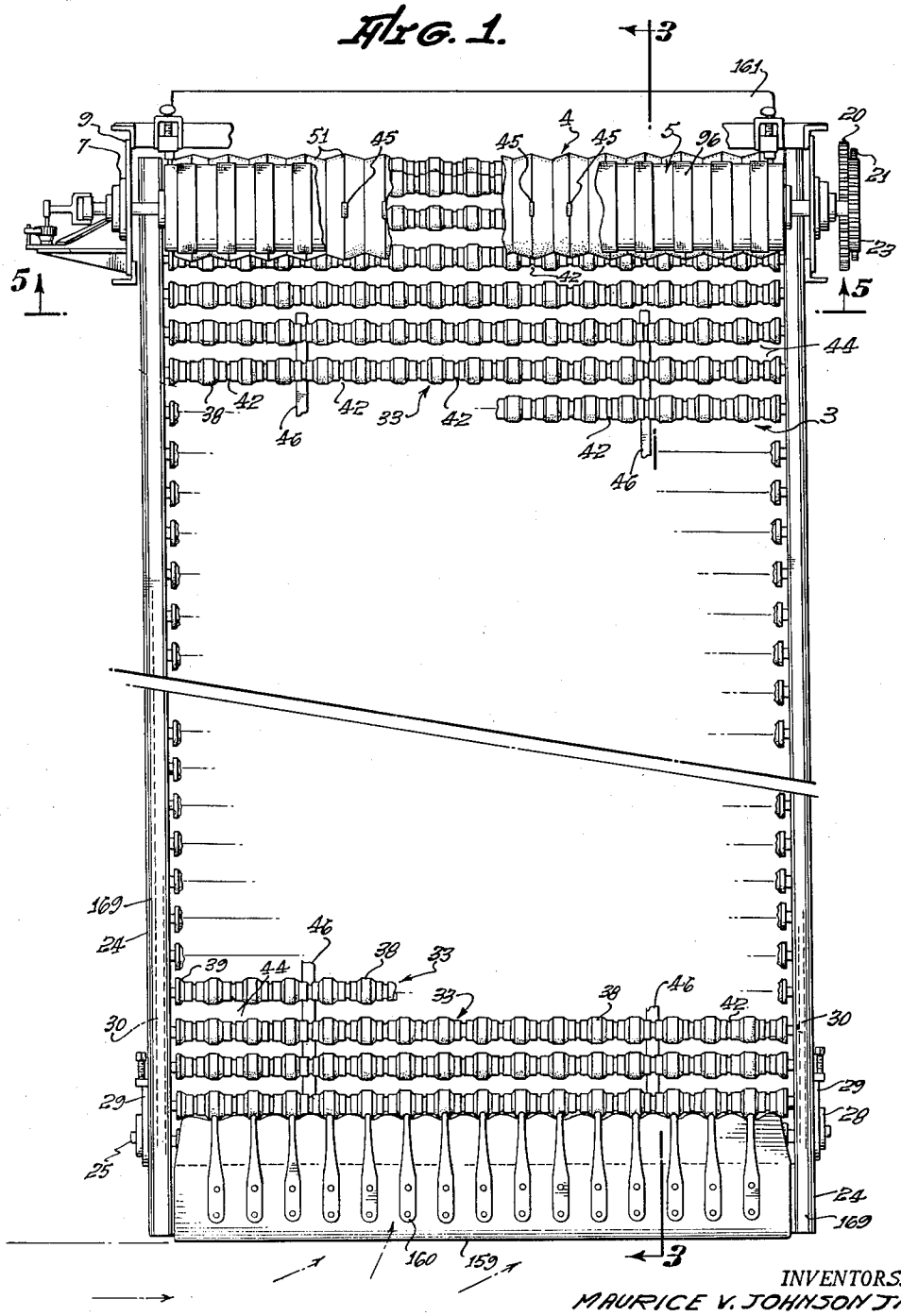
Nov. 13, 1962 M. V. JOHNSON, JR., ETAL 3,063,365

PRINTING MACHINE

Original Filed Feb. 2, 1956 4 Sheets-Sheet 1

FIG. 1.



