United States Patent

[11] **3,601,041**

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[45] Patented **Aug. 24, 1971**
[73] Assignee **Markem Corporation**
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[54] **APPARATUS FOR FEEDING AND PRINTING TABLETS AND CAPSULES**
11 Claims, 15 Drawing Figs.

[52] **U.S. Cl.** ..... **101/37,** 302/2 R, 141/34, 198/209
[51] **Int. Cl.** **B41f 17/36**
[50] **Field of Search** 198/209, 25, 29, 42, 128; 101/35–37; 141/34; 137/262; 221/265; 118/230, 227; 302/2; 424/2, 6; 8/3, 4

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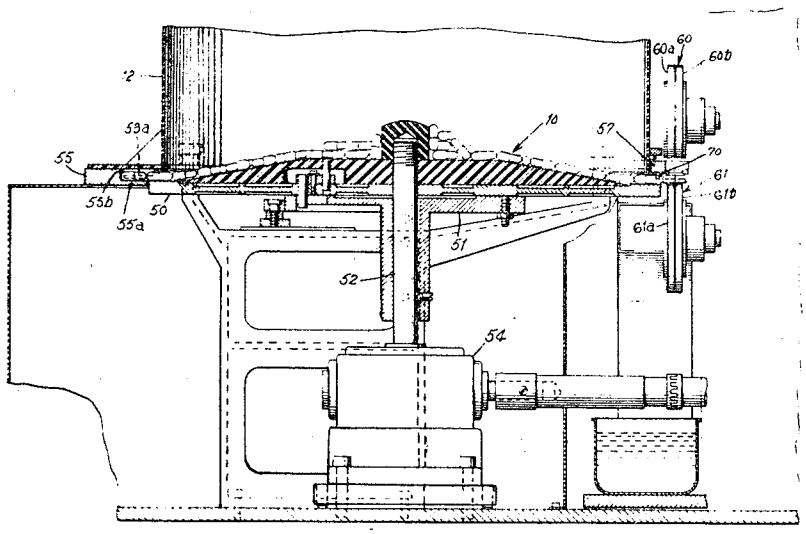
ABSTRACT: Apparatus for orienting and selectively printing capsules or tablets on one or two sides at rates of 10,000 or more units per minute, comprised of a hopper for carrying a bulk supply of capsules which is set over a rotating disc having slotted radial paths. As the capsules fall on to this rotating disc, they are centrifugally thrown toward the outer periphery along these slotted paths. A pair of opposed printing members are positioned over the peripheral edge portion of the rotating disc so that the capsules are passed between these printing members and then discharged into a hopper by an air jet.



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6 Sheets-Sheet 1

Fig. 1.

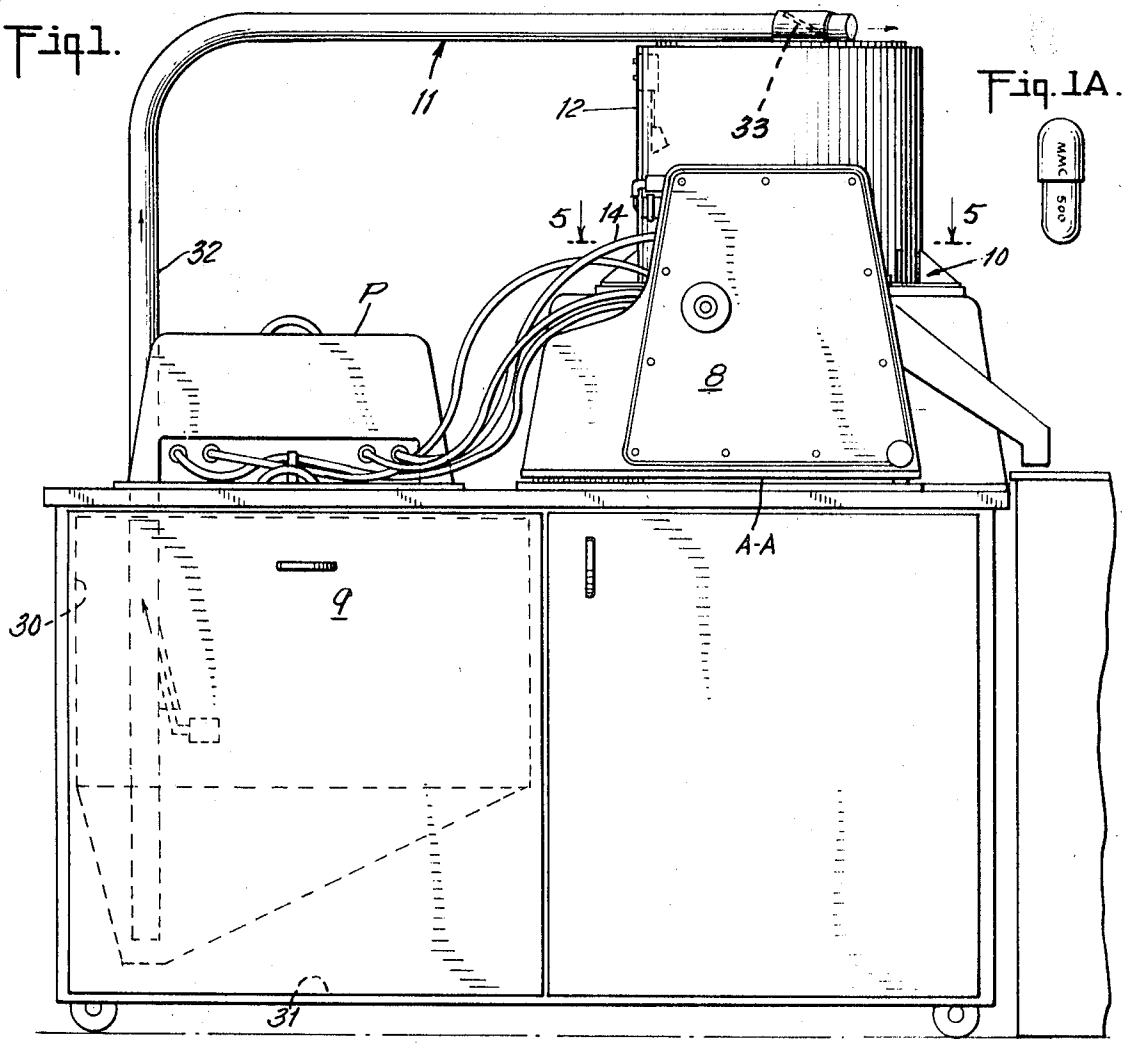
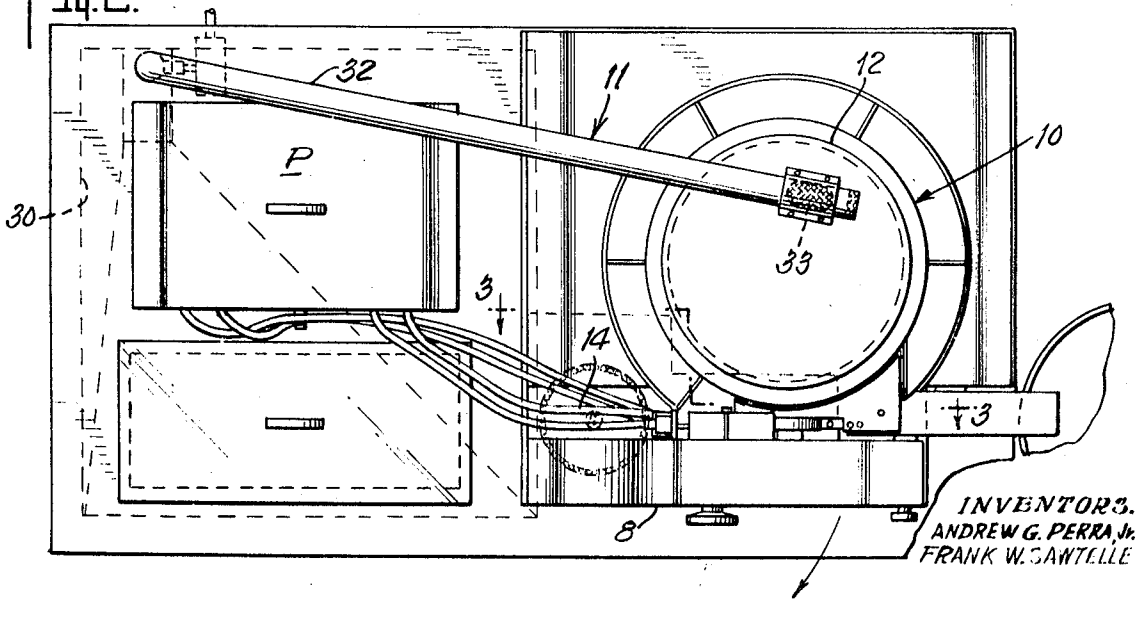


