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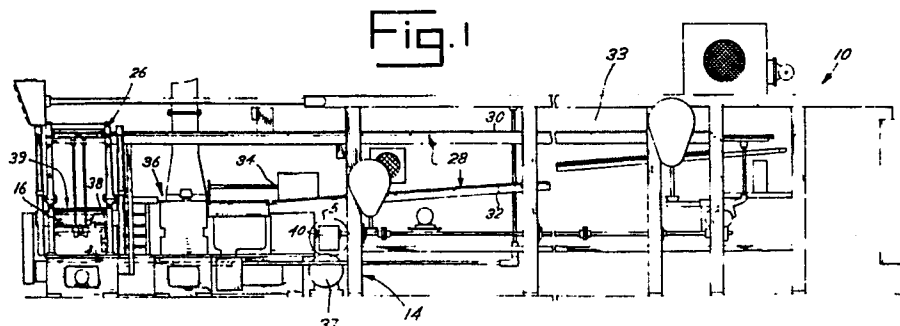
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⑤④ **Hard shell gelatin capsule dipping apparatus and method.**

⑤⑦ An apparatus and method for forming hard shell gelatin capsules. The apparatus is the type that includes a container for holding liquid gelatin therein, and a plurality of separate and distinct rigid bars are provided to rigidly support a plurality of upright pins. The pins are shaped and sized to have individual halves of the capsules formed thereon. Apparatus is provided for dipping a preselected number of adjacent bars with the pins thereon into the liquid gelatin. The gelatin is dried on the pins that are carried on the bars.

The capsules are stripped from the pins. A drive operates the dipping system, the drying system, and the stripping system at a selected speed, when five of the bars are dipped simultaneously into the liquid gelatin. The improvement in the apparatus and process involves dipping six or more of the bars simultaneously, into the liquid gelatin, and providing drive means that operates at least the stripping means at a speed which is at least twenty percent greater than the selected speed when the apparatus utilizes a five bar dip.



-1-

BACKGROUND OF THE INVENTIONField of the Invention and  
Description of the Prior Art

This invention relates to an apparatus for producing hard shell  
5 gelatin capsules and to the method for manufacturing hard shell  
gelatin capsules, and it particularly relates to improvements in the  
apparatus and method, wherein the improvements are highly efficient  
in operation because of significantly improved production speeds as  
compared to well known prior art machines.

10 One of the most commonly used oral drug dosage forms that  
are in use today, is a hard shell gelatin capsule which generally  
comprises two halves which are telescopically locked or secured  
together in various ways, such as by friction. One type of locking  
hard shell gelatin capsule is shown, for example, in United States  
15 Patent No. 4,040,536. These hard shell gelatin capsules are filled,  
generally with a medicament in various forms, such as powdered  
form.

The techniques and apparatus that are employed to  
manufacture hard shell gelatin capsules generally involve well known  
20 and established techniques. In manufacturing such hard shell gelatin  
capsules, a container of a liquid gelatin is provided. Pins are  
supported on a rigid support member and are inverted and dipped into  
the liquid gelatin. The liquid gelatin coats a portion of each pin. The  
gelatin coated pins are repositioned into an upright position and the  
25 gelatin that is formed on the pins is dried to a desired moisture  
content over a period of time by being conveyed through a drying  
chamber which has the temperature and humidity carefully con-  
trolled. The formed gelatin capsule is stripped from the pin and then  
cut to the desired size. The capsule halves are joined together and  
30 finally, ejected and packaged. The empty, joined capsules are later  
again separated and filled, as with a drug in the selected form, by the  
drug manufacturer.