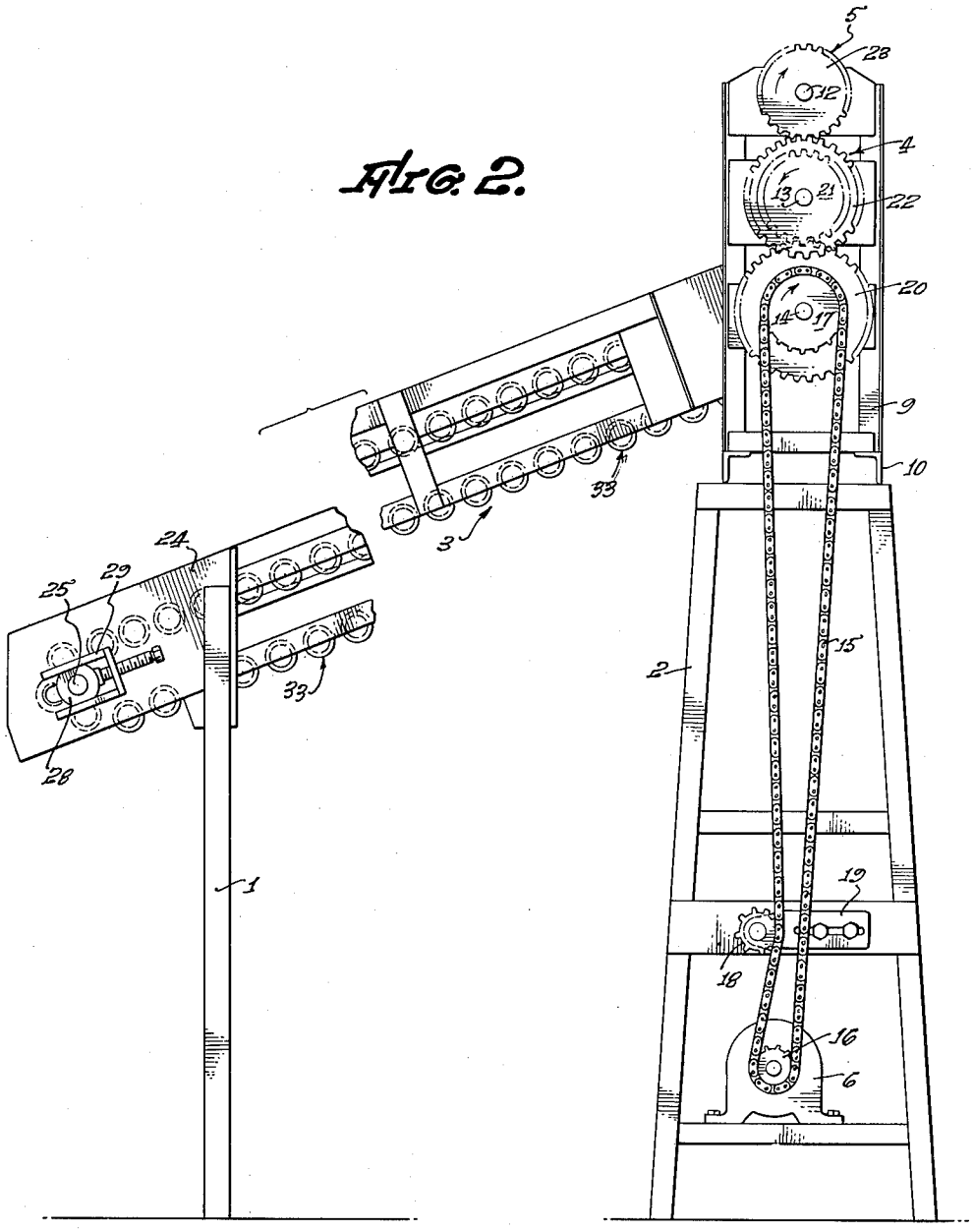
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Original Filed Feb. 2, 1956 4 Sheets-Sheet 2

FIG. 2.