Fig. 1A.

Fig. 2.



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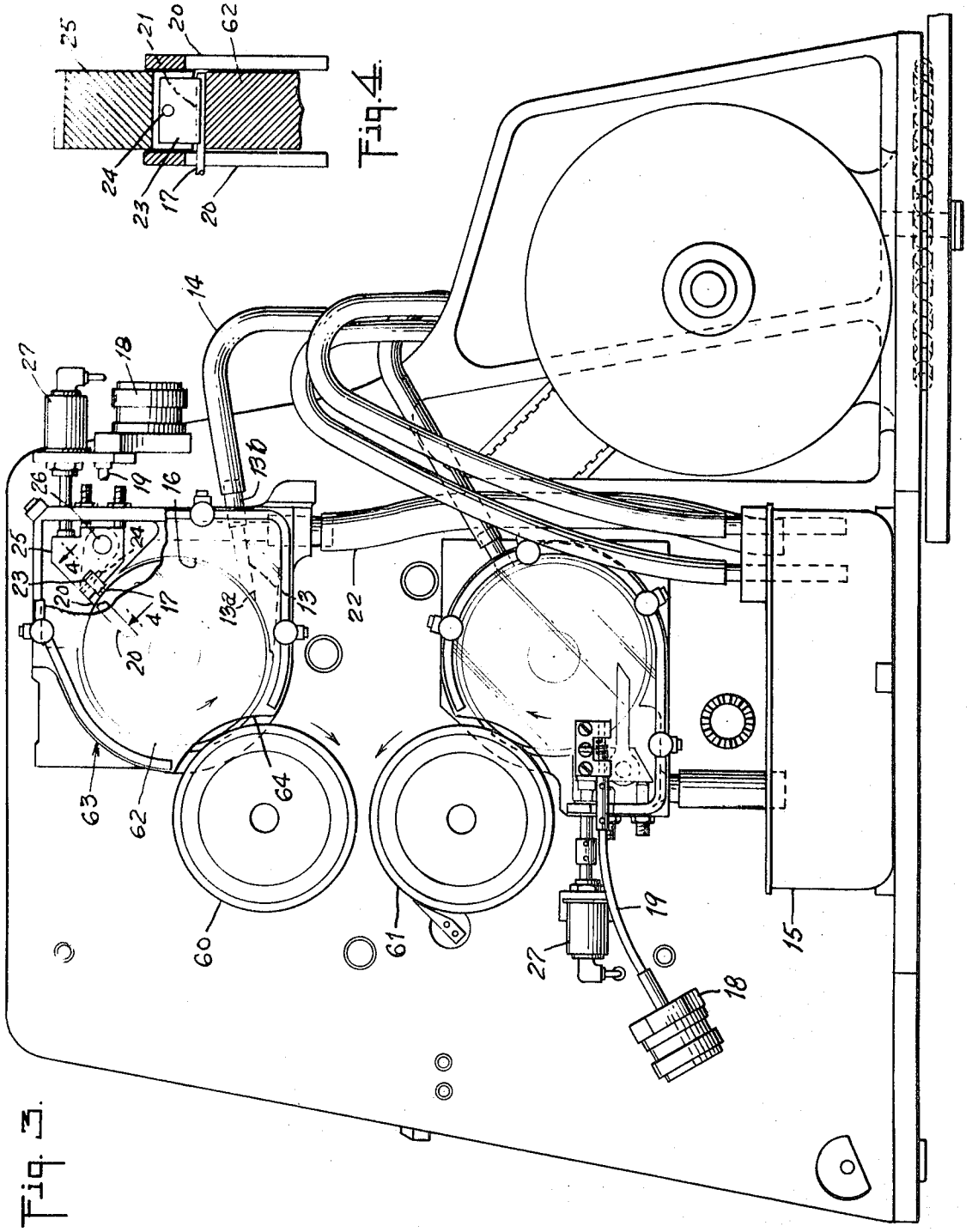

Fig. 4.

Fig. 3.

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Fig. 5.