The art of manufacturing the hard shell gelatin capsules is  
quite a well established art. Typical of older prior art apparatus is  
35 shown, for example, in the Hubel Reissue Patent No. 10,437, the  
Taylor Patent No. 275,092, the Glover Patent No. 297,380, and the

-2-

Taylor Patent No. 311,860. A more recent patent, the Weyers Patent No. 3,756,759 discloses an improvement in a dipping pan that contains gelatin liquid. The Padilla Patent No. 3,794,453 also shows a more modern apparatus, and discloses improvements in the apparatus for  
5 drying the gelatin on the capsule forming pins. Most manufacturing of hard shell gelatin capsules is performed today by equipment, known in the art, as a "Colton 950" machine. The Colton 950 machine generally carries out the manufacture of hard shell capsules according to the techniques discussed above. Although these Colton  
10 950 machines have proven to be quite acceptable in the manufacture of the hard shell capsules, as with most production equipment, any significant increase in the production rate of the equipment would, generally, be considered highly desirable.

15 SUMMARY OF THE INVENTION

It is an important object of the present invention to provide an improved apparatus and process for the manufacture of hard shell gelatin capsules wherein production rates may be increased by twenty percent, or more, relative to production rates possible with prior art  
20 capsule making equipment of the Colton 950 type of hard shell capsule machine.

It is also an object of the present invention to provide an improved apparatus and method for forming hard shell gelatin capsules by increasing the number of bars supporting the gelatin  
25 forming pins during the dipping operation, but without significantly changing other operating parts of the equipment, except for the drive portions thereof.

It is also an object of the present invention to provide an improved hard gelatin capsule making machine and process wherein  
30 manufacturing costs may be significantly decreased in a very simple and economical manner.

It is a further important object of the present invention to provide an improved hard shell capsule manufacturing machine and system wherein at least six bars containing a plurality of gelatin  
35 capsule forming pins are dipped simultaneously into the liquid gelatin in order to form the gelatin capsule half on the pins, whereby the

-3-

production rates of the equipment may be increased by twenty percent and even more wherein the only significant changes are made in the drive system so as to compensate for changes in the production speeds.

5 Further purposes and objects of the present invention will appear as the specification proceeds.

The foregoing objects are accomplished by providing an improved apparatus and process for forming hard shell gelatin capsules, the apparatus being of the type that includes a container for holding  
10 liquid gelatin, a plurality of separate and distinct rigid bars are provided for rigidly supporting a plurality of upright pins that are shaped and sized and have individual halves of the capsules formed thereon, means are provided for dipping a selected number of adjacent bars, with the pins thereon, into the liquid gelatin, means  
15 are provided for drying the gelatin on the pins supported by the bars, means are provided for stripping the dried capsules from the pins, and drive means are provided for operating the dipping means, the drying means, and the stripping means at a selected speed, when five of the bars are dipped into the liquid gelatin, the improvement in the  
20 apparatus and process includes means for dipping at least six of the pin support bars simultaneously into the liquid gelatin, wherein the drive means includes gear means for operating at least the stripping means at a speed which is at least 20 percent greater than the selected speed of the drive means when five of the pin support bars  
25 are used.

#### BRIEF DESCRIPTION OF THE DRAWINGS

Particular embodiments of the present invention are illustrated in the accompanying drawings wherein:

30 FIGURE 1 is a side elevational view of the hard shell capsule manufacturing machine of the Colton 950 type which is constructed and arranged to utilize an improved apparatus for increasing the production rates of the equipment;

FIGURE 2 is a top plan view of the apparatus embodied in  
35 FIGURE 1;

-4-

FIGURE 3 is a an enlarged, front view of our improvement of providing at least six support bars for dipping simultaneously into a container filled with liquid gelatin of the type used in the machine embodied in FIGURES 1 and 2;

5       FIGURE 3A is a side view of a hard shell gelatin capsule half;

FIGURE 3B is a side view of a hard shell gelatin capsule with two halves joined together;

FIGURE 4 is view taken along the line 4-4 of FIGURE 1 illustrating a gearing change used in one portion of the apparatus embodied in FIGURES 1 and 2 to accommodate increased production rates;

FIGURE 5 is an enlarged view of the area "5" of FIGURE 1 showing another change in the gearing of the drive system of the apparatus embodied in FIGURES 1 and 2;

15       FIGURE 6 is a pictorial view of a plurality of hard shell gelatin capsule forming pins supported on a pin support bar;

