the gliding tube, and by the action of the two endless chains 71 and 72 (see Figs. 1 to 8 inclusive; and 16 to 20 inclusive) form, separate, and convey forward the completed capsules.

These chains are carried over sprocket-wheels 74, and are caused to travel at the proper speed. These chains carry blocks 75, and each block is provided with a roller 76 which travels on a track 77 in order to insure the proper distance between the blocks, and the blocks on their inner faces are provided with diagonally set knives 78 which sever the tube 11 (see Figs. 16, 17 and 20) and form the individual capsules 80. The inner faces of these blocks are channeled as at 81 to receive the gelatine tube. Dowel-pins 82 enter holes 83 to insure the proper alignment of the blocks and knives.

The chains 72 are driven through the chain of gears 84 and the speed is regulated by the friction mechanism 85. The knives or cutters 78 and channels 81 in the blocks 75 are kept lubricated by an oil sprinkler 86 on the lower end of the main oil pipe 64' leading from the lubricant tank 65 above. Lubricant tank 65 is kept supplied by pump 99 through a pipe 100. Tracks 77 are held in place by brackets and clamps 94 and bolts 95.

It will be observed by reference to Fig. 4 that the two sprocket-chains approach each other gradually at the left hand end, which receives the gelatine tube, and the knives 78 thus come together gradually and at first merely press the tube to cause a sealing of the otherwise open ends, but finally the cutters are brought together to sever the tube and form the individual capsules. This is done by the tension device which consists of the spur-wheels 88 which are carried by levers 89, and the teeth of which receive the rollers 76 on the backs of the blocks 75. These levers 89 are pivoted to their supports at 90 and are brought together by the tension-rods 91, on which the springs 92 are sleeved, and the tension is regulated by screwing the nuts 93 down upon the threaded upper ends of these rods 91, as shown in Figs. 4 and 8.

These spur-wheels 88 thus suspended by the levers 89 and held under tension of the springs 92 exert pressure toward each other by means of the connecting-rods 91 and the tension of the springs 92. As the rollers 76 on the chains 72 pass between these spur-wheels, a bump or sudden pressure is exerted on each individual block 75 or pair of blades or knives 78 in the blocks by the toggle action through the spur-wheels and spring ten-

sion, thus causing the capsules to be severed and sealed at their ends as they are cut from the flowing gelatinous tube 11.

In this way also, along with the other adjustments as to the feed and formation of the gelatine tube, it is possible to vary the size of the capsule formed by the tension under which the gelatine tube is drawn and held during the severing of the tube and sealing of the ends of the capsule. In other words, the size of the molds or knives are not changed, although the size of the capsule may be, as stated.

At the discharge end of the molding machine, the chains are caused to separate, and the capsules to drop therefrom into a tub 96 containing oil by means of mechanically-operated rotary brushes 97 (see Fig. 1), and the capsules are allowed to cool in the tub, and are finally removed from the oil, washed in a suitable solvent to cleanse them from the oil, and spread on a table to dry to be packed for the market.

A drip pan 105 on the lower floor catches the oil dripping from the endless chains, whence it is returned by pump 99 to the oil tank 65. This oil is kept at a constant temperature by a hot water circulating system 106 from the tank 107, the temperature of which is regulated by steam-pipe 108. The water in tank 107 is generally kept at approximately 100° F. although this, of course, is subject to variation. The pump 109 circulates the water through the coil 106 and the drip-pan 105.

Thus it will be seen that the material which has been mixed in proper proportions is cooked in a vacuum cooker, and allowed to flow into the discharge cylinder. The valve F' is closed, the valve B is opened, and the piston or plunger 10 is raised, it being important that no bubbles should be formed in the gelatine by drawing in air.

Later, the valve B is closed, and the valve F' opened, and the regulating tube is supplied with a continuous flow of gelatine under a predetermined pressure and at a predetermined temperature and viscosity, and the color is supplied from the color unit as the gelatine tube is being finally formed at the nozzle L of the regulating tube. Thence it flows down the heated and lubricated channel 50 on one side, and turns and flows on its other side down a similar channel 51 to the molding machine in which the tube is cut, sealed and fashioned into capsules.

I claim:

1. The art of manufacturing and filling capsules including forcing viscous material into a pressure chamber, forcing the material from the pressure chamber through a regulating tube at a predetermined pressure, filling the tube, and severing the tube into capsules.

2. The art of manufacturing and filling capsules including regulating the temperature of viscous material before the formation of the tube, forcing the viscous material into a pressure chamber, forcing the material from the pressure chamber through a regulating tube at a predetermined pressure for forming the tube, filling the tube, and severing the tube to form capsules.

3. The art of manufacturing and filling capsules including forcing the viscous material into a pressure chamber, forcing the material from the pressure chamber through a regulating tube at a predetermined pressure for forming the tube, filling the tube during and subsequent to its formation, and severing the tube into capsules.