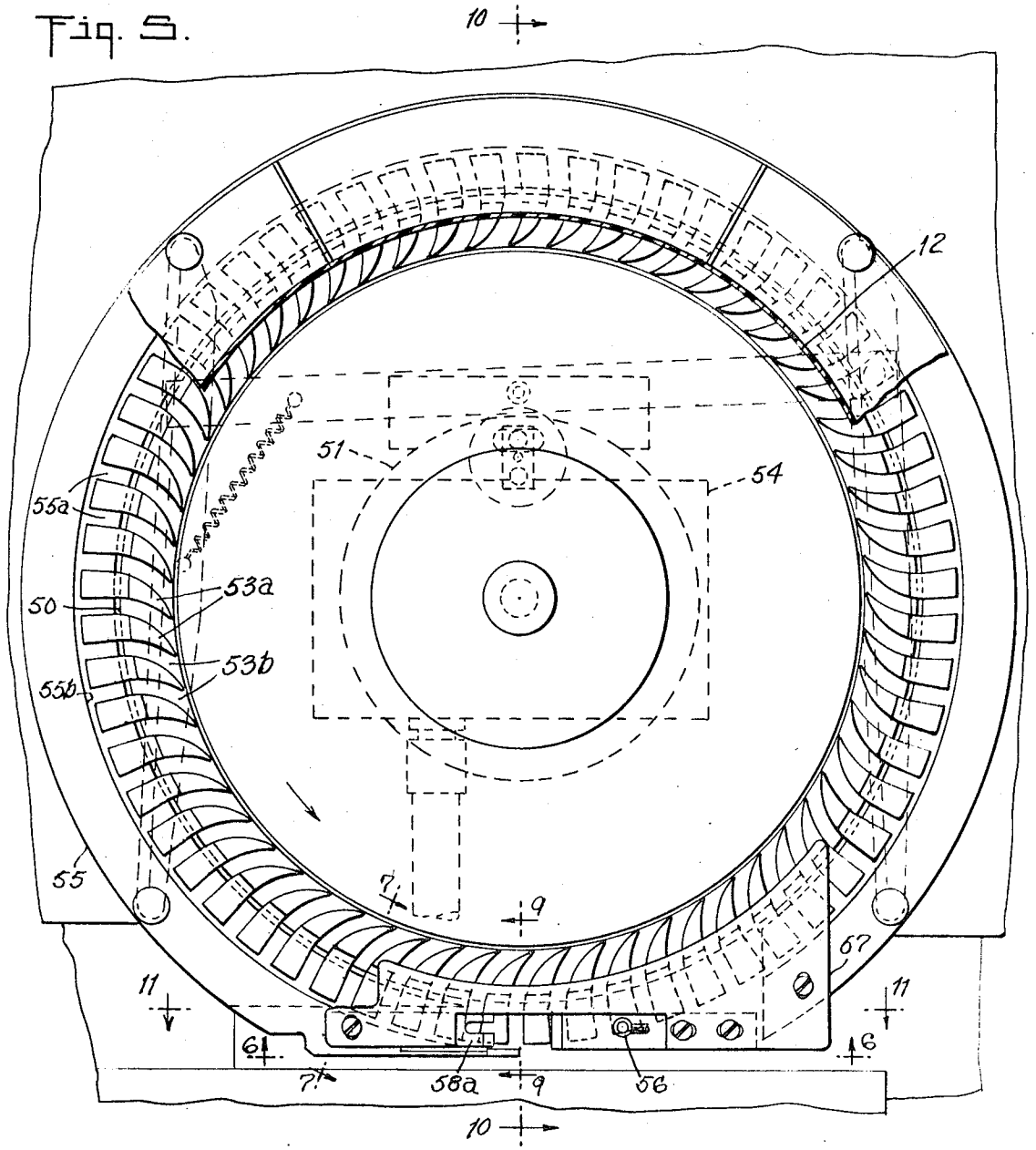


Fig. 6.

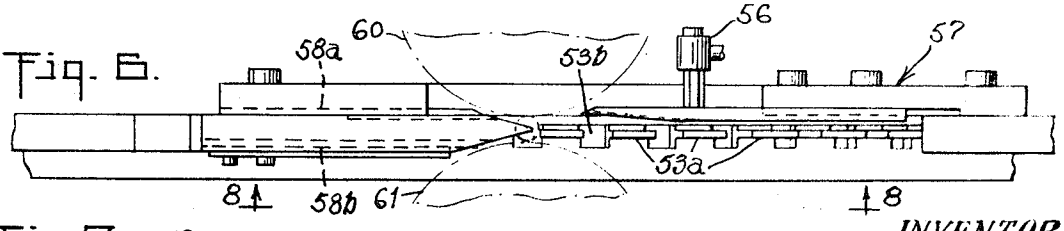


Fig. 7.

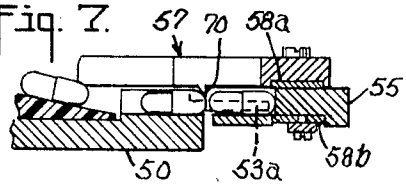
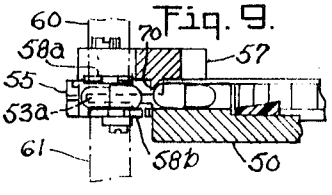


Fig. 9.