FIGURE 7 is a view, similar to FIGURE 3, illustrating seven pin support bars in side-by-side relationship in the same lateral space used for dipping six bars into a liquid gelatin container; and

20       FIGURE 8 is a view similar to FIGURE 7 except showing eight pin support bars in side-by-side relationship.

#### DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Our improvement of increasing the production rate in the manufacture of hard shell gelatin capsules is used in the capsule making machine, generally 10, which is shown in FIGURES 1 and 2. The capsule making machine 10 is of the type commonly known to those in the art as a "Colton 950" hard shell gelatin capsule manufacturing machine. Presently, there are known to be at least two principal manufacturers of the equipment, namely, Cherry-Burrell, of Cedar Rapids, Iowa, and R. & J. Engineering, of Kitchener, Ontario. Since the Colton 950 equipment is of known construction to those skilled in the art, a detailed discussion of the hard shell gelatin capsule manufacturing machine 10 will not be provided herein, although a general description will be provided to provide a full and complete understanding of our improvements in the machine 10.

-5-

As seen in FIGURES 1 and 2, the capsule making machine 10 is elongated, and generally includes two halves or production lines, generally 12. Since each line 12 of the machine 10 is basically a mirror image of the other, it is considered necessary to describe only one of the lines 12. Each line 12 is supported on an elongated machine frame, generally 14. A dipping pan 16 is supported at one end of the frame 14 and contains the liquid gelatin, generally 18, as seen in FIGURE 3, which forms the hard shell capsule halves 20 provided on the machine 10. One typical hard shell capsule half 20 is shown in side view in FIGURE 3A and a fully assembled capsule is shown in FIGURE 3B with two halves 20 joined together.

Referring to FIGURE 3 and to FIGURE 6, a plurality of rigid support bars 22 are provided for supporting a plurality of pins 24 having rounded ends thereon. The support bars are elongated in the same direction as the machine 10. One aspect of the present invention involves improvements in the support bars 22 so as to increase the machine's rate of producing capsule halves 20. The pins 24 are sized and shaped to form individual capsule halves 20 thereon by having gelatin 18 being coated thereon, after the pins 24 are dipped into the liquid gelatin 18 contained within the dipping pan 16. In FIGURE 3, a capsule half 20 is shown in dotted view on each of the pins 24 following dipping into the gelatin liquid 18. The pins 24, as shown, are dipped when in an inverted position.

Referring to FIGURES 1 and 2, after the dipping of the pins 24 into the gelatin 18, as generally shown in FIGURE 3, an elevator mechanism, generally 26, repositions the support bars 22 and pins 24 during elevation thereon and with the liquid gelatin 18 coated thereon, into an upright position. The bars 22 are then raised or elevated into position for conveying by a conveyor mechanism, generally 28. The conveyor mechanism 28 includes an upper section 30, during which the support bars 22 are moved away from the dipping mechanism 39, and a lower section 32, during which the support bars 22 are carried back towards the forward part of the machine.

As seen in FIGURE 2, the conveyor mechanism 28 is quite elongated and is shown partially broken away. The conveyor

-6-

mechanism 28 transports the bars 22 with the pins 24 through a drying chamber, generally 33, for drying the gelatin on the pins to the desired moisture content while also hardening the capsule halves 20 on the pins 24. The temperature and humidity conditions in the chamber 33 are carefully controlled. Also, the time for transportation of the bars 24 through the chamber 33 is carefully controlled. The conveyor 28 carries the bars to a pusher mechanism 34, at the forward section of the machine, after the capsule halves have reached the desired degree of hardening.

10 The pusher mechanism 34 moves the support bars 22 into a stripping and cutting area, generally 36, also of known design. In this area, the gelatin capsule halves 20 are removed from the pins 24 and are also cut or trimmed to the desired length. The capsule halves 20 are then joined together to form the capsule illustrated in FIGURE 15 3B. The joined capsules are then ejected. As indicated previously, the joined capsules, are later separated and filled, generally with a powdered material.

