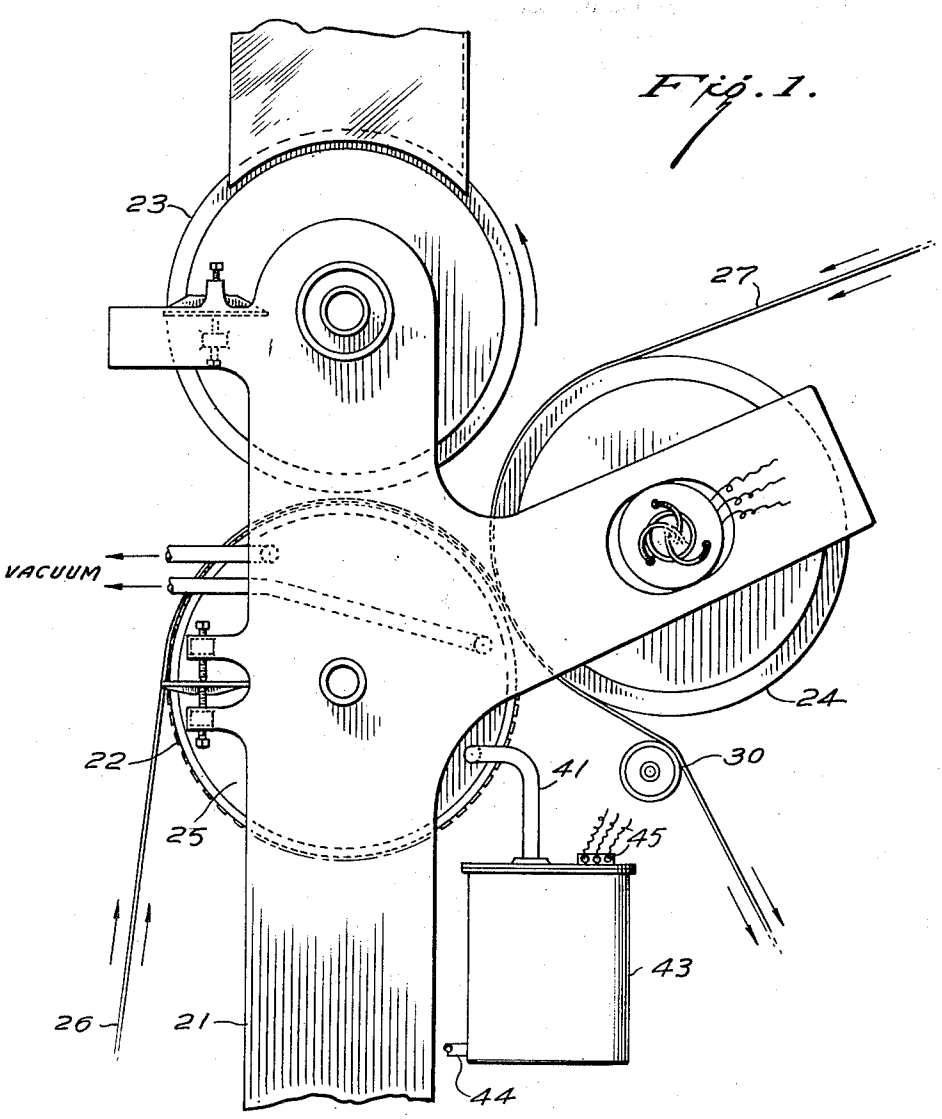
Dec. 21, 1954 F. E. STIRN ET AL 2,697,314

HEATING DIE ROLL

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Fig. 1.