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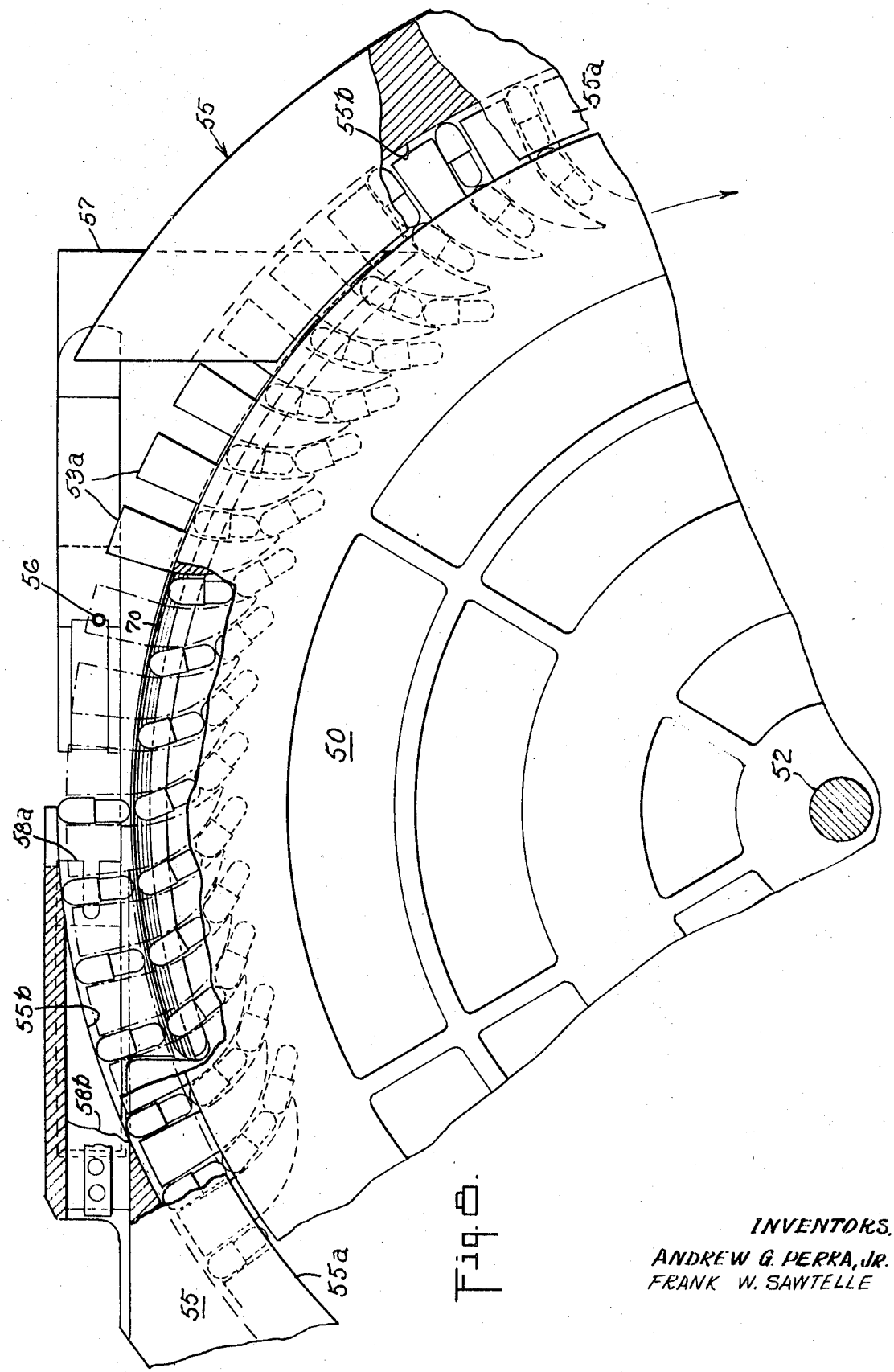

Fig. 4

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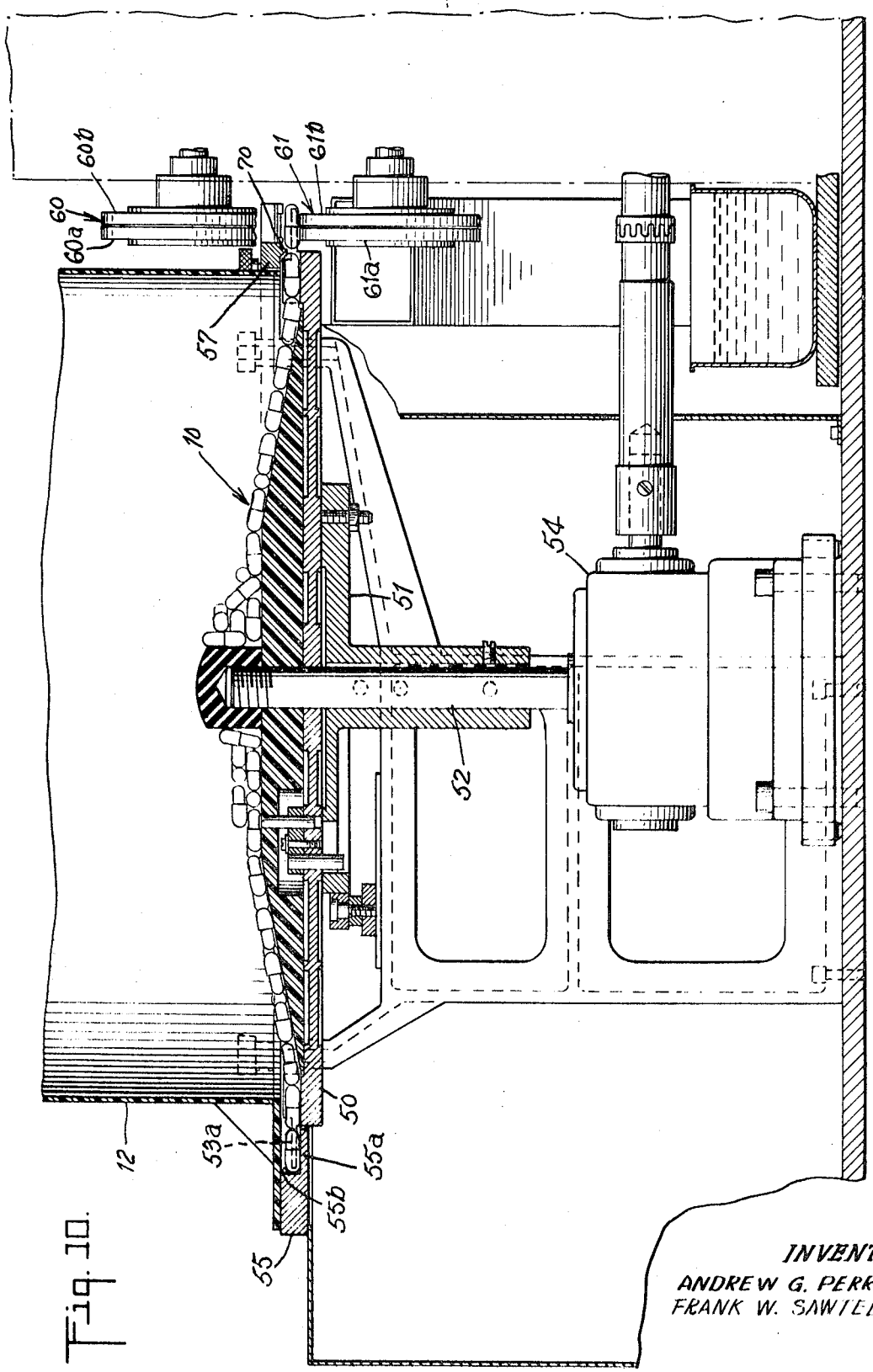

Fig. 10.

