Nov. 9, 1971 A. F. KALMAR ET AL 3,618,512

APPARATUS FOR MARKING POTATOES OR THE LIKE

Filed June 13, 1967 4 Sheets-Sheet 1

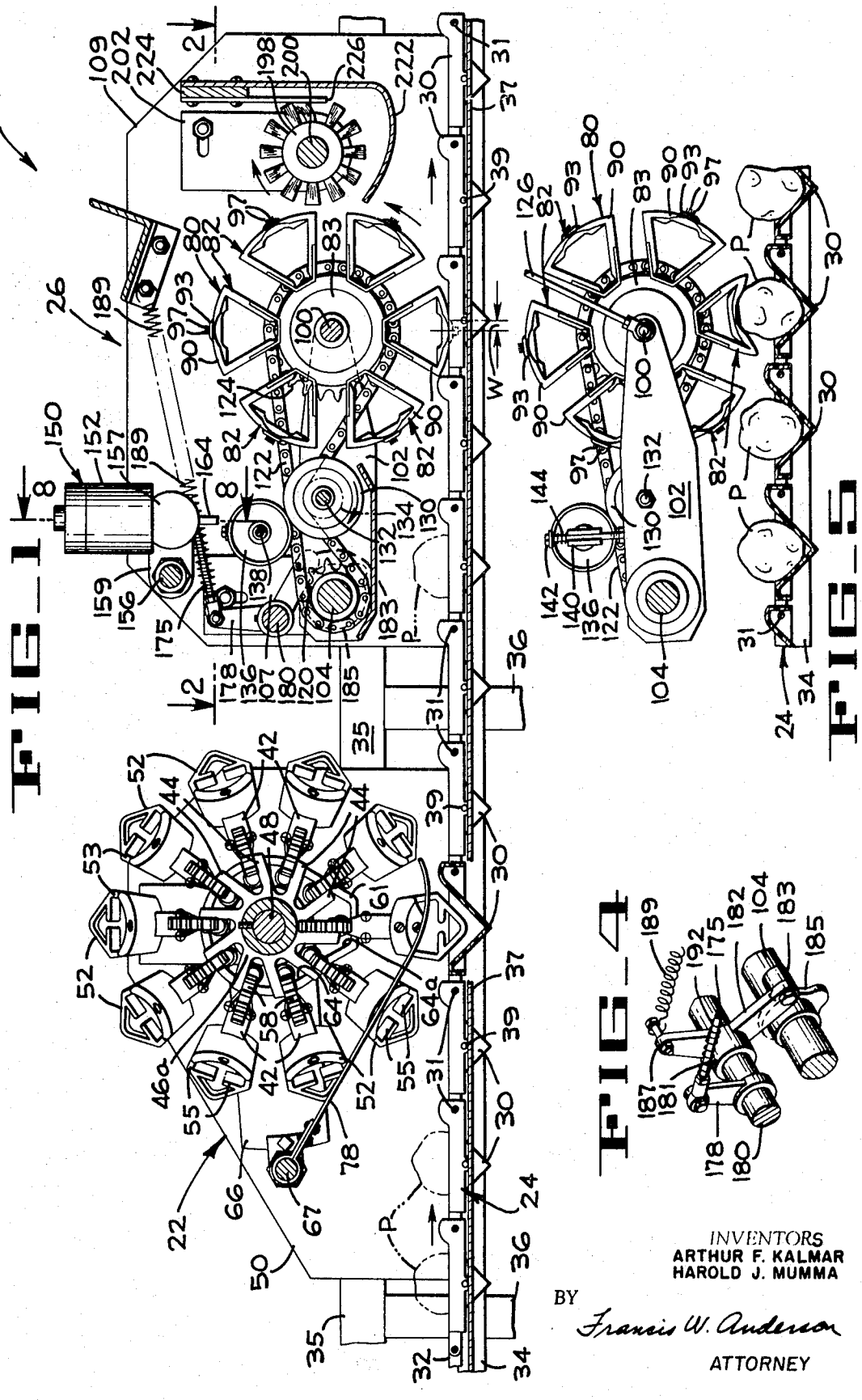


FIG_1

FIG_5

FIG_4

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Filed June 13, 1967 4 Sheets-Sheet 2