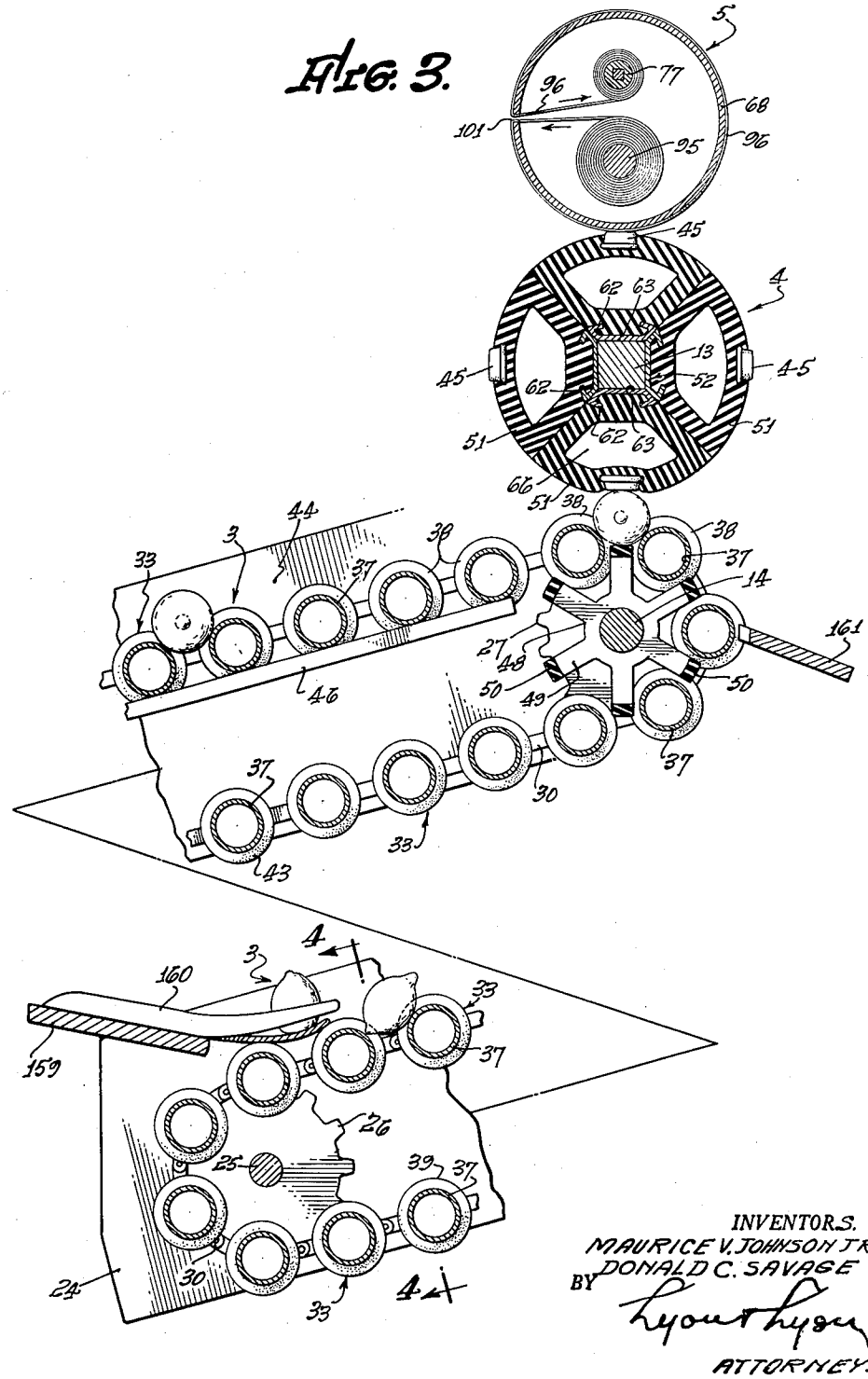
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Fig. 3.



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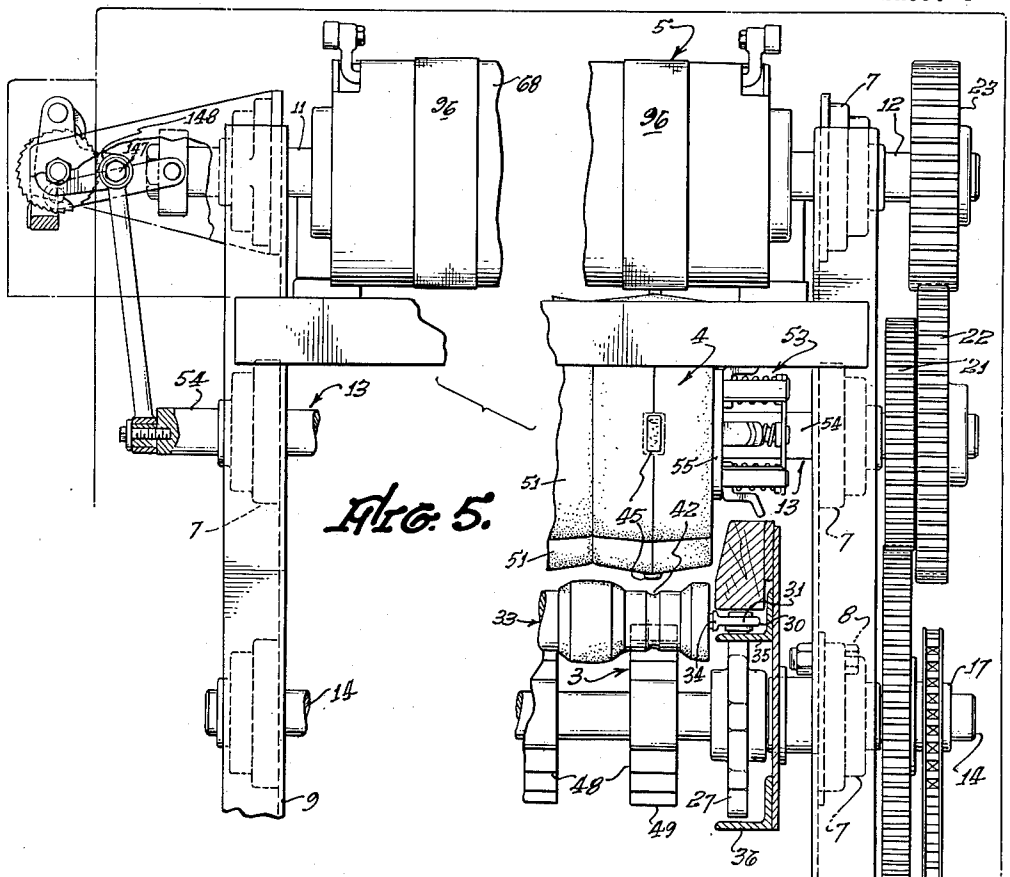


FIG. 5.

