

United States Patent

[11] 3,592,127

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[21] Appl. No. **851,130**
[22] Filed **July 18, 1969**
[45] Patented **July 13, 1971**

2,346,375 4/1944 Harris..... 100/123 X
2,572,352 10/1951 Ketchum..... 100/37
3,093,064 6/1963 Burner et al..... 100/37

FOREIGN PATENTS

481,249 3/1953 Italy 100/107

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[54] **APPARATUS FOR EXTRACTING JUICE FROM
FRUIT AND THE LIKE**
11 Claims, 8 Drawing Figs.

[52] U.S. Cl. 100/107,
100/114, 100/118, 100/122
[51] Int. Cl. B30b 9/02,
B30b 9/06
[50] Field of Search 100/37,
104—115, 122—135, 70—72

[56] **References Cited**
UNITED STATES PATENTS
757,706 4/1904 Wilson 100/125 X
801,872 10/1905 Herr 100/113 X
1,345,963 7/1920 Santos 100/116
2,043,371 6/1936 Davis 100/70 X

ABSTRACT: Apparatus for extracting the juice from fruit and the like, said apparatus comprising a vat to receive material to be treated; a plurality of laterally spaced vertical perforated drainage tubes; manifolds receiving juice from said vertical tubes; an outlet connected to said manifolds; a gate forming a bottom for said vat; means for moving said gate into and out of position whereby to dump at least the lower portion of said vat when said gate is out of its vat-bottoming position; a press receiving material from said vat; a plurality of vertical drainage tubes in laterally spaced rows in said press, drainage means below said tubes and means for separating said drainage means from said tubes whereby to permit dumping of the residue from said tubes and means to compress material inside said press and to bring said tubes into mutual close juxtaposition.

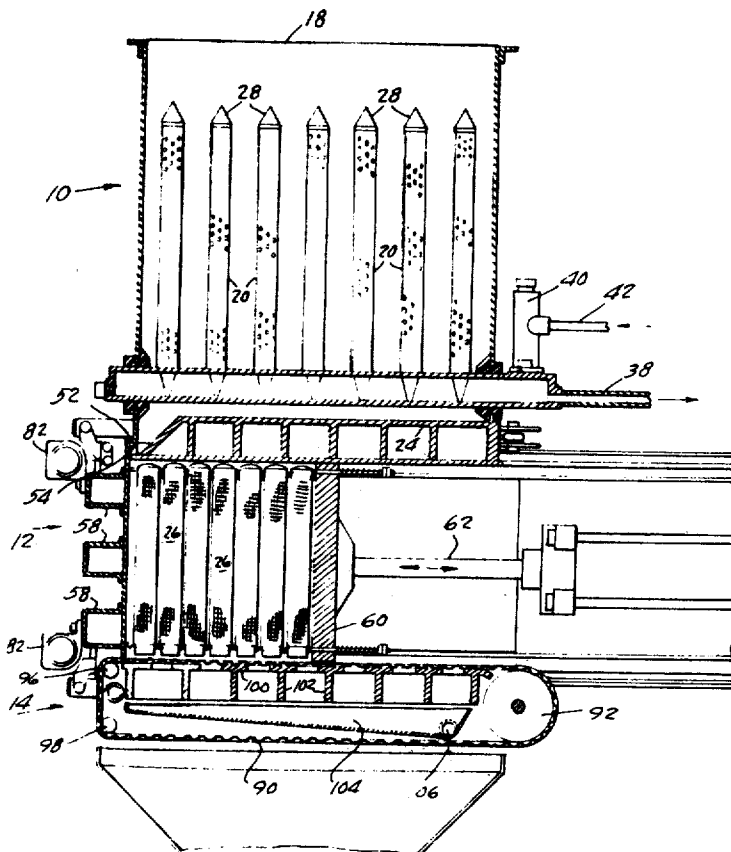


FIG. 1.