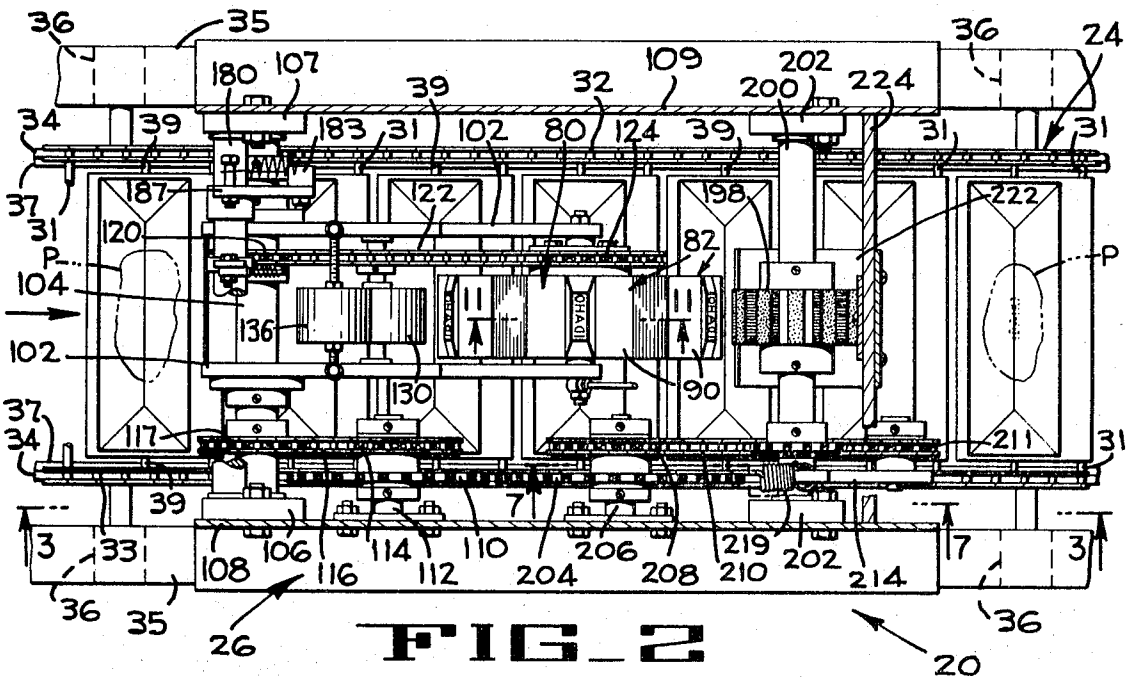


FIG_2

FIG_8

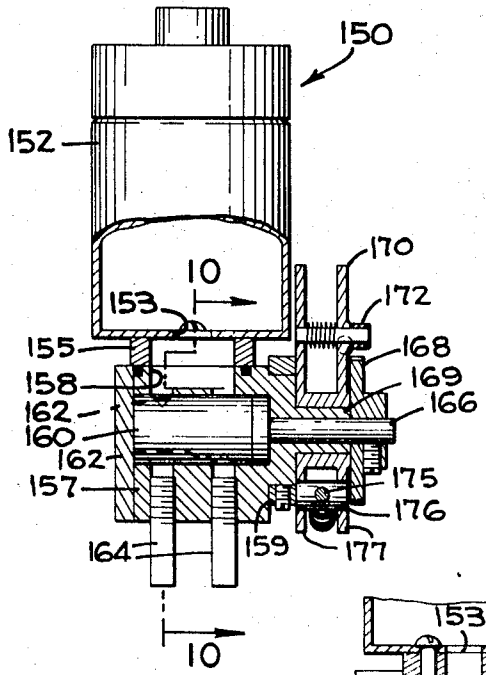
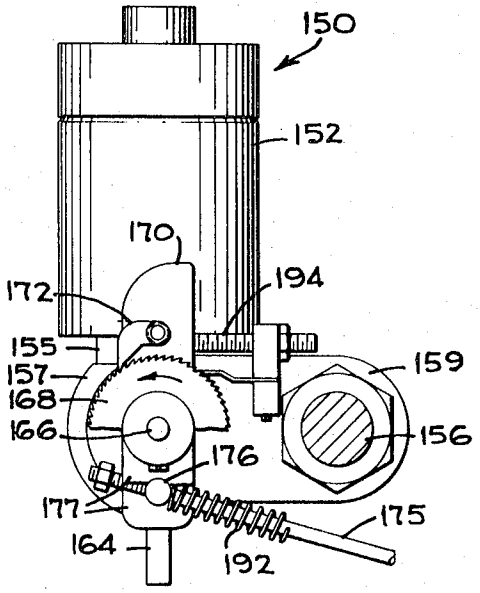