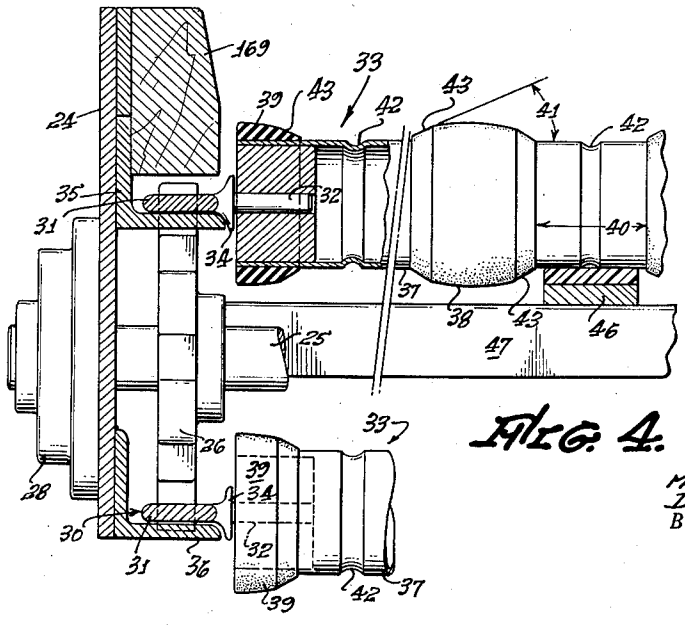


FIG. 4.

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United States Patent Office 3,063,365 Patented Nov. 13, 1962

3,063,365

PRINTING MACHINE

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Original application Feb. 2, 1956, Ser. No. 563,045, now Patent No. 2,987,991, dated June 13, 1961. Divided and this application Sept. 15, 1958, Ser. No. 761,079

11 Claims. (Cl. 101—37)

This invention relates to printing machines and more particularly to a machine especially capable of printing citrus fruit, eggs, apples, cantaloupes, nuts, potatoes, avocados, tomatoes and other substantially cross sectionally circular objects.

This is a divisional application of our copending application Serial No. 563,045, filed February 2, 1956, entitled "Printing Machine," now U.S. Patent No. 2,987,991.

Our invention will be disclosed with specific reference to the printing of trade-marks or other indicia upon lemons, since that fruit, due to its ellipsoidal shape, variance in diameter from fruit to fruit and irregular and easily bruised surface, is difficult to effectively print. It will be apparent, however, that our machine is eminently adapted to print other fruits, nuts, vegetables or articles of manufacture which have a substantially circular cross section.

While many fruit and vegetable stampers or markers have been proposed, the printing of lemons with trademarks has not yet been accomplished commercially and there is not yet known a machine which will satisfactorily serve this function. The obovate to ellipsoidal form of the lemon renders it necessary to orient the fruit so that in passing through the printing assembly the smoothest, most gently rounded surface of the fruit is presented to the printing die. If the fruit is contacted by the die at either its stem or blossom end, it is evident that a true impression of the indicia will not be obtained. In addition to the problems resulting from the shape of the lemon, further problems are created by their large variation in size. The diameter of an average lemon is about 2⅛ inches but this varies from as little or less than 1½ inches to as much as 3⅛ inches or more, consequently a printing machine will not successfully print lemons which have not been previously classified as to size unless it is capable of properly functioning over at least this size range. The problem is further compounded by the fact that lemons grown in the Pacific coastal areas and in other areas having cooler climates, which account for a large percentage of the lemon production of the United States, lack resiliency and have an irregular relatively stiff inflexible peel easily subject to damage by bruising. These characteristics make it impossible to rely upon compression of the fruit itself to compensate for variation in size from fruit to fruit, which would be required if the support to die distance were fixed and unyielding. Irrespective of the size of fruit passing through the printing assembly, it is essential that there be a firm but not severe contact between every part of the die and the lemon at the time of printing. If the contact is not firm enough the indicia will not be clearly printed upon the lemon, while if it is too firm, the die may rupture the peel and possibly inoculate it with mold spores or bacteria or in any event render the fruit subject to future inoculation.