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Fig. 12.

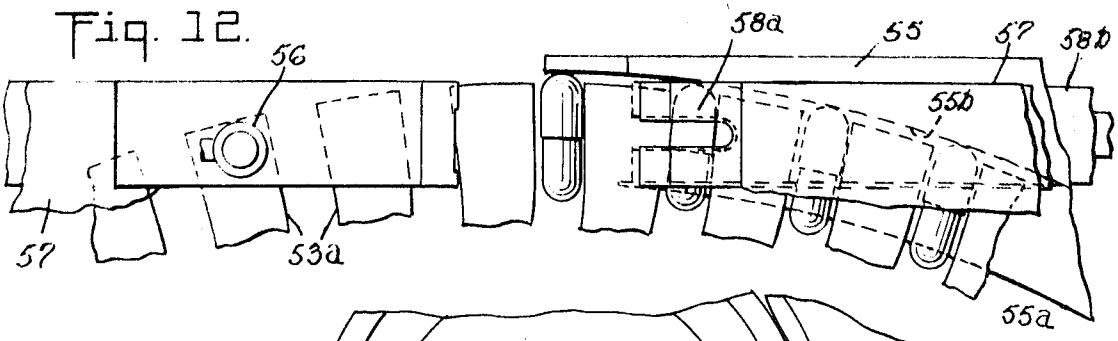


Fig. 11.

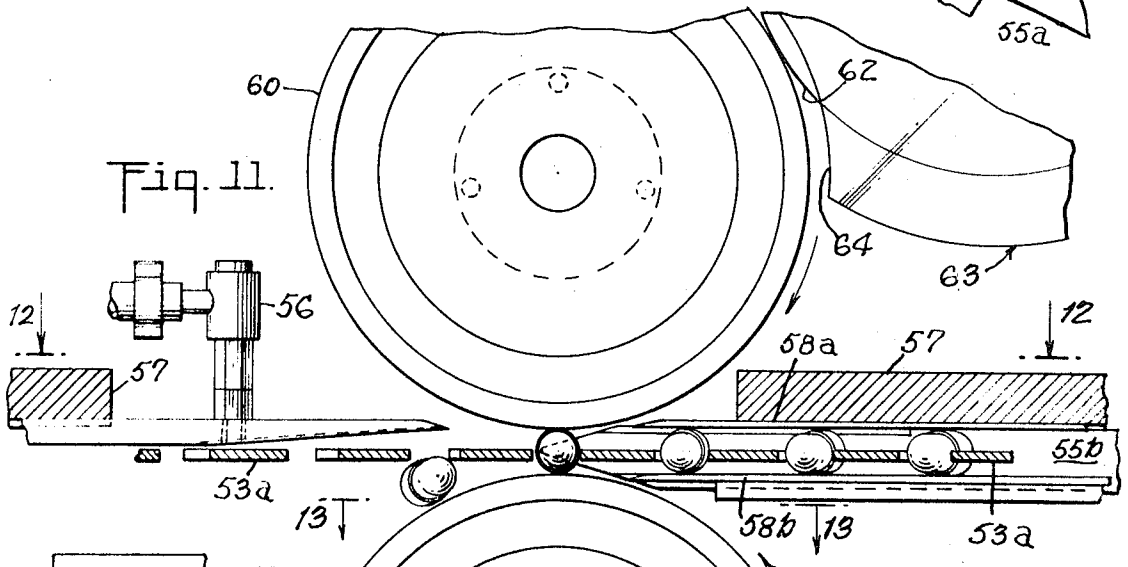
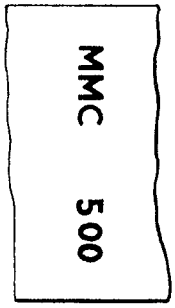
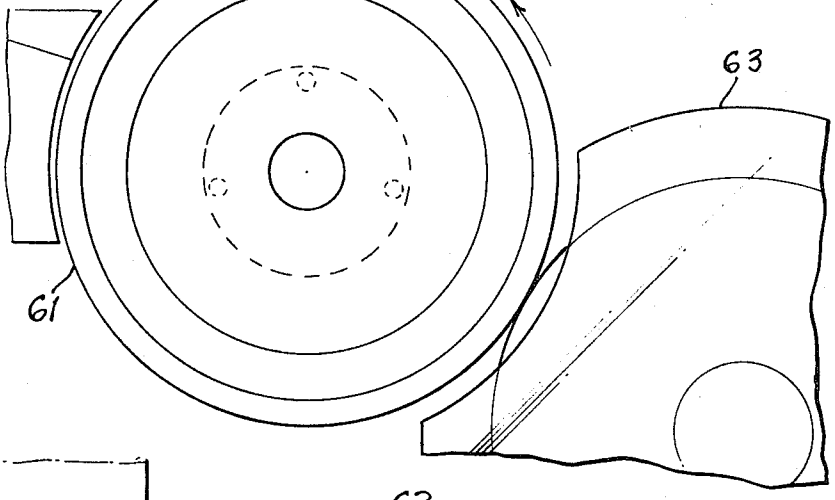


Fig. 14.





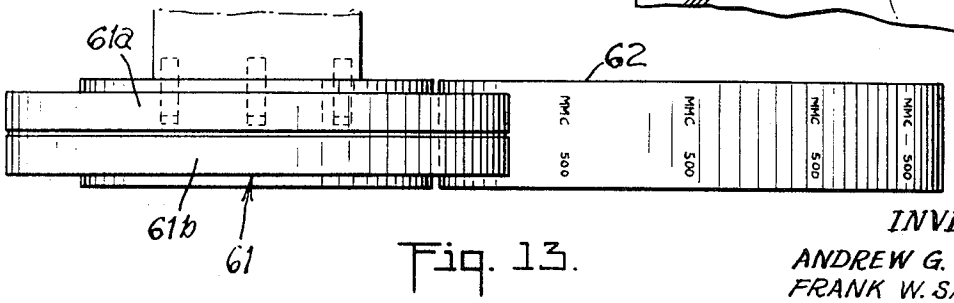


Fig. 13.

