This invention relates to a method and machine for marking soft plastic strip and manufacturing soft plastic capsules therefrom. Soft plastic capsules, usually of gelatin, have been manufactured from continuous plastic strip material.

Machines for the manufacture of gelatin capsules and methods of their use are described in such patents as U.S. Patent 2,663,128, Stirn and Taylor, “Method and Machine for Making Capsules,” December 23, 1953; U.S. Patent 2,513,852, Alfonso M. Donofrio, “Method for Encapsulating,” July 4, 1950; and U.S. Patent 2,497,212, Alfonso M. Donofrio, “Method of Manufacturing Capsules,” February 14, 1950. The present invention may be used with the methods and machines for the manufacture of soft plastic capsules shown by these and other patents. Gelatin plasticized with a polyhydric alcohol, such as glycerine, and water is a preferred strip material.

For purposes of identification both as to content and to origin, it is desirable to mark indicia on the capsules. For identifying origin it may be desirable that the indicia be on the interior of the capsule so that the indicia are visible only when the capsule is open, or the indicia may be embossed in the film forming the capsule so that the indicia will only be discernible by close examination in strong light, or the indicia may be clearly and visibly printed so as to be unmistakably legible. One such process of marking a plastic strip before the manufacture of capsules therefrom is described in U.S. Patent 2,624,163, to Frank E. Stirn, “Method of Making Colored Gelatin Capsules,” January 6, 1953.

By the present invention it has been found that the marking of the strip is greatly simplified by using power driven rolls under controlled conditions. Preferably all of the strip contacting rolls are power driven at substantially the same surface speed as the speed of the strip. Preferably all rolls should be driven at both ends. By using separate gears at each end of each roll, all rolls are uniformly driven at all times, and the plastic strip feeds uniformly and directly through the marking machine.

If the rolls are driven at only one end, it is difficult to prevent the plastic strip from “walking” from side to side over the face of the marking roll, thereby giving non-uniformly marked capsules. The present machine gives uniform and even feeding of a marking ink to a marking roll. As used herein the term ink includes both dyes and pigments in a fluid which is transferred to the surface of the plastic strip. The ink used may be one which is only visible by ultra-violet light or under other specialized conditions.

The indicia on the strip may also be formed by the action of heat or pressure on both plastic strip. Plastic strip material, such as gelatin strip, is easily marked by the use of a die using heat and pressure or both to alter the characteristics of the film over a selected area. Such a marking is visible only on close inspection.

The present machine permits synchronization of the marking and capsule forming step so that the registration of indicia on the capsule is facilitated. It is convenient to use two machines to print matching indicia, as for example a stripe, on each of the strips used in forming capsules so that the finished capsule has rings around or other selected indicia. Similarly two or more of the present marking machines may be used serially upon a single strip to give multi-colored marking.

The problem of registration of markings on soft deformable strips in the past has been an insurmountable obstacle. Registration is difficult on such film such as paper and metals. On flexible films such as plastic strip, particularly soft gelatin strip for capsule formation where the strip may be easily stretched at least 50% in any direction, the problem of registration had not previously been solved for capsule manufacturing.

A machine embodying our invention is shown in the accompanying drawings.

Figure 1 is a side view of the machine. Figure 2 is a top view. Figure 3 is a partial sectional view showing details of a linear registration adjustment. Figure 4 is a diagrammatic view showing the roll system.

Preferably each principal roll is independently positively positionable. Each strip contacting roll is power driven at each side. As shown diagrammatically in Figure 4, one embodiment of the invention comprises essentially the marking roll 11, with raised marking areas on its surface, and a pressure roll 12, between which the plastic strip 13 is passed. Adjacent to the marking roll 11 is an ink transfer roll 14 adjacent to which is an inking roll 15 which rotates partially submerged in an ink trough 16 containing a marking fluid or ink 17. Bearing on the inking roll 15 is a wiper roll 18 to control the quantity of ink transferred by the inking roll. Riding on the surface of the inking roll 15 and the ink transfer roll 14 are two spreader rolls 19 and 20. These rolls assist in spreading the marking fluid uniformly on the surface of the ink transfer roll 14. With many marking fluids the spreader rolls may be eliminated, particularly if the indicia is comparatively uniformly distributed over the width of the marking roll 11. The spreader rolls are particularly useful when forming banded capsules and the indicia on the surface of the marking roll 11 consists essentially of narrow peripheral strips.