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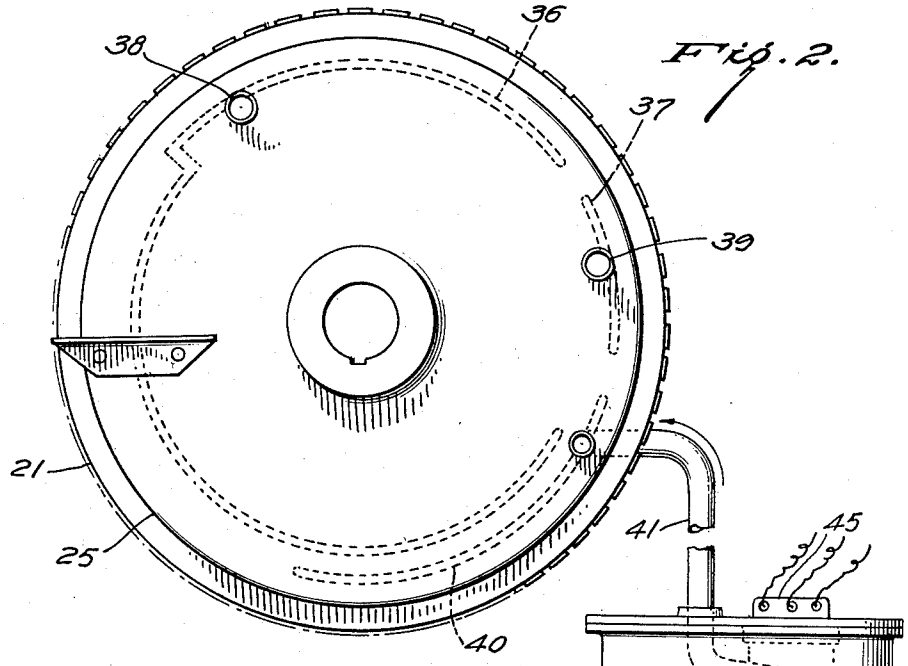


Fig. 2.

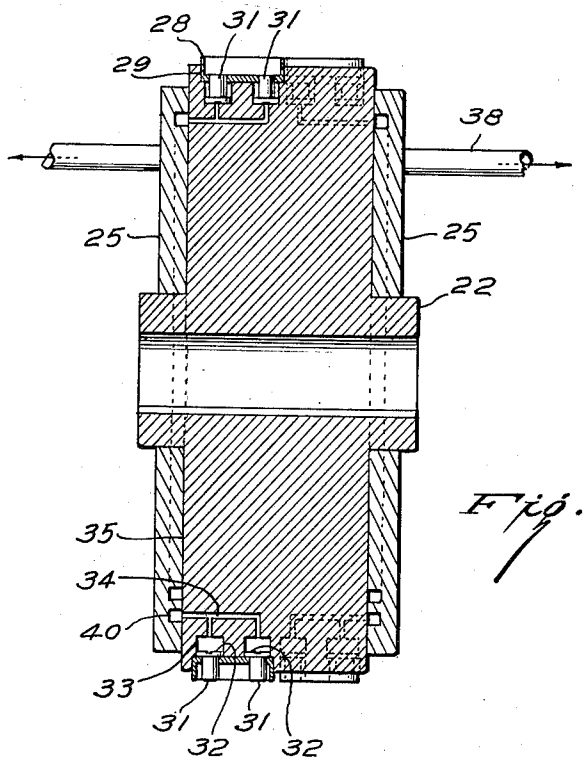


Fig. 3.

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HEATING DIE ROLL

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7 Claims. (Cl. 53—10.5)

This invention relates to improvements in a method and a mechanism for forming and filling capsules in deformable strip material, such as soft gelatin, or a gelatin substitute, which capsules may be filled with any desired material and relates particularly to the heating of a die member by the use of warmed gas, usually air.

It is an object of this invention to provide a method and a machine for practicing the method, whereby a capsuling die roll provided with an air operated ejection system has its temperature controlled by controlling the temperature of the air.

Various types of capsuling machines in the past have made use of ejection plungers in the capsule forming die cavities. These plungers may be operated by compressed air. Particularly if round dies are used, the air itself may be permitted to act directly on the capsule, avoiding the need for a separate ejection plunger. With long oval shapes, one end may release before the other, and unless plungers are used, may not eject the capsules uniformly. If the capsule is such that air would damage it, a gas other than air may be used, and such is contemplated within the scope of this invention.