FIG_9



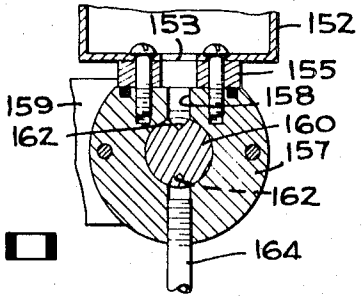


FIG_10

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APPARATUS FOR MARKING POTATOES OR THE LIKE

Filed June 13, 1967 4 Sheets-Sheet 3

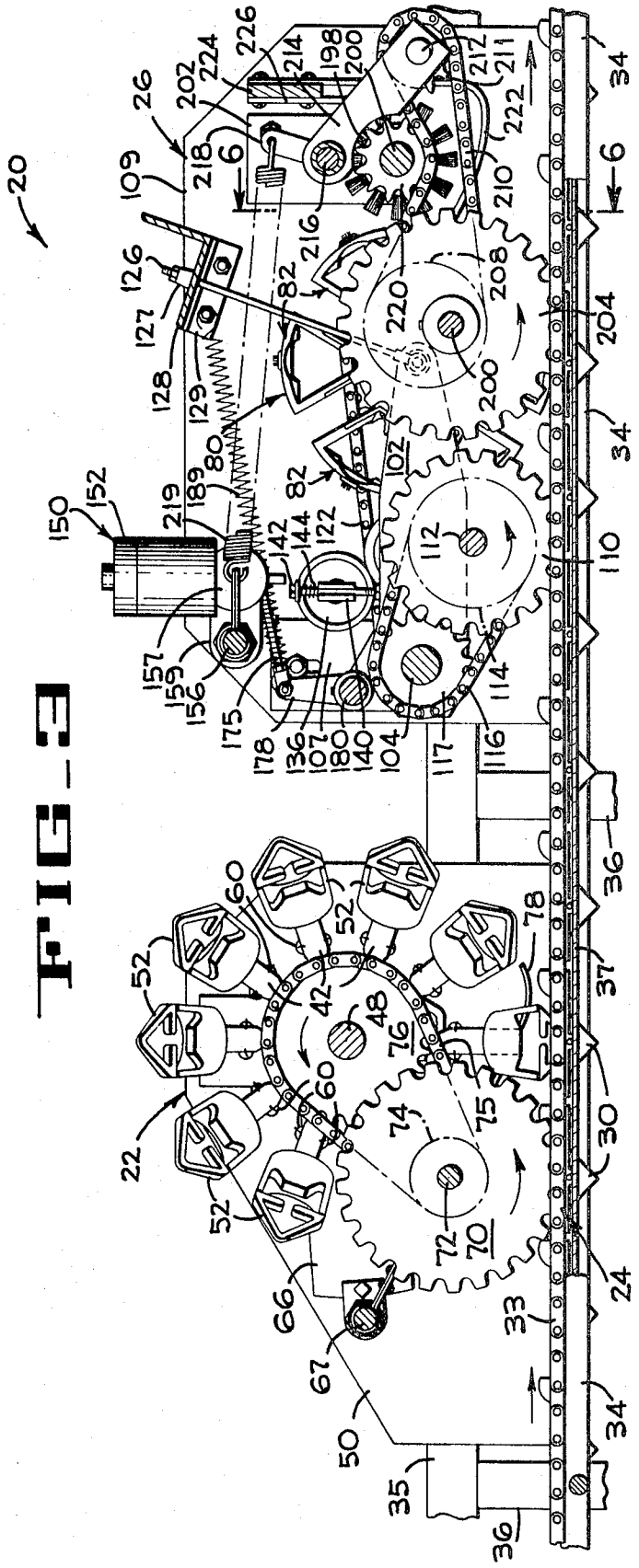


FIG_3

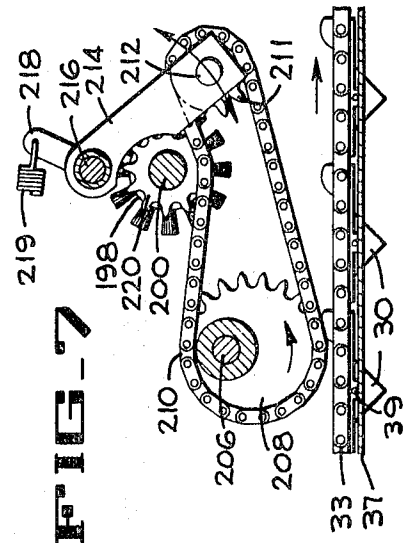


FIG_7

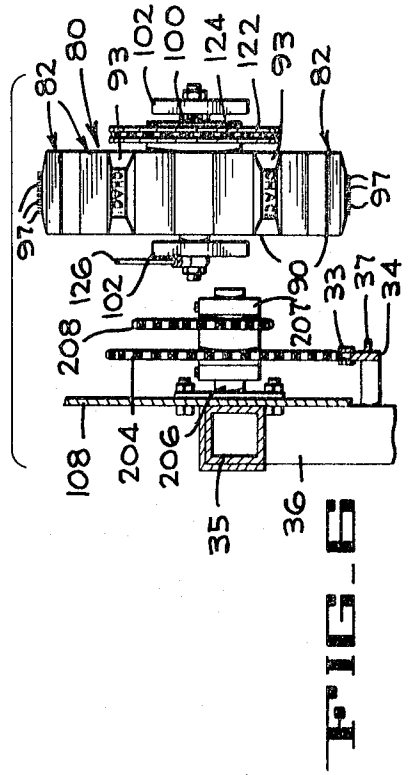


FIG_6

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APPARATUS FOR MARKING POTATOES OR THE LIKE

Filed June 13, 1967 4 Sheets-Sheet 4

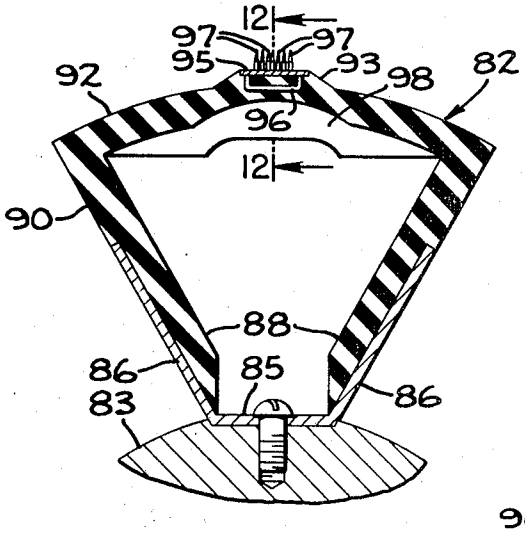


FIG_11

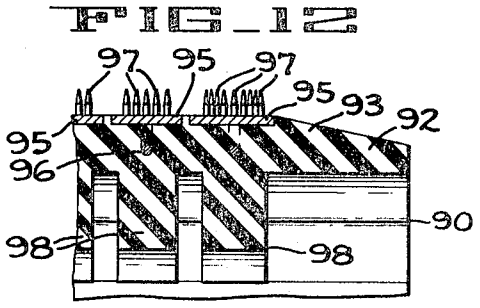


FIG_12

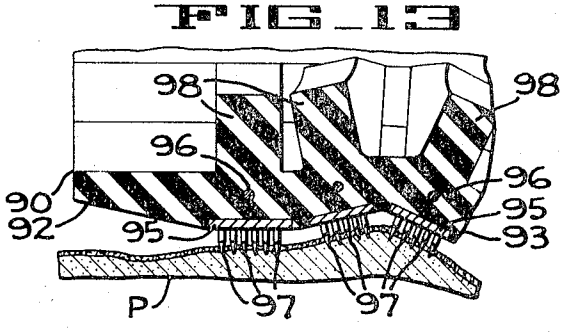


FIG_13

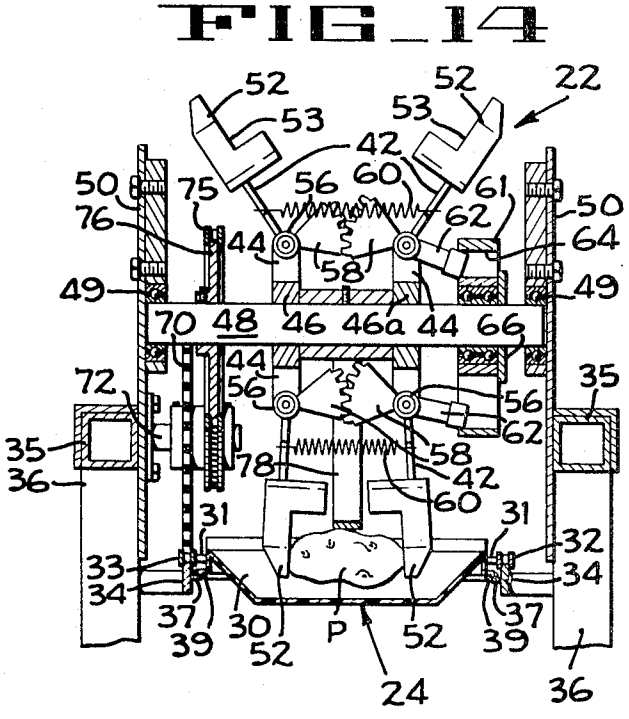


FIG_14

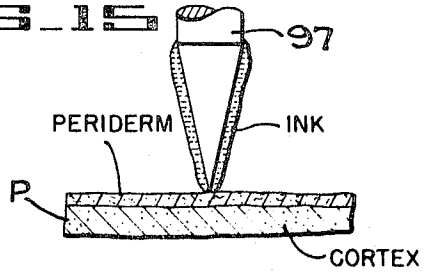


FIG_15

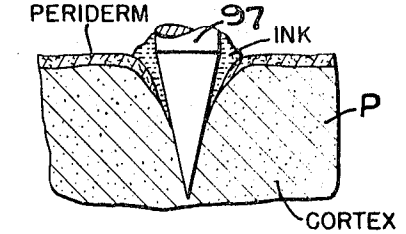


FIG_15A

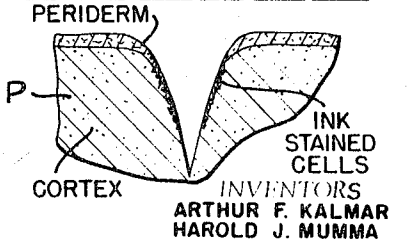


FIG_15B

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United States Patent Office

3,618,512

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3,618,512

APPARATUS FOR MARKING POTATOES OR THE LIKE

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Filed June 13, 1967, Ser. No. 645,799
Int. Cl. B44b 5/00
U.S. Cl. 101—5 2 Claims

ABSTRACT OF THE DISCLOSURE

A potato is permanently marked by being passed beneath a rotatable marking wheel which has attached at its periphery a plurality of spaced groups of needles arranged in patterns forming identifying indicia to be applied to the potato. Ink is applied to the tips of the needles by a transfer roller and is introduced into the outer cortical cell tissue of the potato by the needles which pierce the outer corky periderm layer.

BACKGROUND OF THE INVENTION

Field of the invention

In general, this invention pertains to that field of art concerned with the printing upon or marking of articles, and more particularly, it pertains to the method of and the apparatus for marking fruits or vegetables, such as potatoes, by means of skin-penetrating needles.