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APPARATUS FOR FEEDING AND PRINTING TABLETS AND CAPSULES

This invention relates to apparatus for feeding and printing identification legends on tablets and capsules, and more particularly relates to an apparatus for feeding and printing such tablets and capsules at rates in excess of 10,000 units per minute, with two printed legends appearing on opposed surfaces of each such tablet or capsule.

Though tablets are to be distinguished from capsules both in terms of appearance and their related problems in handling and printing, this disclosure will be presented referring to "-capsules," it being understood that in terms of scope of this invention "tablets" are also embraced by this term.

The manufacturers of pharmaceutical capsules find it highly desirable to properly mark and identify these capsules with various items of information, such as manufacturer identification, lot number, trademark, and the like. Because of the amount of printed legend to be applied to each capsule, it is also desirable, and in some cases, necessary because of space considerations that the printed matter be divided between two printing areas, e.g., on opposite surfaces of the capsule.

Current state of the art printing techniques for developing a double-image legend on a capsule are limited to feeding and printing speeds of 1,000 to 2,000 units per minute. Some improvisation of these existing techniques have boosted these rates to 8,000 units per minute, but with the limitation of being able to print on one side of the capsule only. It is obvious that high rates of capsule printing production can be achieved in one of two ways; namely, (1) a high rate of feeding and printing on an individual capsule basis, or (2) a high volume of feeding and printing which can take place at a slow speed. This invention disclosure particularly concerns itself with the former of these two alternatives, namely, handling each capsule unit on a high-speed basis.

As mentioned hereinabove, printing on both sides of a capsule may soon be more than a question of desirability. Due to pharmaceutical counterfeiting by which capsules not actually made by a particular company find their way into the marketplace and are sold with identification purporting to be manufactured by well-known pharmaceutical houses, there are increased demands for individual capsule coding. Accordingly, the amount of image space on an individual capsule must be increased and thus the most practical solution is to print on two sides of a capsule. Since coding requires absolute identification of numbers, in a multiple-image printing technique, of the type herein disclosed, if one legend should for some reason be unreadable, the other one should be good, so that rejects due to unclear or illegible coding would be substantially eliminated.

At printing speeds which process 10,000 or more capsules per minute, conventional gravure offset printing techniques are not effective because inking of the gravure rolls simply will not take place without an external assist to forcibly push ink into the gravure cells. High gravure roll speed produces a "-cavitation" effect by which ink doesn't have time to flow into the gravure cells preparatory to presentment to the offset roll. Further, attempts to employ conventional offset inking systems to perform at printing rates of 10,000 units per minute generate substantial amounts of "ink slinging," due to high centrifugal forces.

This invention overcomes the prior art disadvantages of slow orienting, feeding and printing by providing a hopper for carrying a supply of capsules, and set over a centrifugal feeding mechanism which orients and presents capsules one at a time to a pair of opposed offset rolls at a rate of 10,000 or more per minute. Each of these offset rolls is inked by a gravure roll that is pressure fed with fluid ink which is doctored off with a rotating doctor blade, thereby assuring positive inking of all gravure cells. As soon as image transfer from offset rolls to capsule surface has been effected, pneumatic means assure positive discharge of the capsule into a collector.

Accordingly, one of the several objects of this invention is to provide means for automatically loading a hopper with capsules on a demand basis from a bulk supply remotely located from the hopper.

Another object of this invention is to provide a feeder mechanism for capsules which is intimately connected to a hopper means, and which can orient and selectively feed therefrom capsules at rates in excess of 10,000 capsules per minute.

A further object of this invention is to provide a printing system which coacts with the aforementioned feeder device and which is capable of printing 20,000 or more legends per minute.

A yet further object of this invention is to provide means for positively clearing the printing apparatus of printed capsules into a collector means.

With these and other objects in mind, references is now had to the following description taken in conjunction with the accompanying drawings in which:

FIG. 1 illustrates a front elevation view of the apparatus of this invention;

FIG. 1*a* illustrates in general form a typical capsule with a printed legend on one side thereof, the other legend being placed on the opposed surface;

FIG. 2 illustrates a top plan view of the apparatus shown in FIG. 1;

FIG. 3 illustrates an elevation view of the inking system taken on line 3—3 of FIG. 2;

FIG. 4 illustrates a cross-sectional view taken on line 4—4 of FIG. 3;

FIG. 5 illustrates an enlarged top plan view taken on line 5—5 of FIG. 1;

FIG. 6 is an elevation view of the feeder mechanism at the point of printing, taken on line 6—6 of FIG. 5.

FIG. 7 is an enlarged detail view taken on line 7—7 of FIG. 5 showing the holdback plate structure which controls capsule feed on a one by one basis;

FIG. 8 illustrates a bottom view of the holdback plate;

FIG. 9 is an enlarged detail view taken on line 9—9 of FIG. 5 showing a capsule about to leave the feeder into the printer;

FIG. 10 is a cross-sectional view taken on line 10—10 of FIG. 5 showing the feeder disc, drive and printing rolls positioned adjacent the exit location of the feeder mechanism;

FIG. 11 illustrates an enlarged view taken on line 11—11 of FIG. 5 of how the printing rolls grasp a capsule from the feeder for printing and discharge;

FIG. 12 is a top plan view taken on line 12—12 of FIG. 11 showing the capsule position relative to the feeder disc as it moves in timed relation with respect to the printing rolls;

FIG. 13 is a top plan view taken on line 13—13 of FIG. 11 showing a gravure roll and its associated offset roll; and

FIG. 14 is an enlarged view of a portion of the gravure roll showing an engraved character legend thereon.

Referring now with greater particularity to the drawings, the disclosed apparatus is comprised principally of a feeder mechanism generally designated in FIGS. 1 and 10 by numeral 10; and the inking system generally illustrated in FIG. 3. In addition thereto, there is disclosed a novel transport means designated at 11 in FIG. 1, which is used to convey unprinted capsules in measured volume from bulk storage behind panel 9 to hopper 12 which sets atop feeder mechanism 10. For purposes of ease of description and clarity of understanding, the principal portions of this invention will be described separately.