A further difficulty involves the requirement that there be substantially no relative velocity between the die and the lemon surface being printed. If there is such relative velocity, i.e., if the lemon surface is moving past the die at a velocity less than or greater than that of the die,

the die will not impress its designation clearly but will produce a smeared unreadable mark.

It will be evident that any printing machine suitable for utilization in the printing of random sizes of lemons must be capable of orienting and aligning the fruit; it must be capable of printing constantly changing sizes of lemons; it must provide a firm but not severe contact between the die and the fruit; and it must function in such manner that there is substantially no relative velocity between the die and the fruit. Of course, it must, in addition, be capable of handling large volumes of fruit at a minimum cost.

It is therefore one of the objects of our invention to provide a printing machine fulfilling all of the requirements set forth in the preceding paragraph.

Other objects of our invention will become apparent from a consideration of the drawings in which:

FIGURE 1 is a plan view of our printing machine with parts broken away for clarity;

FIGURE 2 is an elevation showing the right hand side of our machine;

FIGURE 3 is a sectional view taken on line 3—3 of FIGURE 1;

FIGURE 4 is a view, partly in section, taken on line 4—4 of FIGURE 3; and

FIGURE 5 is a view taken on line 5—5 of FIGURE 1 with parts shown in section.

With more specific reference to the drawings, our machine, which is mounted upon suitable supporting frames 1 and 2, is composed of an orienting conveyor 3, a rotary printing drum 4 and an inking ribbon tube 5 all driven by a motor 6 or other suitable driving means.

As shown in FIGURE 5, the ribbon tube, printing drum and conveyor drive shafts are rotatably mounted in bearings 7 secured by bolts 8 to side frames 9 which are in turn secured to supporting cross members 10 attached to supporting frame 2. The ribbon tube is fixed to stub shafts 11 and 12 while the printing drum 4 is mounted on shaft 13. Conveyor drive shaft 14 is provided for supporting conveyor sprockets and platens hereinafter described. Shafts 13 and 14 are parallel to each other and to ribbon tube shafts 11 and 12. The conveyor drive shaft is driven (FIGURE 2) by chain 15 which is trained over sprocket 16 on the motor shaft and sprocket 17 on conveyor shaft 14. If desired, a suitable chain tension adusting mechanism, such as sprocket 18 rotatably mounted on adjustable bracket 19, may be provided. Gear 20 secured to shaft 14 meshes with gear 21 keyed to shaft 13. Another gear 22 attached to the shaft 13 exteriorly of gear 21 engages and drives gear 23 secured to shaft 12. Through this drive arrangement the conveyor drive shaft, printing drum and ribbon tube are rotated in the directions indicated by the arrows in FIGURE 2.

The orienting conveyor is supported at its delivery end upon drive shaft 14. The receiving end of the conveyor is supported on shaft 25 mounted in bearings 28 in side plates 24 fixed to support frame 1. A pair of sprockets 26 are mounted at opposite ends of the shaft 25 in alignment with a pair of sprockets 27 secured to drive shaft 14. Bearings 28 (FIGURE 2) are longitudinally adjustable by a conventional take-up device 29 secured to the side plates of the conveyor unit. Conveyor chains 30 are trained over the corresponding sprockets on shafts 14 and 25. Alternate individual links 31 of the chain are provided with journals 32 upon which rollers 33 are rotatably mounted. Each of the links 31 is provided with an annular shoulder 34 which retains the rollers 33 in lateral position and guides the chains 30 by cooperating with top and bottom angle guide members 35 and 36 suitably secured to the side plates 24.

The conveyor 3 is capable of angular adjustment as a unit about the axis of shaft 14 as viewed in FIGURES 2 and 3. The relative heights of supporting frames 1 and 2 determine the angular slope of the conveyor. As shown in the drawings the fruit is conveyed upwardly by the rotating adjacent rollers and to obtain optimum orientation and alignment it is preferred that the angle of the conveyor to the horizontal be not greater than the angle of repose on the conveyor of the objects to be printed. As a practical matter this angle of repose is approximately 25° for a lemon printing conveyor assembly. Our machine will effectively print a plurality of cross sectionally circular objects whether the conveyor is horizontal or sloped upwardly or downwardly. However, to obtain maximum printing capacity as well as to avoid possible overload at peak periods or alternatively the necessity for an ancillary controlled feed mechanism, it is preferred that the angle of the conveyor to the horizontal be between 5° and 20° upwardly. Such an angle assures the complete singularization of the fruit prior to its contact with the individual dies.