Each of the rolls are journaled in individual journal blocks. Conveniently the journal blocks may be arranged in a frame 21 as shown in Figure 1. The marking roll 11 is journaled in marking roll journal blocks 22 which slide in vertical slots 23 in the frame. The marking roll may be of resilient material such as rubber but preferably is of a metal. The roll itself may be built up having in its surface indicia 24 which marks the particular legend desired on the plastic strip. Replaceable indicia may be used. The indicia conveniently is of a type metal although more durable metals may be used if a more convenient method of forming them is available. Type metal is particularly convenient because it may be so easily formed to the desired indicia. Also type metal is ready wetted by the marking fluid. Rubber type in the marking roll gives excellent results but usually is more expensive and does not wear as long as type metal.

The marking roll itself is slidably on a marking roll shaft 25. One end of the marking roll is biased by a spring 26 and positioned by a positioning bar 27 which passes through a slot in the marking roll shaft, the axial position of which in turn is controlled by a positioning screw 28 passing through the axis of the marking roll shaft 25. Marking roll drive gears 29 and 30 are located at each end of the marking roll shaft. The marking roll 11 is keyed to, or otherwise caused to rotate with, the
marking roll shaft 25. The marking roll journal blocks 22 each have therein a positioning ball 31 which is raised by a positioning ball spring 32. Both the positioning ball and the positioning ball spring 32 are held in the marking roll journal blocks by a positioning ball retainer 33 which is a press fit in the marking roll journal blocks 22 and which permits the ball to be held in an upper position by the positioning ball spring.

The pressure roll 12 is journalized in pressure roll journal blocks 30 which slide in the vertical slots 23. The pressure roll journal blocks rest upon the positioning balls 31 and are held in a raised position thereby. A cross member 35 is attached to the frame above the pressure roll and has therethrough pressure roll positioning screws 36. These pressure roll positioning screws, one on each side, hold the pressure roll journal blocks against the force of the positioning ball springs. The pressure roll may be accurately positioned vertically so as to bear against the plastic strip 13. The gap between the marking roll 11 and the pressure roll 12 is controlled by these screws so that the pressure roll positions do not unduly compress the plastic strip. A very light pressure as compared with conventional printing processes is required. The pressure roll 12 is preferably of resilient material such as rubber when used with a metal marking roll and preferably of metal when used with a rubber marking roll. The pressure roll must be of polyurethane or other prevent strip adhesion. The pressure roll is driven at each end by pressure roll drive gears 37 and 38 which drive the pressure roll at the same surface speed as the plastic strip and the marking roll.

Adjacent to the marking roll 11 is the ink transfer roll 4. The ink transfer roll preferably is of rubber or other resilient material. The ink transfer roll 14 is journaled in the ink transfer roll journal blocks 39 which slide in horizontal slots 40. At one end of the horizontal slots 40 are access slots 41 to permit the assembly of the ink transfer roll journal blocks and other mechanism. The ink transfer roll journal blocks are positioned on one side by the ink transfer roll journal block positioning screws 42, which have a conical taper at the lower end to control the position of the ink transfer roll. The pressure of the ink transfer roll against the marking roll is controlled by these screws. In the horizontal slots adjacent to the ink transfer roll journal blocks are the inking roll journal blocks 43. The inking roll 15 is preferably of a slightly resilient material or of metal. A partially resilient material such as hard rubber is particularly useful. The inking roll is in contact with the ink transfer roll and the pressure of contact between them in part determines the rate of ink transfer. The inking roll 15 is journaled in the inking roll journal blocks. These blocks also have a positioning bar spring assembly 44 therein. The pressure from the positioning bar spring assembly 44 holds the ink transfer roll against the marking roll and in turn holds the inking roll against the inking roll positioning screws 45. Separately journaled on the inking roll shaft is a wiper roll yoke 46. The wiper roll yoke has therein the wiper roll 18 which is held against the inking roll 15 by the wiper roll pressure screws 47. The wiper roll 18 is preferably of a resilient material such as rubber to compensate for any irregularities in either it or the inking roll. The wiper roll is normally pressed against the surface of the inking roll and either the inking roll or the wiper roll is resilient. The wiper roll yoke is held in position by the wiper roll indexing pin 48.