4. The art of manufacturing and filling capsules including regulating the temperature of the viscous material before the formation of the tube, forcing the viscous material into a pressure chamber forcing the material from the pressure chamber and through a regulating tube at a predetermined pressure for forming the tube, filling the tube during and subsequent to its formation, lubricating the tube to enable it to pass freely and easily from the regulating tube to tube-severing means, and severing the tube to form capsules.

5. The art of manufacturing and filling capsules including forming the tube, cooling a liquid filler, forcing said liquid filler into the tube, and severing the tube into capsules.

6. The art of manufacturing and filling capsules including forming the tube, mixing a liquid filler, filtering and cooling said liquid filler, forcing said liquid filler into the tube, and severing the tube into capsules.

7. The art of manufacturing and filling capsules including forcing material through a regulating tube to form a tube, mixing a liquid filler, filtering the liquid filler, forcing the liquid through a cooling medium and into the formed tube, and severing the tube to form capsules.

8. The art of manufacturing and filling capsules including forming a tube, filling the tube, directing the filled tube down an incline after the forming and filling operations, reversing the position of the tube on the incline, and severing the tube into capsules.

9. The art of manufacturing and filling capsules including forming a tube into a continuous length, filling the tube, slidably directing the filled tube continuously down an incline on its side, turning said tube completely over to cause it to slide on its opposite side during a portion of its movement over the incline, and severing the tube into capsules.

10. Mechanism for the formation of capsules

including means for forming a tube, means for filling said tube, means for supplying lubricant inside and outside the tube to cause it to flow continuously, and means for severing the filled tube into capsules.

11. Mechanism for the formation of capsules including means for regulating the temperature of material, means for forming said material into a tube, means for filling said tube, means for supplying a lubricant inside and outside of the tube to cause it to flow continuously, and means for severing the filled tube into capsules.

12. Mechanism for the formation of capsules, which consists in means for regulating the temperature and viscosity of the raw material, means for forming said material into a tube, means for filling said tube as it is formed, means for supplying lubricant inside and outside of the tube to cause it to flow continuously without touching the parts required in its formation, and means for severing the filled tube into lengths and sealing the severed ends to form the completed capsules.

13. A machine for the manufacture and filling of capsules, combining means for preparing the raw material, means for causing it to feed under a predetermined amount of pressure, means for forming the material into a tube, means for maintaining a predetermined heat in said material and in the tube while forming, means for supplying the liquid contents to the tube during its formation, means for chilling the liquid contents, means for causing the tube to flow continuously, and means for severing it into individual sealed capsules.

14. The combination of a regulating tube terminating in a nozzle, means for forcing a viscous material through said nozzle to form a tube, means for lubricating the interior of the formed tube as it leaves the nozzle, and means for filling said tube.

15. The combination of a regulating tube terminating in a nozzle having a substantially annular space therearound, means for forcing a viscous material through said space to form a tube, said nozzle having an opening therethrough for a filler liquid, a conveying tube communicating with said opening and extending outwardly from the nozzle into the formed tube, said conveying tube having an orifice therethrough for lubricating the interior of the formed tube as it leaves the nozzle.

16. The combination of a regulating tube terminating in a nozzle having a substantially annular space therearound, means for forcing a viscous material through said space to form a tube, said nozzle having a central opening therethrough for supplying a liquid filler to the formed tube, a conveying tube communicating with said opening and ex-

tending outwardly from the nozzle into the formed tube, said conveying tube having a plurality of orifices therethrough and communicating with the central opening, for supplying a portion of the liquid filler to lubricate the interior of the formed tube as it leaves the nozzle.

17. The combination of a regulating tube terminating in a tapering nozzle and having an annular space formed in the tube and nozzle, means for forcing a viscous material into and through said space, whereby to form a tube thereof, means for lubricating the interior of the formed tube as it leaves the nozzle, and means for conveying and discharging a liquid into the formed tube while flowing from the regulating tube.

18. The combination of a regulating tube terminating in a tapering nozzle and having an annular space formed in the tube and nozzle, means for forcing a viscous material into and through said space, whereby to form a tube thereof, means for lubricating the interior of the formed tube as it leaves the nozzle, means for conveying and discharging a liquid into the formed tube while flowing from the regulating tube, a water-jacket around the regulating tube, means for circulating water through said jacket, and means for maintaining a predetermined temperature in said jacket circulating water.

19. The combination of a cooker, a discharge cylinder, and a regulating tube in communication with one another, means for controlling the passage of material from one to the other, a plunger within the discharge cylinder for filling the latter without drawing in air bubbles, and means for causing the plunger to force material continuously from the discharge cylinder under continuous pressure into the regulating tube.

20. The combination of a discharge cylinder, means for automatically filling and emptying said cylinder, a regulating tube, a pipe leading from the cylinder to the tube, and a control valve in said pipe.