Referring again to FIGURE 4 the individual rotating rollers 33 of the conveyor unit 3 consist of cylinders 37 of suitable material, such as aluminum, upon which intermediate annular sleeves 38 and a pair of end sleeves 39 are secured. The sleeves are of trapezoidal longitudinal half section and are preferably made of rubber to avoid injury to the lemons. The edges of these sleeves are positioned a distance 40 of from 1½ to 2 inches apart. The angle 41 at which the sleeve 38 projects upwardly from cylinder 37 should be from 25° to 35°. Arcuate annular grooves 42 are formed in each of the cylinders 37 at points midway between the sleeves. The width of the intermediate sleeves 38 is not critical except that this dimension should be not less than that necessary to permit independent retention of lemons within the individual pockets 44 shown in FIGURE 1 formed by any two adjacent rotating rollers 33 without resulting in the contacting or abutment of properly aligned fruit in transversely adjacent pockets.

We have found that while a conveyor directed at an angle to the horizontal and having perfectly cylindrical adjacent rotating rollers will tend to orient small ellipsoidally shaped objects to that their longitudinal axes are parallel to the axes of the rollers, such rollers will not satisfactorily orient larger fruits of this general shape. On the other hand, a conveyor directed at an angle to the horizontal and having adjacent concavely shaped rolls will orient large fruit but will not satisfactorily orient the smaller sizes. We have discovered that the angled shoulders 43 form a roller structure with the cylinders 37 which functions similarly to concave rollers in orienting large fruit. Longitudinally adjacent rollers consequently form pockets 44 in which individual fruits are supported and oriented. In addition, the dimension 40 is sufficient to provide between adjacent sleeves substantially cylindrical longitudinally adjacent rollers for the proper orientation of small sized lemons.

It will be noted from a consideration of FIGURES 1 and 5 that the grooves 42 are in alignment with printing dies 45. These grooves are of arcuate form but not of sufficient width or depth to receive or contact the major surface of the lemons. This groove is, however, of utmost importance since smaller sized lemons will center themselves over the groove in proper transverse alignment for stamping as the rollers rotate and progress along the conveyor. While transverse alignment of large sized lemons is assisted by the presence of the groove 42, such alignment is mainly the result of the magnitude of the angle 41 as well as the distance 40 between adjacent sleeves. The individual rollers 33 are spaced sufficiently close to one another to provide for retention of the smallest size lemons which it is desired to print. Referring further to FIGURE 4, longitudinal roller actuating members 46 retained upon suitable transverse brackets 47 extend beneath and contact cylindrical portions of rollers 33, thus rotating the rolls about journals 32 as the top flight of the conveyor is driven toward the printing end of our machine. Actuating members 46 terminate at a point spaced from the platens so that the rolls are not rotated by these members immediately prior to or during printing. The conveyor structure of our machine thus makes it possible to orient, align and singularize ellipsoidally shaped objects to be printed to a degree not heretofore obtainable by devices of the prior art irrespective of whether our conveyor is positioned horizontally or at an angle upwardly or downwardly from the horizontal.

Securely mounted upon conveyor drive shaft 14 are a plurality of rotary platens or star wheels 48 (FIGURE 3) having spokes or web-like members 49 which extend between adjacent rollers and assist in supporting the fruit during the printing thereof. In order to properly perform their supporting function, the spokes are so arranged and of such length as to extend into pockets 44 between the rollers to the circle of revolution defined by the rotation of the axis of each of the rollers about the shaft 14. The width of the spokes is less than the distance between adjacent cylinders 37 but greater than the distance between the sleeves 38. In addition, the spokes are no greater in thickness than the dimension 40. If desired, each spoke may be tipped with rubber 50 or other flexible, resilient material in order to provide a somewhat yielding supporting surface that will not injure the fruit. The utilization of spoked platens permits adjacent rollers to be spaced no closer together than is necessary to retain the smallest size lemon which it is desired to print. As adjacent rollers progress in their path of revolution about the shaft 14, the lowest position of the largest fruit branded will ordinarily not extend below the circle of revolution defined by the axis of the rollers. In the absence of our platen the smallest size fruit to be printed would extend well below this circle, thus necessitating positioning of the stamping drum closer to the conveyor and resulting in excessive deflection of the die holders when large fruit was in the process of being printed. Our platen thus makes it possible to print lemons with the minimum degree of deflection required of the die holders. In addition, the platen assists greatly in assuring the lemons of a certain, firm but resilient support during printing, and prevents the wedging of smaller fruit between adjacent rollers during printing.

As best seen in FIGURES 3 and 5, the printing drum assembly 4 is composed of shaft 13 and segmental die holders 51 secured on the shaft by retaining bars 52, which are detachably secured to shaft 13 by spring lock assembly 53. The shaft 13 is square in cross section throughout its length except for journal portions 54 at each end, which are journaled in the bearings 7. The retaining bars 52 are long strips and, as shown in FIGURE 3, are flanged along their longitudinal edges at an angle from the flat portion of said retaining bars. These edges are in addition bent toward one another to provide inwardly extending flanges 62. The base portion 63 of the retaining bars 52 is flat and abuts against a flat surface portion of the shaft 13.