In the upper face of the frame 21 are spreader roll shaft slots 20 in which the shafts of the rolls 19 and 20 rotate. These rolls are permitted to rotate by friction and are positioned only by gravity. The wiper roll is rotated by friction by the inking roll.

The inking roll has inking roll drive gears 50 and 51 which drive each end of this roll which in turn are driven by the ink transfer roll drive gears 52 and 53. The uniformity of marking fluid transfer is clearly stabilized and rendered more uniform by having separate drive gears on each side of the marking roll, ink transfer roll, and ink feeding roller. For example, the inking roll markings are produced under a suitable part of an encapsulation machine, suitable parts of which are shown in the Figures.

The ink trough 16 is a hollow drive shaft 61 which is held in position by a suitable bearing 62. The inking roll is driven by the ink transfer roll drive gears 50 and 51 which drive each end of this roll which in turn are driven by the ink transfer roll drive gears 52 and 53. The ink trough is held in position by suitable bearing 55 and 56. The ink trough runs on an ink feed pipe 57 to an ink feed funnel 58. The ink feed funnel is positioned at an ink reservoir 59 which may be an ordinary oil feed cup.

One end of the marking roll is driven by a main drive gear 69 which meshes with the marking roll drive gear 50. The main drive gear is on one end of a hollow drive shaft 61 which is held in position in the frame by a positioning ring 62. The drive shaft 61 is driven by a main drive gear 63 on the other end of the hollow drive shaft 61 which is driven by the marking roll drive gear 50.

The uniformity of marking fluid transfer is clearly stabilized and rendered more uniform by having separate drive gears on each side of the marking roll, ink transfer roll, and ink feeding roller. For example, the inking roll markings are produced under a suitable part of an encapsulation machine, suitable parts of which are shown in the Figures.

In operation, the present device is preferably placed so as to be as close as possible to the point at which the strip is formed into capsules as to simplify the problems of registration. The marking machine frame may be inclined to fit in the space available. Machines for the manufacture of capsules may be modified slightly if necessary, in order that there is provided sufficient space adjacent to the capsule forming rolls for the marking operation. Depending upon the design, the capsule, one or more marking devices may be used for the outside of or the inside of the strips of plastic material used in the capsule. In capsule forming machines which use two separate strips such as is shown in the Figures, a capsule may be produced with two different colored inks which are particularly convenient. The strip is preferably marked before it is oiled or coated.

Various types of marking fluids may be used as the ink. In particular, a volatile solvent base fluid is used. It is preferable that the ink used in the device be of such a type which have a small amount of a wetting agent incorporated therein, as a small amount of a wetting agent appears to cause the marking fluid to penetrate the surface of the plastic strip, particularly if of gelatin, and prevents feathering at the edges of the incised.

An ink which makes an excellent marking fluid may be prepared by dissolving 300 grams of an edible dye such as F.D.&C. blue dye number 1 in 10,000 milliliters of water and 500 milliliters of ethanol to which has been added 10 milliliters of a 70% solution of bis(2-ethylhexyl)sodium sulfosuccinate (Aerosol OT). Another excellent marking fluid is prepared by dis-
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solving 10 milliliters of bis(2-ethylhexyl)sodium sulfosuccinate in 5000 milliliters of propylene glycol, adding 5000 milliliters of water, concentrating to about 60° C., and adding thereto with stirring 700 grams of blue dye P.D.&C. blue number 1. This ink containing the propylene glycol is particularly useful as the alcohol therein is only slightly volatile and therefore remains in fluid form in the ink trough and on the surface of the rolls. The use of the wetting agent permits a simple transfer without bleeding or feathering, thereby giving a sharp clear mark in the surface of the plastic strip.

A capsule marking machine was set up using a soft gelatin strip colored yellow in a machine similar to that in the Stirn et al. Patent 2,663,128. A marking machine was installed to mark, with upper strip only. Elliptical shaped indicia were used on the surface of the marking roll 11. The spacing of the ovals on the surface of the marking roll was such that ovals containing trademarks were marked on the gelatin strip with spacing such that a single oval appears on each finished capsule.