As described previously, the machine 10 is of known construction, that is, of the Colton 950 type. As seen, for example, in 20 the Weyers Patent No. 3,576,759 and in the Padilla Patent No. 3,794,453, during the dipping operation, the pins 24 are dipped into the dipping pan 16 in the inverted position with five of the support bars 22 in side-by-side relationship. In the known prior art, only five pin bars have been simultaneously dipped.

25 It has now been discovered that production rates for the machine 10 may be increased by at least twenty percent by increasing the number of support bars being dipped into the liquid gelatin from five, which was the only known practice in the prior art, to at least six in number. Our improvement, namely, a six bar dipping system is 30 illustrated in FIGURE 3. In the Colton 950 type of machine, it has been found that by narrowing the support bar enables there to be at least six bars mounted in the available space for dipping the pins 24 into the liquid container supported on the machine 10. Commonly, thirty pins 24 are provided on a single bar. Thus, by increasing the 35 number of the separate and distinct bars 22 from five to six in number, for each dip, production increases from one hundred fifty to

-7-

one hundred eighty capsules per dip, or a twenty percent increase in the production rate.

Since both the available dipping time and the required drying time are the same with the improved equipment, there is an increase  
5 in the machine speed for at least the bar pusher, and for the stripping, cutting, joining and ejecting operations as compared to a prior art machine using a five bar dip. For the additional bar that is added, the pusher speed must be increased in speed, as by twenty percent. Also, the stripping, cutting, joining and ejecting operations  
10 must also be increased in speed. Referring to FIGURES 1 and 4 and 5, the drive system, generally 37, used in the machine 10 includes various drive motors and the like shown in FIGURES 1 and 2. In our invention, a gearing arrangement, generally 38, as seen in FIGURE 4, is provided to gear down the speed of the dipping mechanism 39  
15 relative to the speeded up production operations of the machine 10. A gear reduction box, generally 40, as seen in FIGURE 5, uses a gear arrangement for gearing down the speed of the drying mechanism 28 relative to the speeded up operations of the machine 10.

As seen from the above, by increasing the number of support  
20 bars 22 from five to six in number for a single dipping operation, production rate on a Colton 950 machine can be increased by twenty percent, while, at the same time gearing mechanism 38 and 40 are provided so as to maintain the machine speed for the dipping and drying times at a lower machine speed relative to other, increased  
25 machine speed rates which are twenty percent greater than a five bar dipping machine, of the type used in the prior art.

As seen in FIGURES 7 and 8, additional bars, such as seven bars 22 or eight bars 22 may be used. These additional pin bars 22 would proportionally further increase the production rate of the  
30 equipment 10. Each of the separate and distinct support bars is narrowed in width so that the desired number of bars, such as six, seven, or eight may be dipped into the dipping pan which has only an available width, such as about 4-3/8 inches, but requires no change from the prior art. In summary, by narrowing the support bars, and  
35 changing the speed of the dipping time and the drying time of the gelatin capsules relative to increased machine production rates so as



-8-

to maintain the prior art dipping and drying times as found in the prior art five bar dip, the present invention results.

It is seen that by the foregoing apparatus and method, we have been able to significantly increase production time with simple and economical changes on the equipment 10. It is believed that all of the objects previously set forth have been accomplished.

While in the foregoing there has been provided a detailed description of a particular embodiments of the present invention it is to be understood that all equivalents obvious to those having skill in the art are to be included within the scope of the invention, as claimed.

What we claim and desire to secure by Letters Patent is:

-9-

## CLAIMS:

1. In an apparatus for forming hard shell gelatin capsules, said apparatus being of the type which includes a container for holding liquid gelatin, a plurality of separate and distinct rigid bars for rigidly supporting a plurality of upright pins shaped and sized to have individual halves of said capsules formed thereon, means for dipping a pre-selected number of adjacent bars with said pins thereon into said liquid gelatin, means for drying said gelatin on said pins on said bars, means for stripping said dry capsules from said pins, and drive means for operating said dipping means, said drying means and said stripping means at a selected speed, when five of said bars are dipped into said liquid gelatin, the improvement comprising means for dipping at least six of said bars simultaneously into said liquid gelatin, and wherein the drive means includes gear means for operating at least said stripping means at a speed which is at least twenty percent greater than said selected speed.