Referring to FIGURE 3 the segmental die holders 51 are constructed of rubber, sponge rubber or other flexible resilient material and are provided with slots into which the flanges 62 fit to removably secure the holders to the retaining bars. The printing dies 45 are wedged or keyed into openings provided in the circumferential portion of the die holder segments. The segments may be provided with cavities 66 of any desired size or shape to provide the requisite flexibility of the segments depending on the nature of the material used in their fabrication.

As illustrated in FIGURE 3 inking ribbon 96 is withdrawn from the feed spool 95, inserted through ribbon feed slot 101, wound about the ribbon tube in a counter clockwise direction, inserted back through slot 101 and attached to take-up spool 77.

As the take-up spools **77** rotate, they wind the spent inking ribbon upon them and cause the ribbon to be unwound from the spools **95** drawing it over the outer surface of the ribbon tube. The rotation of the take-up spools **77** results in the continuing renewal of inking ribbon **96** thus providing a constant ink supply for the printing dies **45**.

As shown in FIGURES 1 and 3, we provide a delivery board **159** for our conveyor. This is secured to the side plates **24** and is provided with a plurality of fingers or guides **160** mounted at positions corresponding with the locations of the sleeves **38** of each individual roller. While these guides assist in assuring that individual aligned pockets such as those indicated by the reference numeral **44** receive only a single fruit, they are not essential to the proper functioning of our conveyor unit. A suitable board **161** is provided to receive printed fruit delivered from the machine. Side rails **169** preferably of wood are secured to side plates **24**.

In operation our printing machine is installed so that a conveyor belt, not shown, will feed lemons to the delivery board and so that dropboard **161** secured adjacent the delivery end of the conveyor directs the printed fruit to a receiving conveyor, a sizer or to other lemon treating apparatus. Upon operation of the motor **6**, drive chain **15** rotates the sprocket **17** on the shaft **14**, thus rotating sprockets **27** which drive the pair of chains **30** and move the upper run of conveyor rollers toward the printing drum. As these rollers progress they are contacted by a roll actuating member **46**, which causes each roller to rotate in a clockwise direction as viewed in FIGURE 3. This rotation permits the retention of but a single fruit within the individual pockets **44** defined by adjacent rollers **33**. As previously noted, the rotation and the particular shape of these rollers are responsible for the orientation of the longitudinal axis of each fruit to a position parallel to the axis of the rollers. In addition, the annular channel **42** and the angled shoulders **43** result in the transverse alignment of individual lemons with the dies **45**, thus presenting the most gently rounded surface of the lemon to the die for printing. The die holder drum **4** is rotated in a counterclockwise direction in the illustrations of FIGURES 2 and 3 by gear **21** which is driven by gear **20** secured to the shaft **14**. Each individual die **45** contacts the inking ribbon at a point diametrically opposed from the point of printing. The inking ribbon tube is rotated in a clockwise direction, as seen in FIGURES 2 and 3, by gear **23** driven by gear **22** secured to the die holder shaft **13**.

In considering the actual fruit stamping operation, it is most important to consider the relationship of the various drive gears **20**, **21**, **22** and **23** to each other, to the diameters of the die holder drum and the inking tube, and the vertical distance between the axis of the shaft **14** and the die **45**. In order to properly stamp fruit of varying size the stamping drum is positioned from the circle of revolution of the axis of the rollers about the shaft **14**, a distance equivalent to the diameter of the smallest size lemon which it is desired to print. The result is that in the printing of the smaller size lemon, the die, though firmly contacting the lemon, is not deflected inwardly toward the shaft **13** against the flexible resistance of the individual die holders **51**. To obtain freedom from relative motion of the die with respect to the fruit, we have found that the elevator head gear **20** shown in FIGURE 5 must have a radius equal to the radius of revolution of the axis of the rollers plus the diameter of the average size fruit which it is desired to stamp. This gear engages gear **21** whose radius is equivalent to the radius of the stamping drum less the distance which an average sized fruit deflects the die holder inwardly. Thus during the actual printing of an average sized lemon the die is deflected to a position on a circle of rotation whose radius coincides with the radius of the gear wheel **21**. Since the periphery

of the gear **20** has the same velocity as the outermost point of the average sized fruit and since the peripheral velocity of gear wheels **20** and **21** are identical, the die **45**, during its contact with the fruit, will have the same velocity as the fruit. It will be apparent that for a fruit smaller than the average size, the die will have a velocity slightly greater than that of the fruit, and that for fruit of a size larger than the average, the die will have a velocity slightly less than that of the fruit. This minute variation in the velocity of the fruit and the stamping drum permits diametrical adjustment of the stamping die is, however, compensated for by the freedom of the individual fruit to roll upon the platen and upon the rollers.