FEED SYSTEM

Referring first to FIG. 10, there is shown in cross-sectional view the feeder mechanism 10 comprised generally of a feed disc 50 fixed to a flange 51, which is in turn connected to rotatable shaft 52 driven from conventional gear reducer 54. As seen in FIG. 5, feed disc 50 carries on its outer periphery a series of spaced-apart, upstanding separators 53*a* which pro-

ject beyond the periphery of the feed disc forming therebetween a corresponding number of slots or recesses **53***b*. Though the separators in the illustrated embodiment are shown as being generally curved, it is to be understood that other configurations of slanted, or straight shapes can also be used, depending on the size and shape of the object being fed through. Immediately beneath these slot portions which extend beyond the periphery of feed disc **50** is a stationary ring **55**, shown in plan view in FIG. **5** and in cross section in FIG. **10**, comprised of a flat support track portion **55***a*, and an upstanding wall portion **55***b* which extends upwardly adjacent the outer end portions of separators **53***a*. Referring to FIGS. **5** and **11**, it is to be noted that support track **55***a* and wall **55***b* are discontinuous from a point just prior to the printing station to a point approximately 45° following the printing station to permit capsules to be passed between offset rolls **60**, **61**.

Mounted over feed disc **50** is a hopper **12** comprised essentially of an open-ended cylinder of plastic or other suitable material which holds an adequate supply of capsules. **12** and ring **55** remain stationary, while feed disc **50** rotates counterclockwise at about 170 r.p.m. As the capsules are flung outward by centrifugal force, they are urged into the slots in an end-to-end aligned relation. The shape and size of the slots is determined by the size of capsule to be printed, and these slots are designed so that capsules cannot "jam" in the openings thereof. As feed disc **50** rotates, the capsules carried in each slot are thrust outwardly by centrifugal force, the outermost capsule in each slot being thrust against the upstanding wall portion **55***b* on ring **55** and supported underneath by supporting track **55***a*. This is most clearly seen in FIGS. **10** and **12**. As shown in these illustrations, the orbicular line of travel of the outermost capsules will carry each such capsule directly between offset rolls **60**, **61**.

After each capsule passes between the offset printing rolls, and since there is no support track portion beneath it at this point, the capsule simply falls into a collector. A high-pressure air jet **56** assists the capsule in its downward fall.

As the printed capsule leaves the printing station and its plane of rotative movement, the capsule immediately behind it in the same slot tends to move outwardly under the influence of centrifugal force, but is held in check for a period of substantially 45° of rotation of the feed disc by a holdback ridge **70**, seen in FIG. **8**, which is integrally connected to its supporting holdback frame **57**. This holdback frame is not essential to the operation of the disclosed apparatus, but may be considered as an optional accessory depending on the nature of the capsule or other item being processed. Its presence, therefore, in the illustrated embodiment is not to be regarded as necessary for operation of the apparatus. Referring however, more particularly to FIG. **8**, which illustrates a bottom view of holdback frame **57**, the ridge member **70** is clearly shown in its function of separating the outermost aligned capsule member from that one immediately behind it. This ridge member **70** seen in cross section in FIGS. **7** and **9** limits the outward movement of capsules so as to assure that only one capsule from each slot member is presented to the printing rolls. Once the capsule passes the terminal end of this holdback ridge, it is thrust out against wall portion **55***b* in the manner previously described. Thus, it can be seen that the stationary ring **55** not only supports the slot-carried capsule on its bottom, but also limits its axial travel preventing the capsule from leaving the feed disc except at the printing station and even then only one at a time.

Just before approaching the printing station, capsules carried in the slots are urged against the trailing edge of the feed slot by an upper and lower set of cooperating adjustable stabilizers or drag plate members **58***a*, **58***b*, respectively. Such stabilizers may also be considered as optional accessory items. These are seen in FIG. **6** and are adjustable as to the distance therebetween. They are adjusted so as to just contact or grip the capsule surface as it passes therebetween thus placing a drag on it and forcing it against the trailing edge of the feed slot. This relative positioning of every capsule where such positioning may be required assures that each capsule will pass between the printing rolls **60**, **61** in the same relative position so as to prevent a capsule from striking one roll before the other, which would result in an imperfect print registration.

INKING AND PRINTING SYSTEM

The inking system of this invention is designed so as to be able to print one or two images on each capsule at the rate of at least 10,000 capsules per minute.

Referring briefly to FIGS. **1** and **2** of the drawings, the inking and printing system is carried in a vertically oriented attitude on the inside of panel member **8** which is pivotally mounted along its vertical edge A—A so that it can be swung to an open position for adjustment and other purposes preparatory to operation. FIG. **3** illustrates in enlarged detail the interior of panel **8** and the associated inking and printing system as viewed on line 3—3 of FIG. **2**. The inking and printing system illustrated in the disclosed embodiment consists essentially of two separate and independent systems. Accordingly, for ease of description, one of these systems will be described in detail, it being understood that the other system operates in a similar manner.

Referring with particularity now to FIG. **3**, there is shown a resilient offset printing roll **60** which receives its inked image in the conventional manner from corresponding gravure roll **62**. Surrounding gravure roll **62** is a housing member **63** of plastic or other suitable material adapted to substantially fully enclose roll **62** and provide an opening **64** for permitting contact with offset roll **60**. Juxtaposed the periphery of roll **62** with approximately a 0.010-inch clearance therebetween is a spreading member or shoe **16**. Fluid ink is forcibly fed through inlet pipe **13** which passes through housing member **63** and shoe **16**. The discharge end **13***a* of inlet pipe **13** is juxtaposed gravure roll **62** and the inlet end **13***b* is connected to tube **14** which may be of plastic or other suitable material. The other end of tube **14** is connected to a pressurized supply of ink discharged from gear pump P.

In operation, the system above described would function as follows: Ink from supply reservoir **15** is drawn into gear pump P and discharged under pressure into tube **14**, thence into inlet pipe **13** against gravure roll **62**. The amount of ink discharged against roll **62** is just in excess of the quantity actually needed to assure proper inking and doctoring of the gravure cells. As roll **62** rotates in a counterclockwise direction, the inked-roll surface comes into contact with round doctor blade **17** which is continually rotatably driven by conventional motor means **18** through a flexible drive cable **19**. Conventionally, the prior art has disclosed doctor blades having a sharp edge in contact with the gravure roll to wipe away excesses of ink. Such contact, of course, produces wear. In the disclosed embodiment, with the gravure rolls rotating at speeds of 900 r.p.m., the wear rate of a conventional doctor blade would be significantly increased resulting in degradation of the sharp edge to a "flat." I have, accordingly, provided a round doctor blade of approximately 0.031 inch diameter which by constant rotation spreads this wear uniformly over the peripheral surface and does not develop any "flat." Doctor blade **17** is thus adapted to turn in a clockwise direction approximately one revolution every one-quarter hour wiping the gravure roll surface substantially clean with the ink excessive flowing to the sides of the roll to be redirected by wiper blades **20**, one on each side, to return the ink to the bottom of housing **63** where drain tube **22** carries it back to supply pan **15**. All rotating members and rolls are conventionally driven in timed relation by a suitable power source (not shown).