Description of the prior art

It has long been the practice to mark individual fruits or vegetables with distinctive indicia to indicate to consumers their brand name, quality classification, or geographical origin. For example, oranges, lemons, and other types of citrus fruit have been marked with ink which has been applied with a flexible rubber stamping die. The use of a flexible rubber stamp mounted upon a yieldable backing member has served the industry well since such a device can generally accommodate differently sized and shaped fruit and is capable of operation at high speeds, which latter factor is, of course, essential when marking individual fruits and vegetables.

Certain types of produce, however, have not lent themselves to the conventional rubber stamp type of marking. Notable among these exceptions are potatoes. When bulk potatoes are processed for the marketplace, they are brought from their storage places, washed to remove the field dirt therefrom, and then carried by conveying means to positions where they can be loaded into bags or boxes for transport to the markets, with a weight or size grading system being sometimes interposed in the conveying line. Due to the wet condition of the potatoes while they are thus being handled, marks applied with a rubber stamp are quickly rubbed out or scuffed off, or are otherwise blurred and made illegible before the potatoes can be packaged. The corky outer skin of the potato, known as the periderm, is generally loose and crumbly and has a tendency to disintegrate as the potato is jostled by other potatoes during the conveying process or by the conveyor belts and shear boards. An example of a prior art device which utilized the ink stamp technique is the patent to Ahlburg 2,982,203.

Due to the lack of permanence in ink marks applied with rubber stamps or similar equipment, other means of marking potatoes have been attempted. One such attempt was made with an electrostatic stamper which used an electrically charged powder that was directed through a screen causing the powder to conform to the desired indicia on the skin of the oppositely charged potato. This device encountered many of the same problems as the

rubber stamps, and, in addition, had some serious electrical problems and clogged screen problems because of the excess moisture on the potatoes, an operating condition which could not be entirely eliminated.

Another method of marking which was attempted was the use of a hot branding iron to burn indicia in the outer corky layer of the potato. This device encountered problems in keeping the iron at a hot enough temperature, particularly at the processing speeds required for commercial operation, and also failed to function properly on odd sized or irregularly shaped potatoes.

The apparatus of the present invention overcomes the problems existing with the aforedescribed prior art devices by adopting a wholly new approach, the use of ink-tipped penetrating needles. This basic tattooing process has, of course, been used since ancient times for forming more or less permanent marks on the arms or torsos of human beings. Also, the meat packing industry has used such a tattoo method of marking for a considerable number of years as evidenced, for example, by the prior art patents to McKee 1,806,076; 1,815,716; or 1,849,407. However, the problems involved in stamping the fatty carcass of a large piece of meat, wherein fat-soluble dyes may be effectively used, are considerably different from the problems involved in stamping fruits or vegetables, such as potatoes, in a high-speed processing line. It is to the solution of these latter problems that the present invention is addressed.

SUMMARY OF THE INVENTION

In general, the present invention comprises a process whereby a permanent mark is placed on a fruit or a vegetable, such as a potato, by means of ink-tipped needles which are arranged to briefly penetrate the skin or outermost layer of the fruit and deposit the ink in the punctured flesh of the fruit. The needles are arranged in predetermined patterns to form identifying indicia. In the embodiment of the invention described, the needles are arranged in a pattern to spell out a word with each letter in the word being formed by a group of closely spaced needles which groups are individually and flexibly mounted with respect to the other letter groups of needles.

In the case of a potato, it is not strictly necessary that the needles be provided with ink since the cortical cells of the potato will suberize about an open cut or puncture and the location of each needle perforation will thus be detectable by the darkened appearance of the suberized cells. However, it has been found to be highly preferable to use ink since this produces a much more legible mark which is readily detectable without resorting to close examination of the potato.

The present invention also comprises the apparatus for carrying out the aforedescribed process including a continuously rotating wheel having the desired needle patterns attached to yieldable die members which are mounted in spaced relationship about the periphery of the wheel. Potatoes which have been singulated and uniformly spaced are aligned with the marking wheel and are carried beneath it at a predetermined rate of speed so that each die member will engage one of the potatoes and cause the surface thereof to be perforated with the desired indicia. The needles are supplied with ink from an adjacent ink transfer roller, and, following the marking of the potatoes they are carried through an adjacent brush roller to prevent potato skins or other extraneous matter picked up from the potatoes from adhering to the needles and affecting the tattooing operation.

It is the primary object of the present invention to provide a method and means for marking potatoes or similar produce which will overcome the disadvantages in-

herent in the aforedescribed prior art practices. Particularly, it is an object of the present invention to provide a process whereby the mark will be rendered permanent even when the potatoes are in a very wet condition and whereby the mark will not be rubbed off during subsequent rough handling of the product even if portions of the outer skin of the potato are scraped off. It is also important that the mark not be blurred and made illegible by the excess of water. These objectives are achieved with the present invention because the marking needles penetrate and leave a mark below the surface of the potato which cannot be removed by the normal rubbing or blurring of the surface material.

Another object of the present invention is to provide an apparatus for marking fruits or vegetables which apparatus is capable of handling individual fruits at required commercial operating speeds of from 200 to 300 per minute. In order to more efficiently accomplish this objective a specially designed aligner is used to position the fruit upon a continuously moving conveyor to prepare it for engagement with the yieldable die members carrying the needles.

The apparatus of the present invention also has the advantage of being capable of handling a wide range of product sizes and of handling irregularly shaped fruits and vegetables because of the yieldable mounting for the needles and particularly because of the individual flexible mounting for different portions of the identifying indicia.

The apparatus of the present invention is also capable of sustained operation over long periods of time and under varying conditions of dirt and moisture so that it is particularly adaptable for commercial operation.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a longitudinal section through the marking apparatus of the present invention with the underlying conveyor for the potatoes being shown in full.

FIG. 2 is a horizontal section taken along the line **2—2** of FIG. 1.

FIG. 3 is a longitudinal section through the apparatus taken along the line **3—3** of FIG. 2 on a plane spaced outwardly from the section shown in FIG. 1.

FIG. 4 is an enlarged isometric detail of the camming mechanism for operating the ink pump.

FIG. 5 is a side elevation of the marking wheel structure illustrating its elevated position when a marking die is in penetrating engagement with a large potato.

FIG. 6 is a partial section taken along the line **6—6** of FIG. 3.

FIG. 7 is a section taken along line **7—7** of FIG. 2 illustrating the cleaning brush and its drive means.

FIG. 8 is an enlarged section through the ink pump taken along the line **8—8** of FIG. 1.

FIG. 9 is a side elevation of the ink pump shown in FIG. 8.

FIG. 10 is a section through the ink pump taken along the line **10—10** of FIG. 8.

FIG. 11 is an enlarged central section through one of the marking dies taken along the line **11—11** of FIG. 2.