In such a machine, space is usually at a premium and the use of conventional heating means such as electrical resistances is difficult because of the problems of fitting in such a heating mechanism into the space available and supplying it with energy.

We have found that by using an air operated ejection system in which plungers are used to eject the formed capsules and the plungers are operated by an air blast, it is possible to control the temperature of the operating air so that the temperature of the die member is maintained within desired limits.

Obviously, the relative proportions and the details may vary within wide limits depending upon the construction and size of the die roll. Similarly, the temperature of the ejecting air will vary depending upon the amount of air, the amount of heat which is required, the efficiency of heat transfer and other considerations obvious to those skilled in the use of such machines.

We have found that if a rather loose fitting piston and air ejection means is used, the die roll operates more satisfactorily because there is less danger of foreign particles jamming the mechanism and the air itself will operate to assist in the ejection. Also, a loose fitting piston enables a vacuum applied under the piston to be used in drawing the plastic film down into the forming die. The use of such a vacuum causes a cooling of the die. This necessitates the use of more heat. The exact operating temperature of the die depends upon the gelatin formulation, but if the die is warmed, a higher rate of encapsulation is practicable.

Certain modifications of our invention are shown in the accompanying drawings.

Figure 1 is a diagrammatic view of a capsuling machine embodying our improved die heating means.

Figure 2 is an enlarged view showing the capsuling die itself with its associated valve plate and heating means.

Figure 3 is a cross-sectional view through the die showing modifications of its internal construction.

The capsuling machine

In Figure 1 is shown a typical capsuling machine such as may be used with our invention. A frame **21** supports a cavity die roll **22**, a powder measuring roll **23** and a seal roll **24**, together with their accompanying auxiliaries. The figure is diagrammatic as our improved

heating system can be used with other forms of capsuling machines.

The cavity die roll **22** has associated therewith a valve plate **25** on each side. A lower gelatin strip **26** suitably prepared and treated is fed on to the surface of the cavity die roll, is drawn down into the cavities on the die roll by a vacuum, and a charge placed in the individual gelatin lined cavities. The metering roll as illustrated may be used for placing a powder charge in the lined cavities although other mechanisms may be used for placing pastes or liquids or combined charges in the cavities. After the charges are placed in the cavities, the cover strip **27** is fed over the surface of the seal roll **24** into juxtaposition with the die roll and the capsules cut from the two strips by the cutting out rims **28** of the capsule cavity inserts **29**. The capsules thus formed may be held in their forming cavities by suction, the residual web **30** stripped away, and the capsules ejected by warmed air.

Die roll assembly

As shown in Figure 3, the cavity die roll **22** may consist of a solid blank in which capsule cavity inserts **29** are inserted, in the bottom of which are capsule ejector plugs **31** having integral therewith a capsule ejector piston **32** in a capsule ejector piston cylinder **33**. A manifold **34** connects the cylinders with a valve seat surface **35** of the cavity die roll. On this surface rests the valve plate **25**. In the valve plate are vacuum chests **36** and **37** to apply vacuum over desired portions of the cycle. Vacuum connections **38** and **39** are provided.

In this valve plate is a pressure chest **40** to which is fastened a warmed air connection **41**, the other end of which is fastened to an air heating coil **42** in a constant temperature tank **43**. Air is supplied to the heating coil by means of an air supply line **44**. A thermostatically controlled electric heater **45** may be used to keep the constant temperature tank at the desired temperature. Other heating means may of course be used.

Operation

Air, or other inert gas, supplied through the line **44** under a suitable pressure, for example 5 pounds per square inch, is found satisfactory with small dies. The air flows through the heating coil in the constant temperature tank. The temperature of this tank may vary over wide limits depending on other operating variables. We have found a temperature of from 120 to 160° F. to be satisfactory to provide sufficient warming to keep a small die roll at the preferred temperature. The thus heated air is carried by the warmed air connection **41** to the pressure chest **40**. The air in the pressure chest flows through the manifolds **34** into the capsule ejection cylinders raising the piston and the plug, thereby ejecting the capsule. The warmed air which leaks around the piston and the plug also assists in ejecting the capsule. The warmed air chest as shown covers about one-quarter turn of the capsule die roll. The length of the chest may be varied; for a longer chest a lower temperature air and more of it, and vice versa, may be used. The exact ratios of air pressure, temperature, etc. vary with other operating variables but are readily controlled to maintain the die temperature at its desired optimum during operations. For many purposes, a temperature of about 5° F. above room temperature is found desirable for this die.