2. In a method for forming hard shell gelatin capsules, said method including the steps of containing a liquid gelatin, providing a plurality of rigid bars supporting a plurality of upright pins sized and shaped to have individual halves of capsules formed thereon, dipping pre-selected numbers of said pins supported on said bars into said liquid gelatin, drying said gelatin on said bars, stripping and cutting dried capsules from said pins, said dipping step, said drying step, and said stripping step being operated at a pre-selected speed when pins supporting on five of said bars are dipped simultaneously into said liquid gelatin, an improved process comprising the steps of dipping pins carried on at least six of said bars simultaneously into said liquid gelatin, and operating at least said stripping means at a speed which is at least twenty percent greater than said pre-selected speed.

Fig. 2

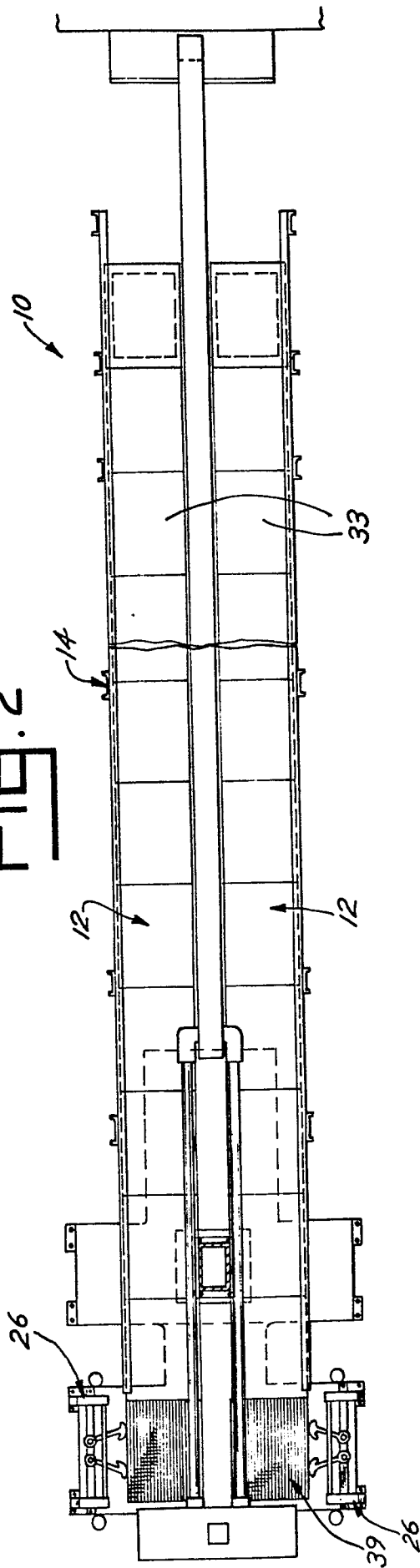


Fig. 1

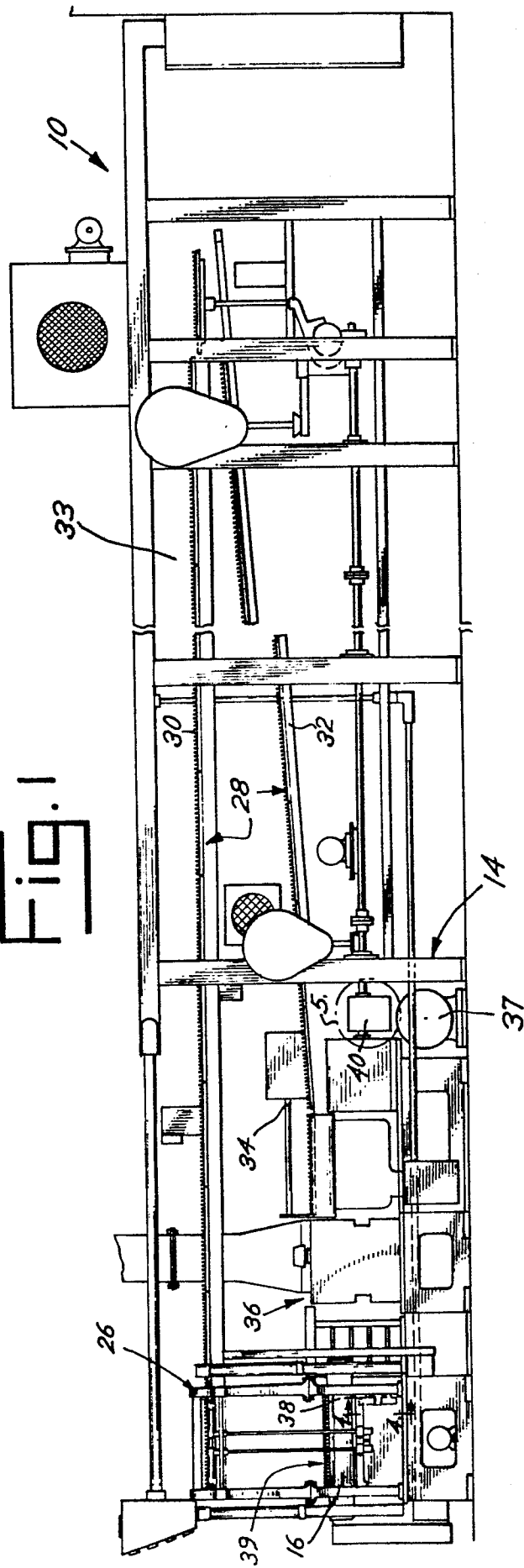


Fig. 3

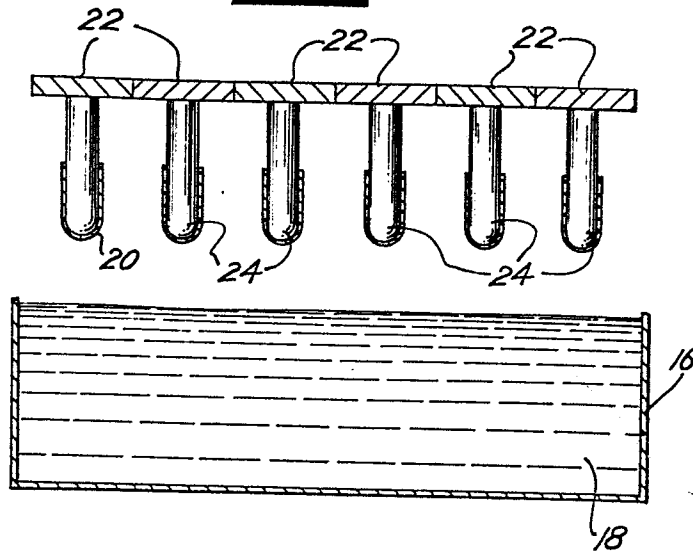


Fig. 3A

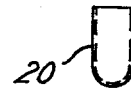


Fig. 3B

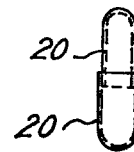


Fig. 4

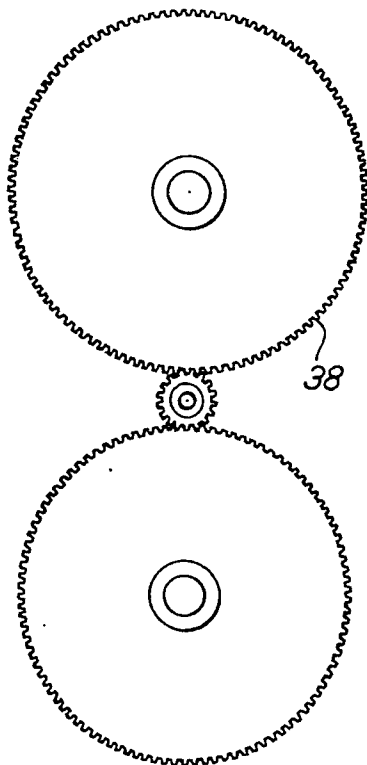


Fig. 5