FIG. 12 is an enlarged partial section taken along the line **12—12** of FIG. 11.

FIG. 13 is a partial section of the marking die similar to FIG. 12 but illustrating its distorted condition when stamping an irregularly shaped potato.

FIG. 14 is a central transverse section through the aligner shown in FIG. 1 illustrating the position of the aligning heads when centering a potato on the conveyor.

FIGS. 15, 15A and 15B are diagrammatic illustrations of the method of penetrating the outer skin of a potato with a needle and depositing the ink from the needle within the puncture that is formed.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The marking apparatus **20** (FIG. 1) of the present invention generally comprises an aligner **22**, which functions to properly center the articles to be marked upon a continuously driven conveyor **24**, and a marking structure **26** which applies the mark to the articles as they are moved therebeneath by the conveyor. In illustrating and describing the preferred embodiment of the invention, its operation will be characterized with respect to the marking of potatoes P—a product which has proven very difficult to mark in the past. However, it will be understood that the apparatus of the present invention may be readily adapted for use in marking other fruits or vegetables which have skin characteristics such that a penetrating needle can be utilized to leave a legible mark below the surface of the fruit which will not be subject to becoming blurred or rubbed out during subsequent handling.

In packing plants which process potatoes from the field, conveying means of various types are used to transport the potatoes, after they are washed, to the packaging stations. In the instant embodiment of the invention, the longitudinally extending conveyor **24** represents such a conveyor which is specially designed for use in conjunction with a weight-grading apparatus (not shown). The conveyor comprises a plurality of aligned plastic troughs **30** of generally V-shaped cross section which are attached at their lateral leading edges by means of pins **31** to a pair of longitudinally extending conveyor chains **32** and **33**. The conveyor chains are continuously driven during operation of the apparatus (by conventional drive means, not shown) and are supported upon longitudinally extending rails **34** (FIG. 14) that are attached to upstanding posts **36** spaced along the length of the apparatus. Each of the rails **34** support an inwardly extending flange **37** which is positioned adjacent to the lateral edges of the trough and serves to support a laterally projecting pin **39** attached to the central side portion of the trough so that the troughs will be maintained in a horizontal position for carrying potatoes through the apparatus of the present invention.

As mentioned hereinbefore, the dscribed conveying apparatus is one which operates in a weight-grading system where individual potatoes are placed (by means not shown) into each of the conveyor troughs **30**. However, the operation of the present invention is not dependent upon such a particular conveying means, and other more standard fruit or vegetable conveying systems may be used. For example, a conventional roller conveyor may be utilized which is comprised of a plurality of spaced cylindrical rollers with the potatoes being received between adjacent pairs of rollers. The only requirement of the instant marking apparatus is that the potatoes must be singulated and generally centered upon the conveying means if each potato is to be marked.

The function of the aligner **22** (FIG. 1) is to place each potato in the center of a conveyor trough **30** so that they will be in the proper positions for engagement by the marking apparatus **26**. The aligner, which is best seen in the transverse sectional view of FIG. 14, generally comprises a plurality of pivotally mounted arms **42** which are arranged in opposed pairs that are adapted to be swung together to push the potato into the center of a trough. Each arm **42** is rotatably mounted upon projecting spokes **44** of a pair of hubs **46** and **46*a*** that are secured together and keyed to a drive shaft **48** which is rotatably mounted in bearing blocks **49** at the side of the apparatus. The bearing blocks are adjustably mounted upon side plates **50** which are carried by tubular frame members **35** extending the length of the apparatus **20** and being supported by the upstanding posts **36**.

Fastened to the outer end of each arm **42** is a flexible head **52**, of rubber or rubberlike material, which is cut away at the outermost portion **53** (FIG. 14) of its inner face for yieldable engagement with the small end of a potato. The recessed portion **53** includes a potato-engaging face comprised of a pair of oppositely projecting flexible ribs **55** (FIG. 1). The inner ends of the arms **42** that carry the flexible heads are attached to hubs **56** which

are rotatably mounted upon the adjacent spokes **44** and carry gear segments **58** which project laterally inwardly of the arms **42**. The gear segments of each of the oppositely positioned arms **42** have inter-engaging teeth so that each set of arms will be moved inwardly and outwardly together, and a tension spring **60** is fixed to each of the oppositely positioned arms to continuously urge them toward their innermost position.

The opposed arms **42** are normally forced outwardy by a cam **61** which is rotatably mounted upon the drive shaft **48**. Each of the arms **42** which are mounted upon the hub **46***a* at the right-hand side of the apparatus (as viewed in FIG. 14) include cam followers **62** which are attached to the hubs **56** at the inner end of the arms and which project laterally in a direction opposite to that of the associated gear segments **58**. The cam followers are arranged to ride in a cam track **64** on the face of the cam which is welded to a support arm **66** that is secured to one of the side plates **50** by a laterally extending shaft **67** (FIG. 1).

The aligner **22** is continuously driven by means of a sprocket **70** which is rotatably mounted upon a stub shaft **72** affixed to one of the side plates **50** and is positioned to be engaged by the drive chain **33** of the conveyor **24**. Rigidly attached to the inner side of the sprocket **70** is a smaller sprocket **74** (FIG. 3) which is also rotatably supported upon the stub shaft **72** and which drives a chain **75** that is trained about a sprocket **76** which is keyed to the aligner drive shaft **48**.

It will be apparent that continuous movement of the conveyor chain **33** will cause the drive shaft **48** to be rotated and the cam followers **62** to move about the cam track **64**. The shape of the cam track, as best seen in FIG. 1, has the effect of forcing the opposed pairs of arms **42** apart during the major portion of their rotation about the axis of the shaft **48**. However, when the opposed arms descend near to their lowermost position the cam track **64** is widened at **64***a* (FIG. 1) and the interconnecting springs **60** pull the opposed arms together to thus laterally center a potato within the trough **30**. As stated hereinbefore, the heads **52** on the arms are made of a highly flexible and yieldable rubberlike material so that the potatoes will not be damaged thereby. In the case of extremely long potatoes, the heads **52** are capable of being compressed folded so as to ride over the top of the potato. A thin metal strap **78** is pivotally mounted to the transverse shaft **67** (FIG. 1) and extends along the center line of the aligner with its lowermost end resting just above the conveyor trough that is directly beneath the aligner structure. This strap keeps the potatoes in the troughs when they are slapped by the flexible heads **55** and is particularly effective in preventing the small and light potatoes from being knocked into an adjacent trough. The strap also serves to keep the potatoes centered in the trough.