Variations in the construction and operating conditions will, of course, be obvious to those skilled in the capsuling arts.

Having thus described certain embodiments thereof, as our invention we claim:

1. Apparatus for forming soft plastic capsules comprising a die roll which comprises vacuum capsule forming means and gas operated ejection means; a source of inert gas under pressure, and gas heating means connected to heat the gas which operates said gas operated ejection means whereby the heated inert gas causes both the ejection of the capsules and the warming of the die roll.

2. Apparatus for forming capsules which comprises a die roll for forming soft plastic capsules from sheet material which comprises a substantially cylindrical die

roll blank, a plurality of capsule cavity insert slots in the cylindrical periphery of said die roll blank, at least one capsule ejector piston cylinder in the bottom of each slot, a plurality of capsule ejector plugs, one for each of such cylinders, a capsule ejector piston attached to each of such capsule ejector plugs and slidable in a capsule ejector piston cylinder, a capsule cavity insert in each of said insert slots, said capsule cavity inserts having in the bottom thereof openings for each capsule ejector plug, a cutting out rim on each insert extending above the surface of the cavity die roll blank, the outermost surfaces of such cutting out rims forming portions of a cylindrical surface concentric with the axis of the cavity die roll blank, a manifold means extending from the lower portion of each of said capsule ejector piston cylinders to a valve seat surface of said roll, whereby a vacuum may act on said sheet material to position it in the capsule cavity inserts and a gas pressure can act to raise the pistons and the plugs and eject the capsules, and gas heating means to warm the gas causing said ejection.

3. The method of controlling the die temperature of a soft plastic capsule forming die and simultaneously ejecting capsules from therein which comprises continuously rotating a capsule forming die, forming capsules in cavities in said die, passing an inert gas under pressure through a heating zone, passing the heated gas through a part of the die roll and through the capsule forming cavities in the die roll.

4. A method of controlling the die temperature of a gelatin capsule forming die and simultaneously ejecting capsules from cavities in the die which comprises rotating a gelatin capsule forming die, forming capsules in cavities in said die, passing an inert gas under pressure through a temperature controllable heating zone, passing the thus warmed gas through a valve plate, through passages in the die, and through the capsule forming cavity into the atmosphere during selected portions of the rotation of the die, thereby causing the ejection of the capsules and simultaneously warming the die.

5. Apparatus for forming capsules comprising a die

roll, inert gas passages therein, capsule forming cavities in the surface of said die roll, capsule ejecting plugs, inert gas operated pistons connected to said plugs for ejecting the capsules, a flat valve plate adjacent a flat surface of the die roll, a pressure chest in said valve plate selectively connectable to said gas passages in the die roll to cause the flow of gas to raise the plugs at a desired portion of the cycle, and thereby eject the capsules, a source of inert gas under pressure, and temperature controllable gas heating means to warm the inert gas, and thereby control the temperature of the die roll.

6. Apparatus for forming capsules comprising a die roll, capsule forming cavity inserts therein, at least one gas cylinder under each insert, a piston and ejection plug for each cylinder, gas manifold means in the die roll connected to said cylinders, an inert ejection gas distributing means to supply inert ejection gas during an ejection portion of a capsule forming cycle, thereby raising the plug and ejecting the capsule, and temperature controllable gas heating means to heat said inert ejecting gas, and thereby control the temperature of the die roll.

7. A gelatin capsule forming die roll system comprising vacuum capsule forming means, including capsule forming cavities, inert gas operated ejector means, at least a part of said ejector means rising into said capsule forming cavities during part of an ejection cycle, inert gas passages in the die roll for conducting heated inert gas to said ejector means, and temperature controllable ejection gas heating means.

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