21. The combination of a discharge cylinder, means for automatically filling and emptying said cylinder, a regulating tube, a pipe leading from the cylinder to the tube, a control valve in said pipe, the regulating tube having a discharge nozzle at one end, and an annular space in the tube and in the nozzle for the formation of the material forced therein from the discharge cylinder into a continuous tube, said regulating tube having a plurality of radial pins which protrude into the path of the gelatine for regulating and maintaining the proper temperature in the gelatine.

22. In a machine for manufacturing capsules, a regulating tube having an annular gelatine channel formed therein, pins crossing this channel, a water-jacket surround-

ing the regulating tube, means for circulating this water, and means for regulating the temperature of the water in the jacket, and, through the inner wall of the jacket and the pins, the temperature of the on-flowing gelatine in the annular gelatine chamber.

23. In a machine for the manufacture of capsules, the combination of a regulating tube, having a nozzle for forming a tube, a conveying tube extending outwardly from the nozzle and into the formed tube for supplying a filler thereto, said nozzle having an opening therein for discharging a portion of said filler on the outside of the conveying tube and within the formed tube as it leaves the nozzle.

24. In a machine for the manufacture of capsules, the combination of a regulating tube having a nozzle for forming a tube, a conveying tube extending outwardly from the nozzle and into the formed tube for supplying a liquid filler thereto, said nozzle having a plurality of small outlet ports for discharging a limited amount of said liquid filler on the outside of the conveying tube and within the formed tube as it is discharged from the nozzle.

25. In a machine for the manufacture of gelatine capsules, the combination of a regulating tube, a nozzle, an annular gelatine chamber formed in the tube and nozzle, a metal tube below the nozzle around which the gelatine on leaving the nozzle flows, and for supplying liquid to the formed tube at the end thereof, and small outlet ports for discharging a limited amount of said liquid on the outside of the metal tube and within the flowing formed tube as it leaves the nozzle and flows over the metal tube at the lower end thereof.

26. The combination with forming means for forming a tube, of a channel in position to receive the tube therefrom, and means for lubricating the channel to facilitate the passage of the tube therethrough.

27. The combination with forming means for forming a tube, of a channel formed of overlapping, and slightly separated, plates for creating small vacuum chambers.

28. The combination with forming means for forming a tube, of a channel formed of overlapping and slightly separated plates for creating small vacuum chambers, and lubricating means for the channel.

29. The combination of a regulating tube which gives form to a viscous mass, of two channels oppositely inclined, down which the formed tube flows, and whereby the tube on passing from one channel to the other is turned over, and means for lubricating the channels to facilitate the passage of the flowing tube.

30. The combination with forming means for forming a tube, of inclined channels for

receiving the tube, one of said channels being inclined in an opposite direction from the other to turn the tube over in its movement.

31. The combination with forming means for forming a tube, of a water jacketed channel, means for circulating water therethrough, and means for regulating the temperature of the water.

32. The combination of a regulating tube constructed and adapted to form a viscous mass into a tube, an inclined water jacketed channel, means for circulating the water therethrough, and means for regulating the temperature of the water.

33. The combination of a regulating tube, a channel or trough, the surface of which is made up of overlapping and slightly separated plates, whereby a small vacuum chamber is created, and the supply of lubricant for the flowing tube is kept substantially constant.

34. The combination of a regulating tube, a channel or trough, the surface of which is made up of overlapping and slightly separated plates, whereby a small vacuum chamber is created, and the supply of lubricant for the flowing tube is kept substantially constant, and a water jacket for the channels, means for circulating water therethrough, and means for regulating and controlling the temperature of the water.

35. The combination of a regulating tube, a water jacketed V-shaped channel, overlapping blades having vacuum spaces formed at the overlap, means for discharging the formed tube from the regulating tube upon the upper end of the channel, means for lubricating the channel, and means for regulating its temperature through the water-jacket.

36. The combination with means for forming a tube, of means for severing the tube into links including a plurality of knives set diagonally in endless formation for engaging and severing the tube.

37. The combination of a regulating tube constructed and adapted to form a viscous mass into a tube, endless chains to which the tube is conveyed, knives carried by the endless chains for cutting the tube into capsules and sealing the ends thereof, and means for adjusting and regulating the relative position of the endless chains.

38. The combination with means for forming a tube, of endless chains to which the tube is conveyed, knives carried by the chains for cutting the tube into capsules, and means for causing a sudden bump or pressure upon the knives to cause the capsules to be severed and sealed at the ends thereof.

39. The combination with means for forming a tube, of means for severing the tube into links including endless chains to which the tube is conveyed, knives diagonally

arranged on and carried by the endless chains for cutting the tube into capsules, and sealing the ends thereof.