It will thus be evident that the particular construction of our stamping individual die holders to firmly contact and print varying sizes of fruit. It will be equally evident that by virtue of the relationship of the radii of the gears **20** and **21** and the spacing between the peripheral surface of the stamping drum and the circle of rotation of the individual rollers about the shaft **14**, we have been able to obtain substantially no relative velocity between the printing dies and the fruit to be branded.

While we have exemplied the novel inventive aspects of our printing machine with reference to the problem of printing lemons, it will be apparent that our machine is equally adapted for the impression of brands upon other cross sectionally circular articles and specifically oranges, grapefruit, apples, potatoes, tomatoes, nuts, avocados and other fruits and vegetables.

We claim:

1. A machine for printing indicia upon ellipsoidally shaped objects of varying size which comprises a conveyor having a plurality of equally spaced transverse rollers, each of said rollers having a plurality of equally spaced circumferential arcuate grooves therein and having a plurality of sleeves spaced intermediately of said grooves; indicia printing means in adjacency with the discharge end of said conveyor and spaced from said rollers a distance equal to the diameter of the smallest of said ellipsoidally shaped objects; means cooperating with adjacent individual rollers of said conveyor for supporting said objects when said objects are in contact with the dies of said printing means, and means for actuating said conveyor and said printing means.

2. In a lemon printer, a rotary printing drum, a conveyor having spaced rotatatble rollers provided with grooves and sleeves to orient, align and feed lemons into contact with said drum for printing, and a platen mounted below the conveyor means and movable between said rollers at the point where the lemons are contacted by the printing roller to assist in supporting said lemons during printing.

3. In a lemon printing machine, a rotary printing drum, a conveyor having means therein for aligning, orienting and feeding fruit into contact with said drum for printing, and a platen mounted below said conveyor and movable to a position to support the fruit during printing.

4. In a lemon printer, a conveyor, a resilient, flexible rotary printing drum mounted a fixed distance from said conveyor, said conveyor having spaced rotatable rollers provided with grooves and sleeves for orienting, aligning and feeding lemons into contact with said drum for printing, and a platen located below said conveyor and movable to a position projecting intermediate said spaced rollers to cooperate therewith in supporting the lemons during printing.

5. In a lemon printer, a rotary printing drum, a conveyor having spaced rotatable rollers provided with grooves and sleeves to orient, align and feed lemons into contact with said drum for printing, a platen mounted below the conveyor, means moving said platen between said rollers at the point where the lemons are contacted by the printing roller to assist in supporting said lemons

during printing, and a resilient tip on said platen contacting the lemons.

6. In a lemon printing machine, a rotary printing drum, a conveyor having means therein for aligning, orienting and feeding fruit into contact with said drum for printing, a platen mounted below said conveyor and movable to a position to support the fruit during printing, and a resilient tip on said platen contacting the lemons.

7. In a lemon printer, a conveyor, a resilient, flexible rotary printing drum mounted a fixed distance from said conveyor, said conveyor having spaced rotatable rollers provided with grooves and sleeves for orienting, aligning and feeding lemons into contact with said drum for printing, a platen located below said conveyor and movable to a position projecting intermediate said spaced rollers to cooperate therewith in supporting the lemons during printing, and a resilient tip on said platen contacting the lemons.

8. In a lemon printer, a resilient, flexible rotary printing drum mounted a fixed distance from a conveyor, said conveyor having spaced rotating rollers for feeding lemons into contact with said drum for printing, a platen located below said conveyor and movable to a position projecting intermediate said spaced rollers to cooperate therewith in supporting the lemons during printing.

9. In a produce printer, a resilient flexible rotary printing drum mounted a fixed distance from a conveyor, said conveyor having spaced rotating rollers for feeding produce into contact with said drum for printing, a platen located below said conveyor and movable to a position

projecting intermediate said spaced rollers to cooperate therewith in supporting the produce during printing.

10. In a marking apparatus for produce, a frame, a marking station disposed within said frame, die carrying members rotatably carried by said frame at said marking station, an inking drum rotatably carried by the frame and adapted to be engaged by the dies, and conveying means mounted on said frame and adapted to carry produce through the marking station, said conveying means comprising a plurality of spaced rotatable parallel members, and means associated with the conveying means opposite to the die carrying members and having article supporting members extending through said rotatable members and engaging the produce to provide support for the produce while engaged by the marking dies.

11. Apparatus as in claim 10 wherein said last named means are star wheels having web-like article supporting members.

References Cited in the file of this patent

UNITED STATES PATENTS

1,193,297	Porcher	Aug. 1, 1916
1,334,822	Varble	Mar. 23, 1920
2,424,006	Verrinder	July 15, 1947
2,661,840	Ballard et al.	Dec. 8, 1953

FOREIGN PATENTS

603,097	Germany	Sept. 22, 1934