When the potatoes leave the aligner **22** they are carried to the marking apparatus **26** and are passed beneath a marking wheel **80** which is rotatably mounted so that one of a plurality of yieldable marking dies **82** which are spaced about its periphery will be in a position to engage a potato in its carrying trough **30** as it is conveyed beneath the wheel. As clearly shown in FIG. 1, there are six dies **82** mounted upon a central hub **83** of the wheel with the wheel being driven (by means to be later described) in timed relationship with the conveyor **24** so that adjacent dies on the wheel will be received in adjacent conveyor troughs **30** on the conveyor **24**.

One of the dies **82** is shown in detail in FIG. 11 and is seen to comprise a channel-shaped metallic member **85** which is bolted within a shallow recess on the periphery of the hub **83** and is provided with upstanding flanges **86** which are bonded to and reinforce the inwardly extending legs **88** of a yieldable, open-ended supporting member **90** of rubber or rubberlike material. This resilient support **90** includes, besides the inwardly extending legs **88**, a flexible top section **92** of arcuate cross section. At the center of arcuate section **92** is a raised portion **93** in which there is molded a plurality of metal plates **95** (FIG. 12) which are anchored by U-shaped rods **96** within the rubber support **90** and have a plurality of needles **97** soldered to their outer flat faces. Each group of needles that is located upon a single plate **95** is arranged in a pattern to form a letter, and it will be appreciated that each of the plates **95** will carry needles which form a particular letter so that the combination of plates will spell a word identifying the product that is marked. In the illustrated embodiment of the invention, by way of example, each plate **95** carries one of the letters of the word "IDAHO," an indicia identifying the geographical origin of the marked potatoes. Obviously the needles could be used to form indicia other than words, but it is particularly desirable, where the mark is to extend over a certain distance on the product to be marked, that separable portions of the mark be separately mounted upon individual plates **95** so that a high degree of flexibility may be maintained, as will be explained in greater detail hereinafter. As best seen in FIG. 11, the needles **97** are tapered over roughly half of their length to a sharp point so that they will readily penetrate the skin of a potato without requiring excessive stamping force.

When a resilient support **90** is rotated into a position adjacent to a potato that has been carried beneath the marking wheel **80**, the needles **97** are caused to penetrate into the outer cortical cells of the potato just beneath the outer loose corky layer of skin known as the periderm. The top section **92** of the support will flex inwardly, as shown for example in FIG. 5, but each of the letter-carrying plates **95** is backed by a rib **98** (FIG. 12) on the interior surface of the support section **92** to give it good lateral support and urge the group of needles carried by the plate straight into the skin of the potato. It is important to note that each of the metal plates is independently mounted within the resilient support **90** and that the thin supporting wall section **92** is capable of flexing between the ribs **98** so that the groups of needles making up the identifying indicia may assume non-parallel positions with respect to each other to conform to a non-planar surface. This is quite important in stamping irregularly shaped fruits or vegetables, such as potatoes, where the cavities and protrusions on the surface to be marked might easily cause a portion of the needles to fail to puncture the skin or otherwise leave a legible and permanent mark. FIG. 13 clearly illustrates the distorted condition of the resilient support **90** and the non-parallel arrangement of the needles **97** when an irregularly shaped face of a potato P is marked with the apparatus of the present invention.

The hub **83** of the marking wheel **80** (FIGS. 1 and 5) is rotatably mounted upon a fixed shaft **100** that is carried between a pair of pivotally mounted arms **102** extending parallel to the conveyor **24** and lying between the chains **32** and **33** thereof. The upstream end of each arm **102** is rotatably mounted upon a drive shaft **104** which extends transversely of and above the conveyor **24** and is rotatably journaled at its ends within bearing blocks **106** and **107** that are adjustably secured to side plates **108** and **109** carried by the longitudinally extending frame members **35**. The marking wheel is driven through a sprocket **110** (FIG. 3) which is rotatably mounted upon a stub shaft **112** that is fixed to the side plate **108**. Sprocket **110** is positioned so that it will be continuously driven by the conveyor chain **33**. Affixed to the sprocket **110** is a smaller sprocket **114** which is also rotatably received on the shaft **112** and which drivingly engages a chain **116** that is trained about a sprocket **117** fixed to the drive shaft **104**. When the drive shaft **104** is driven through the sprockets **110**, **114** and **117** and the chain **116**, a small sprocket **120** which is keyed to the drive shaft, is rotated to drive the

marking wheel through a chain **122** which is trained about a sprocket **124** affixed to one of the inner faces of the hub **83** (FIG. 1). As the conveyor chains are propelled forwardly, the marking wheel will also be moved with the various sprocket ratios and the marking wheel diameter being such that each of the marking dies **82** will be placed in resilient engagement with a potato carried within one of the troughs **30**. The pivotal mounting of the supporting arms **102** permits the marking wheel to be pivoted upwardly when a large potato is passed beneath the lowermost marking die, as is shown in FIG. 5, but the lowermost position of the wheel is fixed by a stop rod **126** which is pivoted at the end of the wheel-carrying shaft **100** and is provided with a resilient stop **127** at its upper end (FIG. 3) engagable with an angle iron **128** which extends transversely across the top of the machine and is fastened to the side plates **108** and **109** by angle brackets **129** (one only being shown in FIG. 3).

It will be noted from FIG. 1 that when one of the marking dies **82** is in its lowermost position adjacent to the conveyor **24** the center-line of the die and the needles **97** will not coincide with the transverse center line of the conveyor trough **30** but will be offset rearwardly a small distance indicated by the letter "*w*." This offset, which amounts to a distance of from about one-quater inch to about one-half inch, has been found to be desirable since it reduces the angle of the needles as they are pulled out of the potato and tends to prevent the needles from gouging a piece out of the face of the potato.

The ink to be used with the tattooing needles **97** will, of course, vary with the particular product being marked, and it is even possible to get a legible mark without the use of ink where visually detectable chemical changes, such as enzymatic oxidation and suberization, occur in the cells of the product about the punctures. However, it is highly desirable to use an ink since a much more legible mark is obtained. When marking potatoes a preferred ink comprises the dye FD & C Violet #1 dissolved in the mono- and di-glycerides of oleic acid and known commercially as Atmos #300. Although FD & C Violet #1 is soluble in water and would rapidly diffuse into the wet potato skin to give a badly blurred mark if it were applied alone, the mono- and di-glyceride vehicle keeps the dye in check so that it will not run during the time that the potato is wet. The mono- and di-glycerides of oleic acid, however, will permit a slow diffusion of the die into the potato tissue ruptured by the needles. It should be pointed out, however, that while the aforedescribed composition has been found to work well in the marking of potatoes, the invention is not to be limited to the use thereof. When the term "ink" is used in this specification it will be deemed to refer to any fluid which may be used to leave a legible mark upon a surface and will include such substances as a pigment suspension in a fluid carrier, true dye solutions, and chemicals capable of reacting with naturally occurring compounds in the fruit to produce a colored substance.