As seen in FIG. **4**, which is an enlarged side elevation view taken on line 4—4 of FIG. **3**, doctor blade **17** is held within a recessed groove **21** of support block **23**. Block **23** is pivotally carried by pivot pin **24**. This arrangement of parts thus provides a rocking freedom to doctor blade **17** to compensate for gravure roll eccentricity or wobble. The aforementioned blade assembly is carried by housing block **25** pivotally supported on

pin 26. An air cylinder piston 27 set at a predetermined pressure acts on the rear surface of block 25 thus automatically compensating for any blade wear. Doctor blade 17 can easily be replaced without any disassembly of the ink reservoir system simply by withdrawing the old blade and inserting a new one, seating it within groove 21 of block 23.

It should be noted, by referring to FIGS. 10 and 13, that each offset roll surface is divided into two separate coplanar surfaces, e.g., 60*a*, 60*b* and 61*a*, 61*b*, respectively. This separation of surfaces permits the resilient offset rolls to deform independently so as to accommodate the different diameter surfaces which comprise each half of a typical capsule, as seen in FIG. 1*a*.

TUBE FEED SYSTEM

A supply of unprinted capsules is carried within a barrel 30 in the base of compartment 31. A tube 32 of plastic or other suitable material is mounted through the top portion thereof with its opening spaced just above the bottom of the barrel. As seen in FIG. 1, this tube communicates with hopper 12. A flow of pressurized air (from any conventional source) is forced into the tube in the direction of the arrows generating a suction at the bottom opening so as to carry capsules into the tube. A deflector screen 33 is angularly mounted at the exhaust end of tube 32 whereby the air continues to flow through the screen, but the capsules are deflected downward. By keeping this flow of air directed out of the hopper, the capsules which have a very low mass, are prevented from being blown about.

Though this disclosure has generally been directed to pharmaceutical capsules, it will be obvious to those skilled in the art that the feeder mechanism herein described has application in environments other than that described. For example, in place of the printing rolls, the feed mechanism of this disclosure would be useful in combination with a counting device, and thus provide an apparatus for counting small items with speed and accuracy previously unavailable.

It will be understood that various changes in the details, materials, setups and arrangements of parts which have been herein illustrated in order to explain the nature of the invention may be made by those skilled in the art within the principle and scope of the appended claims.

We claim:

1. Apparatus for orienting, feeding and printing pharmaceutical capsules comprising the combination of:
   a. a pair of printing members rotatably mounted in opposed spaced-apart coplanar relation;
   b. means selectively inking each printing member;
   c. rotatable disc means for orienting capsules in radial paths thereon in end-to-end relation and ejecting them from the periphery thereof;
   d. the periphery of said disc means rotatably disposed intermediate said pair of opposed printing members; and
   e. means juxtaposed the periphery of said disc means for regulating the release of capsules from the peripheral edge of said disc means to said printing members.

2. The structure of claim 1 wherein said rotatable disc means comprises:
   a. a disc member;
   b. means on said disc member providing a series of substantially radial slots which extend beyond the periphery thereof; and
   c. means connected to said disc member for driving it in a substantially horizontal plane of rotation.

3. The structure of claim 2 wherein there is provided:
   lateral support means in contiguous spaced relation beneath said radial slots, said support means being discontinuous between points on either side of said printing members.

4. The structure of claim 1 wherein said means juxtaposed the periphery of said disc means for regulating the release of capsules therefrom comprises:
   a. means providing an upstanding wall portion surrounding substantially the entire periphery of said rotatable disc means;
   b. said upstanding wall portion being discontinuous between points on either side of said printing members; and
   c. a hold back plate means cooperatively connected to the aforesaid means providing an upstanding wall portion.

5. The structure of claim 4 wherein
   a. said hold back plate means has a ridge member extending generally in arcuate extent from its bottom surface.

6. The structure of claim 1 further comprising;
   a. hopper means cooperatively mounted on top of said rotatable disc means;
   b. container means remotely located from said hopper means for carrying a bulk supply of capsules;
   c. a tube conveyor connecting said container means and said hopper means;
   d. means for maintaining a controlled flow of air within said tube conveyor with sufficient turbulence to carry capsules from said container to said hopper; and
   e. means at the discharge end of said tube conveyor for deflecting capsules into the hopper without deflecting the flow of said turbulent air.

7. Apparatus for orienting feeding and printing pharmaceutical capsules, comprising the combination of;
   a. a pair of offset printing wheels rotatably mounted in opposed, spaced-apart coplanar relation;
   b. an ink reservoir selectively inking each offset printing wheel;
   c. a rotatable feed disc with radial paths in one of its plane surfaces for orienting capsules in radial paths thereon in end-to-end relation and ejecting them from the periphery thereof;
   d. the periphery of said feed disc rotatably disposed intermediate the pair of opposed offset printing wheels; and
   e. an upstanding wall with a discontinuity therein positioned adjacent the periphery of said feed disc for regulating the release of capsules from the peripheral edge of said disc through the wall discontinuity to said printing members.

8. The structure of claim 7 wherein said rotatable feed disc includes;
   a. a series of substantially radial slots which extend beyond the periphery thereof; and
   b. a powered shaft connected to said disc member for rotatably driving it in a substantially horizontal plane of rotation.

9. The structure of claim 8 wherein there is provided;
   a lateral support plate in spaced relation beneath said radial slots, said support plate being discontinuous between points on either side of said printing members.

10. The structure of claim 7 wherein each offset wheel is comprised of at least two independently resilient surfaces in lateral side-by-side relation.

11. The structure of claim 7 further comprising;
   a. a hopper cooperatively coacting with said rotatable feed disc;
   b. a container remotely located from said hopper for carrying a bulk supply of capsules;
   c. a tube conveyor connecting said container and said hopper;
   d. a supply of pressurized air connected to said tube conveyor to generate sufficient turbulence to carry capsules from said container to said hopper; and
   e. an angularly oriented screen located at the discharge end of said tube conveyor for deflecting capsules into the hopper without deflecting the flow of said turbulent air.