40. The combination of a regulating tube constructed and adapted to form a viscous mass into a tube, endless chains to which the tube is conveyed, knives carried by the endless chains for cutting the tube into capsules and sealing the ends thereof, said chains arranged to receive the flowing tube therebetween and to grip it gradually, and means to cause the exertion of a bump or sudden pressure upon the blades, thereby to cause the capsules to be severed and sealed at their ends as they are cut from the flowing gelatinous tube.

41. The combination of a regulating tube constructed and adapted to form a viscous mass into a tube, endless chains to which the tube is conveyed, knives carried by the endless chains for cutting the tube into capsules and sealing the ends thereof, said chains arranged to receive the flowing tube therebetween and to grip it gradually, means to cause the exertion of a bump or sudden pressure upon the blades, thereby to cause the capsules to be severed and sealed at their ends as they are cut from the flowing gelatinous tube, said means including pivoted levers, spur-wheels rotatably supported thereon, and adjustable tension means connecting the levers.

42. The combination of a cooker, a discharge cylinder, a regulating tube, a channel, and cutting means whereby automatically and continuously to fashion prepared viscous material into a tube and to sever the tube into sections.

43. The combination of a cooker, a discharge cylinder, a regulating tube, a channel, cooking means, and means for filling the formed tube with liquid while it is being formed, whereby automatically and continuously to fashion prepared viscous material into a tube and to sever the tube into sections.

44. The combination of a cooker, a discharge cylinder, a regulating tube, a channel, cooking means, means for filling the formed tube with liquid while it is being formed, whereby automatically and continuously to fashion prepared viscous material into a tube and to sever the tube into sections, and means within the control of the operator for regulating the flow, the speed and the temperature of the various mechanisms and of the viscous material and the liquid contents thereof, whereby the size of the capsule or the thickness of the wall of the formed tube or both may be varied or regulated.

45. The combination of a regulating tube, means for forcing the viscous material thereinto for forming it into a tube, and means

extending through a portion of the regulating tube and projecting into the formed tube as it is discharged from the regulating tube for filling the tube with the liquid subsequent to its formation.

46. The combination of a regulating tube, means for forcing viscous material thereinto for forming it into a tube, and means extending through the regulating tube and into the formed tube as it is discharged from the regulating tube for filling the tube with a liquid subsequent to its formation and discharging from the regulating tube.

47. The combination of a regulating tube, means for forcing viscous material thereinto, whereby it is formed into a tube, means for filling the tube with liquid as fast as, and simultaneously with, its formation, means for mechanically mixing the liquid, means for filtering the same, and means for refrigerating and regulating the temperature thereof, whereby it becomes more or less coagulated, and causing it to set at the required point by the sudden chill to which it is exposed, preparatory to its discharge into the forming tube.

48. The combination of a regulating tube, means for forcing viscous material thereinto, whereby it is formed into a tube, means for filling the tube with liquid as fast as, and simultaneously with, its formation, means for mechanically mixing the liquid, means for filtering the same, means for refrigerating and regulating the temperature thereof, whereby it becomes more or less coagulated, and causing it to set at the required point by the sudden chill to which it is exposed, preparatory to its discharge into the forming tube, and means for returning and salvaging any excess supply of the liquid.

49. The combination of a regulating tube having an annular gelatine channel therein for the formation of a gelatinous tube during its passage therethrough, a water-jacket, a water-tank, means for circulating water from the tank through the jacket, and

means for regulating the temperature of the water in the tank, whereby quick and almost instantaneous regulation of the viscosity of the gelatine may be had.

50. The combination of a regulating tube having an annular gelatine chamber, means for forcing a viscous material thereinto under a constant pressure, a discharge nozzle through which the formed tube issues from the regulating tube, a pipe for conducting a liquid through the regulating tube to discharge it into the gelatinous tube, and means for reducing the temperature of the liquid sufficiently low to cause more or less coagulation therein and to insure its being sufficiently chilled to cause it to set as the gelatine tube issues from the regulating tube and discharge nozzle.

51. The combination of a regulating tube having an annular chamber to receive gelatine, and within which the latter is formed into a tube, an inclined channel for conveying the tube, a pipe for discharging lubricant at the upper end of the channel, and a valve in said pipe which more or less controls the flow of the formed tube down the channel.

52. In a device of the character described, a channel, or trough, the surface of which is made up of overlapping and slightly separated plates, whereby a small vacuum chamber is created.

53. In a device of the character described, a channel, or trough, formed of a plurality of plates having the ends thereof overlapping and slightly separated for creating a vacuum chamber and maintaining a constant supply of lubricant for the surface.

54. In a device of the character described, a channel, or trough, formed of a plurality of plates having the ends thereof overlapping and slightly separated for creating a vacuum chamber and maintaining a constant supply of lubricant for the surface.

In testimony whereof I affix my signature.

JACOB SCHAUB.