The ink is supplied to the tips of the needles by an inking roller **130** which is provided with a neoprene (40 Shore) covering over its outer cylindrical surface and which is keyed to a shaft **132** that is rotatably mounted between the arms **102** carrying the marking wheel **80**. The inking roller is driven by the marker wheel drive chain **122**, the lower run of which engages a sprocket **134** (FIG. 1) that is fixed to the shaft **132**. The face of the roller **130** is positioned so that the tips of the needles **97** will lightly brush over it and pick up the loose ink thereon.

The inking roller **130** receives ink from the Teflon-faced transfer roller **136** which is adjustably fixed onto a threaded shaft **138** that is welded or otherwise firmly attached at its ends to two channel-shaped bearing blocks **140**. Each bearing block is slidably received an upstanding bolt **142** which is rigidly secured to the top of one of the arms **102**. The bearing blocks are constantly urged downwardly by compression springs **144** (FIG. 5) which are received between the heads of the bolts **142** and the tops of the blocks **140**, and, therefore, the transfer roller **136** which is carried by the bearing blocks will be constantly urged into engagement with the inking roller **130** and will be caused to rotate therewith. The relatively slick surface of the Teflon facing on the transfer roller prevents bits of potato skin and other extraneous matter that are transferred from the needles to the inking roller from building up on the surface of the transfer roller.

Ink is supplied to the upper surface of the transfer roller **136** by an ink pump **150**, shown in detail in FIGS. 8, 9 and 10. The ink pump includes a cylindrical supply tank **152** having a hole **153** in the bottom thereof to allow the ink to gravitate through a slotted spacer member **155** and into a narrow passage **158** in a valve body member **157**. A bracket **159** is rigidly attached to the valve body to support it with the leading end of the bracket (FIG. 10) being fixed to a pin **156** that extends between and is attached to the side plates **108** and **109** of the marking apparatus. Rotatably mounted within the valve body **157** is a valve spool **160** which has a pair of indentations **162** in its outer cylindrical surface positioned so as to receive ink from the passage **158** in the valve body. Threadedly mounted in the lower end of the valve body in vertical alignment with the indentations in the spool are a pair of metering tubes **164** which permit the ink which is transferred from the supply tank by the spool to drip onto the upper face of the transfer roller **136**.

The valve spool **160** is slowly and intermittently rotated within the valve body **157** by a pawl and ratchet drive mechanism. The spool **160** includes a laterally extending shaft **166** which carries a ratchet **168** at its outermost end. Rotatably mounted upon a cylindrical projection **169** of the valve body is a slotted ratchet drive arm **170** which rotatably carries at its upper end a spring-loaded pawl **172** engageable with the teeth on the ratchet. The ratchet and the valve spool are intermittently rotated together, in the direction of the arrow shown in FIG. 9, by a rod **175** which is threadedly received in a pin **176** pivotally mounted between the downwardly extended legs **177** of the ratchet drive arm **170**. The lower, or driven, end of the rod **175** is carried by a lever arm **178** (FIG. 4) which is keyed to a shaft **180** that is rotatably journaled in the bearing blocks **106** and **107** which support the drive shaft **104** for the marking wheel. Also rigidly attached to the shaft **180** is a hub **181** carrying a cam follower arm **182** which includes a roller **183** at its outermost end positioned to be engaged by the rotating face of a cam **185** that is rigidly secured to the drive shaft **104**.

The inking spool **160** will be rotated through a predetermined angular segment once during each rotation of the drive shaft **104** as the enlarged portion of the cam **185** engages the cam follower roller **183** and causes the rod **175** to pull the lower end ratchet drive arm **170** in the direction indicated by the arrow in FIG. 9. Because of the resilient engagement of the pawl **172** with the ratchet **168**, the ratchet is rotated counterclockwise (as seen in FIG. 9) to move the spool. In order to maintain engagement between the follower roller **183** and the cam **185** a lever arm **187** extends from the hub **181** carrying the follower arm to mount one end of a tension spring **189**, the other end of which is secured to a bolt in the mounting bracket **129** (FIG. 3) that is secured to the top edge of the side plate **109**. When the normal diameter of the cam **185** is in engagement with the roller **183** a compression spring **192** surrounding the rod **175** urges the ratchet drive arm **170** in the clockwise direction (as viewed in FIG. 9) allowing the pawl to slide over the teeth of the ratchet until the ratchet drive arm reaches a vertical position where it strikes an adjustable abutment member **194** carried by the ink pump supporting bracket **159**. It will be noted that the threaded connection of the rod **175** to the ratchet drive arm permits ready adjustment of the length of the stroke of the rod so that the amount of ink deposited by the ink pump upon the transfer roller can be varied.

Since the needles **97** will quickly become clogged with tiny bits of potato skin, dirt or other debris from the surfaces of the potatoes which are marked, it is imperative that the needles be continuously cleaned during operation of the marking apparatus. In order to accomplish this a rotary cleaning brush **198** is mounted on the upstream side of the marking wheel **80** in a position such that the outermost edges of the bristles will be received between the adjacent needles on the marking dies as the wheel is rotated. The cylindrical brush structure is keyed to a drive shaft **200** which is rotatably mounted within bearing blocks **202** that are adjustably secured to the side plates **108** and **109**.

The brush **198** is provided with a special drive system whereby the peripheral or linear speed of the bristles will continuously and uniformly vary throughout the operating cycle of the device, with the bristles sometimes moving faster than the needles **97** on the marking wheel and sometimes slower. This reversible linear speed differential between the brush and the needles will cause the bristles to brush through each set of needles in different directions at different times so that a thorough cleaning action is provided. In order to provide the required variable speed drive, a large sprocket **204** is mounted upon a fixed stub shaft **206** that is attached to the side plate **108** of the apparatus, the sprocket being arranged to be driven by means of its contact with the continuously moving conveyor chain **33**. A smaller sprocket **208** is rigidly attached to the sprocket **204** by means of a collar **207** and is also rotatably mounted upon the stub shaft **206**. As clearly shown in FIG. 7, the sprocket **208** is eccentrically mounted on the shaft **206**. This eccentric sprocket drives a chain **210** the other end of which is trained about a small sprocket **211** rotatably received upon a shaft **212** that is fixed to a pivotally mounted arm **214**. Arm **214** is fixed to a pivot shaft **216** that is mounted for rotatable movement in the bearing blocks **202** which support the brush **198**. Shaft **216** also mounts a lever arm **218** which carries a tension spring **219** that is fixed at its other end to the shaft **156** carrying the ink pump. The tension spring, through the lever arms **218** and **214**, yieldably supports the shaft **212** so that the brush drive chain **210** will be free to shift longitudinally (in the direction of the arrows shown in FIG. 7) under the urging of the eccentric driving sprocket **208**. The upper run of the brush drive chain is received upon the teeth of a sprocket **220** that is fixed to the brush drive shaft **200**.