After threading the machine and initiating operation the ink reservoir was filled with blue dye in propylene glycol-water solvent, prepared as above described. The ink trough was filled, and the rate of feed adjusted to the rate of consumption. The pressure of the pressure roll 12 against the film was adjusted so that the film was only slightly compressed. The ink transfer roll and the inking roll were adjusted so as to press slightly against each other and the ink transfer roll against the marking roll. By having each side of each roll separate adjustably the individual printing on the gelatin web was readily adjusted as to intensity and uniformity so as to give a clear even imprint. The positioning screw 28 was adjusted until the alignment axially was as desired, and the knurled knob 67 used to position the helical gear 64 so that the angular relationship between the marking roll 11 and the encapulating dies was such as to center the oval on the individual capsules. By using a light pressure on the gelatin film and by driving the film contacting rolls at the surface speed of the film, the capsules were marked evenly and uniformly and it was found that the strip did not "walk" but fed uniformly through the machine. By having the marking device close to the point of capsule formation it was found that a minimum of care was necessary to insure continuous registration of the roll on the capsule.

Various modifications of the present machine suggest themselves to those skilled in the art. The number of marking machines and the type of indicia and the color and quantity of marking fluid are a matter of choice depending upon the final indicia desired on the finished capsules. With some types of marking, the ink roll may directly contact the marking roll without using an intermediate ink transfer roll.

The present machine has the additional unexpected utility that by slightly decreasing the clearance between the pressure roll 12 and the marking roll 11 the plastic strip is slightly compressed. This pressure thins the film at the point of contact. The marking roll may be slightly warmed in the thinning operation if desired. This thinning gives a mark which is discernible by close inspection of the surface of the capsule as the characteristics of the film are changed by the pressure and, if desired, heat. Such heat or pressure embossing may be used simultaneously with a marking fluid of independent of the marking fluid so that the same machine may be used to make both types of capsules. The ink transfer roll may be used as an additional heated element to aid in warming the marking roll by heat transfer there to. If pressure alone is used for embossing, the ink transfer rolls and inking roll may be removed from the machine.

Pressuring and heat embossing is particularly convenient for use without ink to give identifying indicia for proof of origin of capsules to detect substitution or counterfeit goods.

Other modifications and variations suggest themselves to those skilled in the art and may be incorporated in the present machine and method as set forth within the scope of the claim.

We claim:

In a machine for making marked soft plastic capsules from plastic strips, in which a gear train drives a plastic strip marking roll and associated mechanism, the improvement which comprises: a frame having two parallel spaced apart sides, internal slots in each side of said frame, marking roll journal blocks in said slots so a marking roll shaft having a slot therein journaled in said marking roll journal blocks, a marking roll drive gear on said marking roll shaft, a marking roll having marking indicia on the peripheral surface thereof solidly mounted on said marking roll shaft, a spring pressing against one end of said marking roll, a positioning bar passing through the slot in said marking roll shaft and acting against the other end of said marking roll, a positioning bar screw threaded into the marking roll shaft and acting through the positioning bar to press the marking roll against the pressure of said spring, thereby axially positioning said marking roll for lateral register; pressure roll journal blocks in said slots in each side of said frame, a pressure roll journaled in said pressure roll journal blocks, positioning spring means between said pressure roll journal blocks and said marking roll journal blocks to bias the blocks apart, and a pressure roll positioning screw pressing said pressure roll journal blocks and said marking roll journal blocks together on each side of said frame, whereby the pressure roll is positively but adjustably positioned with respect to the marking roll; a non-rotating helical gear shaft screw threaded in one side of said frame for axial adjustment, a helical gear journaled therein, helical gear retaining means positioning said helical gear on said helical gear shaft against axial movement with respect to said shaft, but permitting free rotation, a hollow drive shaft positioned concentrically on said helical gear shaft and journaled in the other side of said frame, means to positively axially position said hollow drive shaft, a main drive gear fixedly positioned on said hollow drive shaft, allowing said marking roll drive gear, and an axially slidable rotationally fixed connection between said helical gear and said hollow drive shaft, whereby axial shifting of the helical gear changes the linear register of the marking roll with respect to an encapsulation machine; and a drive gear for the pressure roll, driven by said marking roll drive gear.

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