With the driving arrangement described, it will be appreciated that the brush **198** will be driven at a varying angular speed dependent upon the position of the eccentrically mounted sprocket **208** with respect to the drive chain **210**. When the eccentric sprocket is in the position shown in FIG. 3, the brush will have just passed its point of maximum speed which will occur when the largest diameter of the eccentric sprocket is at the tangent point of the drive chain **210** linking the chain with the brush drive sprocket **220**. When the eccentric sprocket has rotated to the position shown in FIG. 7, the brush will have just passed through its point of minimum speed where the smallest diameter of the eccentric sprocket is tangent to that portion of the drive chain **210** connecting the eccentric sprocket to the brush drive sprocket **220**.

The relative timing of the drive means for the marking wheel **80** and the drive means for the brush **198** is such that the moments of maximum and minimum brush speeds will occur at different angular positions of the marking wheel during each rotation of the wheel. Thus, the needles of each marking die will be periodically subjected to brushing in both directions to effect a thorough cleaning thereof. In the described embodiment of the invention, the eccentric sprocket **208** driving the brush rotates six times for every five revolutions of the marking wheel **80**. With this arrangement, each revolution of the sprocket **208** will cause the moment of maximum brush speed with respect to the wheel to change through the angular distance of 60°. That is to say, if a given die is numbered "one" and the other dies are consecutively numbered "two" through "six" about the periphery of the wheel, and if the moment of maximum brush speed occurs when die one is passing through the bristles, the next moment of maximum brush speed will occur when die six is being brushed, the next moment of maximum speed when die five is being brushed, and so forth. The moment of minimum brush speed will occur after the marking wheel has rotated 150° from its position at the moment of maximum brush speed.

The potato skins and other debris which is removed from the needles by the bristles of the brush **198** are caught by a collecting trough **222** which is positioned beneath the brush and is supported by a bracket **224** carried between the side plates **108** and **109**. The front edge of this bracket carries a scraper bar **226**, the lower edge of which is positioned to deflect the bristles and cause any extraneous matter thereon to be snapped off and into the collecting trough (FIG. 1).

The reaction between the needles **97** and a potato P which causes a legible mark to be left in the surface of the potato is graphically illustrated in FIGS. 15, 15A and 15B. The outermost layer of skin of the potato consist of the periderm and is a brown corky netting, some six to fourteen cells deep depending upon the type and maturity of potato. For example, the Russet variety of potatoes commonly have a thick periderm while the White Rose and other early season potatoes commonly have a very thing peridermal layer. Underlying the periderm is the cortex which consists of a narrow layer of starchy tissue. It is in the ruptured cells of the periderm and outer cortex that the ink is permanently deposited.

When a needle **97** is pressed against the outer skin of the potato, the tapered portion carrying the ink pierces the periderm and presses into the tissue of the cortex, as shown in FIGS. 15 and 15A. The ink on the needle tip is primarily rubbed off by the ruptured and depressed portion of the periderm, as shown in FIG. 15A, and some will be transferred into the punctured cortex. Due to the wet condition of the potatoes, however, there will be a tendency for ink to drain from the periderm and diffuse into the punctured area of the cortex, as shown in FIG. 15B. The ink will not diffuse very far into the unbroken starchy cells of the cortex since suberization, or corking, of the wounded area will rapidly occur. It will be noted that ink which is received well within the puncture, particularly in the cortex, will not be rubbed off by subsequent scraping and scuffing of the outer surface of the potatoe and hence is well protected against the packing house conditions that render the surface ink stamp type marks illegible.

If desired, a fungicide or bacteriocide may be incorporated into the ink to prevent microbial growth at the puncture. However, this is not belived to be necessary since a polyphenolase enzyme which is present in potatoes appears to produce a fungicidal and bacteriocidal action which prevents deterioration of the cell tissue at the point of puncture.

It will be appreciated that the present invention provides an efficient and rapid manner of marking individual potatoes, or other fruits or vegetables, by means of puncturing needles. While the marking may be accomplished without the use of ink, it is preferable to use ink on the tips of the needles since a much clearer and more easily controlled mark is obtained. The apparatus of the present invention is readily adaptable to commercial fruit and vegetable processing lines since it is operable to apply the mark to the products as they are carried on any conventional conveying means.

Although the best: mode contemplated for carrying out the present invention has been herein shown and described, it will be apparent that modification and variation may be made without departing from what is regarded to be the subject matter of the invention as set forth in the appended claims.

We claim:

1. Apparatus for marking individual fruits or vegetables with identifying indicia comprising means for positioning said fruit in alignment in a spaced row, means for transporting said fruit from said positioning means to a marking station, and means at said marking station for applying the mark to each fruit in said row, said means for applying the mark comprising a wheel having a plurality of marking dies spaced about the periphery thereof, each of said dies including a plurality of needles arranged in a predetermined pattern defining said identifying indicia and being mounted for penetrating engagement with the surface of said fruit, means rotatably mounting said wheel adjacent to said row of fruit, and means for ratating said wheel in timed relationship with said fruit transporting means so that successive dies on said wheel will engage and mark successive fruit in said row, each of said dies including a yieldable support member, said needles being positioned in a plurality of groups on each support member extending in a line laterally across the support member so that each of said groups of needles will contact the fruit to be marked at approximately the same time, the needles of each separate group being mounted upon a rigid backing member that is independently attached to said support member.

2. Apparatus for marking fruits or vegetables with

identifying indicia comprising a resiliently yieldable supporting member, a plurality of rigid backing members molded within said supporting member, and a plurality of needles attached to said backing members to project from said supporting member, said needles being arranged in a predetermined pattern defining said identifying indica, said needles being arranged in a plurality of groups extending in a line laterally across the support member so that each of said groups of needles will contact the fruit to be marked at approximately the same time, each of said groups being mounted upon separate backing members, said backing members being mounted in spaced relationship within said supporting member whereby said groups of needles will be rendered flexible to permit them to conform to and properly mark a fruit having an irregular surface.

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J. REED FISHER, Primary Examiner

U.S. Cl. X.R.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,618,512 **Dated** November 9, 1971

Inventor(s) ARTHUR F. KALMAR et al

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Col. 4, line 38, change "dscribed" to --described--.
Col. 7, line 15, change "engagable" to --engageable--.
Col. 7, line 72, after "received" insert --about--.
Col. 10, line 29, change "thing" to --thin--.
Col. 10, line 49, change "potatoe" to --potato--.
Col. 11, line 15, change "ratating" to --rotating--.
Col. 12, line 7, change "indica" to --indicia--.

Signed and sealed this 4th day of July 1972.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

ROBERT GOTTSCHALK
Commissioner of Patents