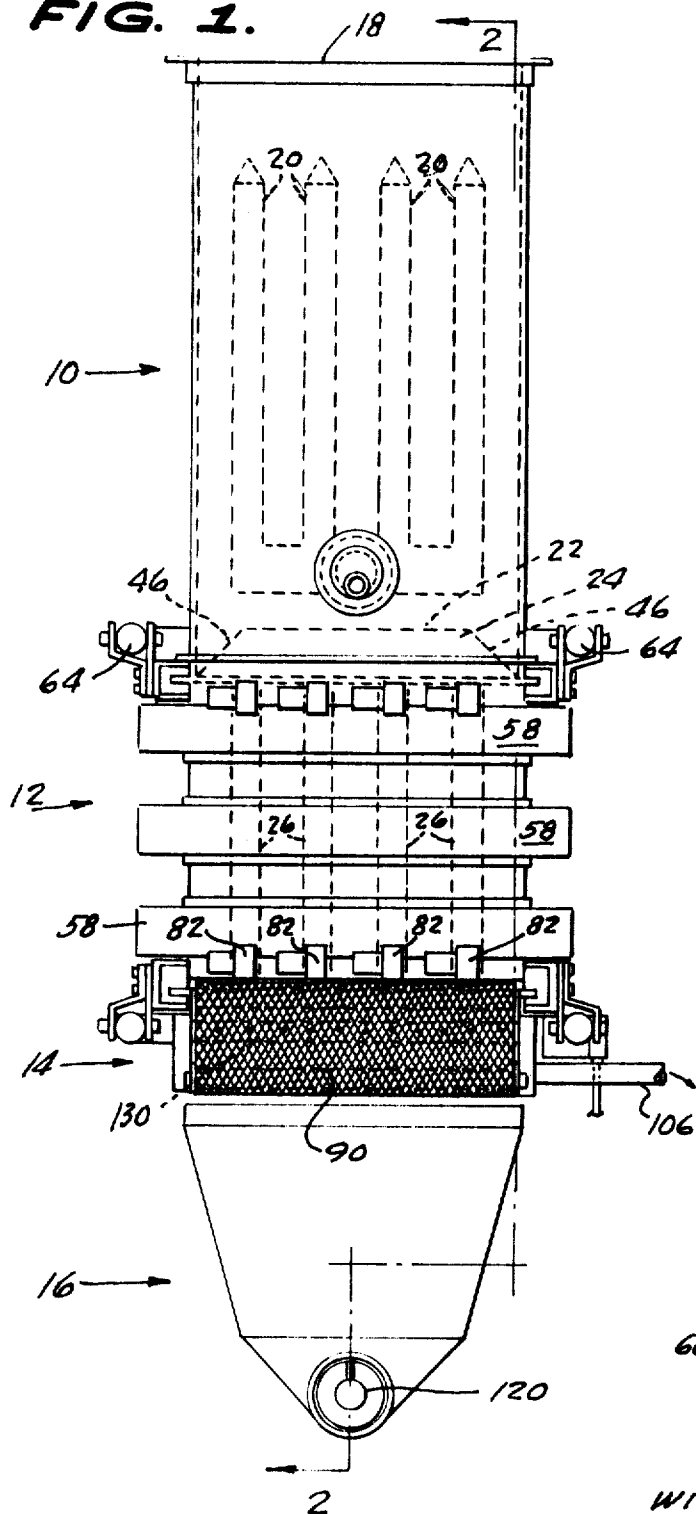
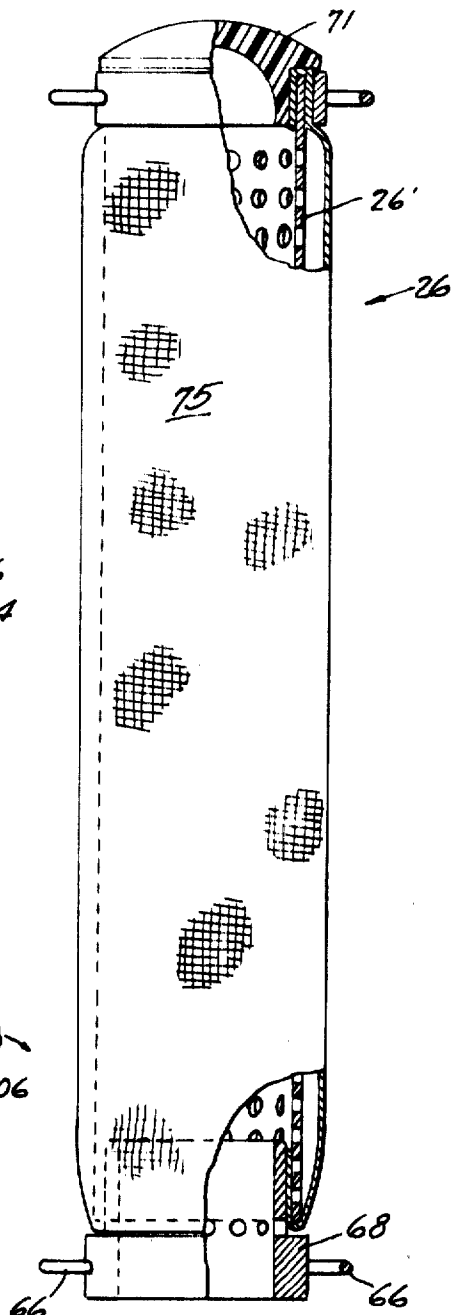
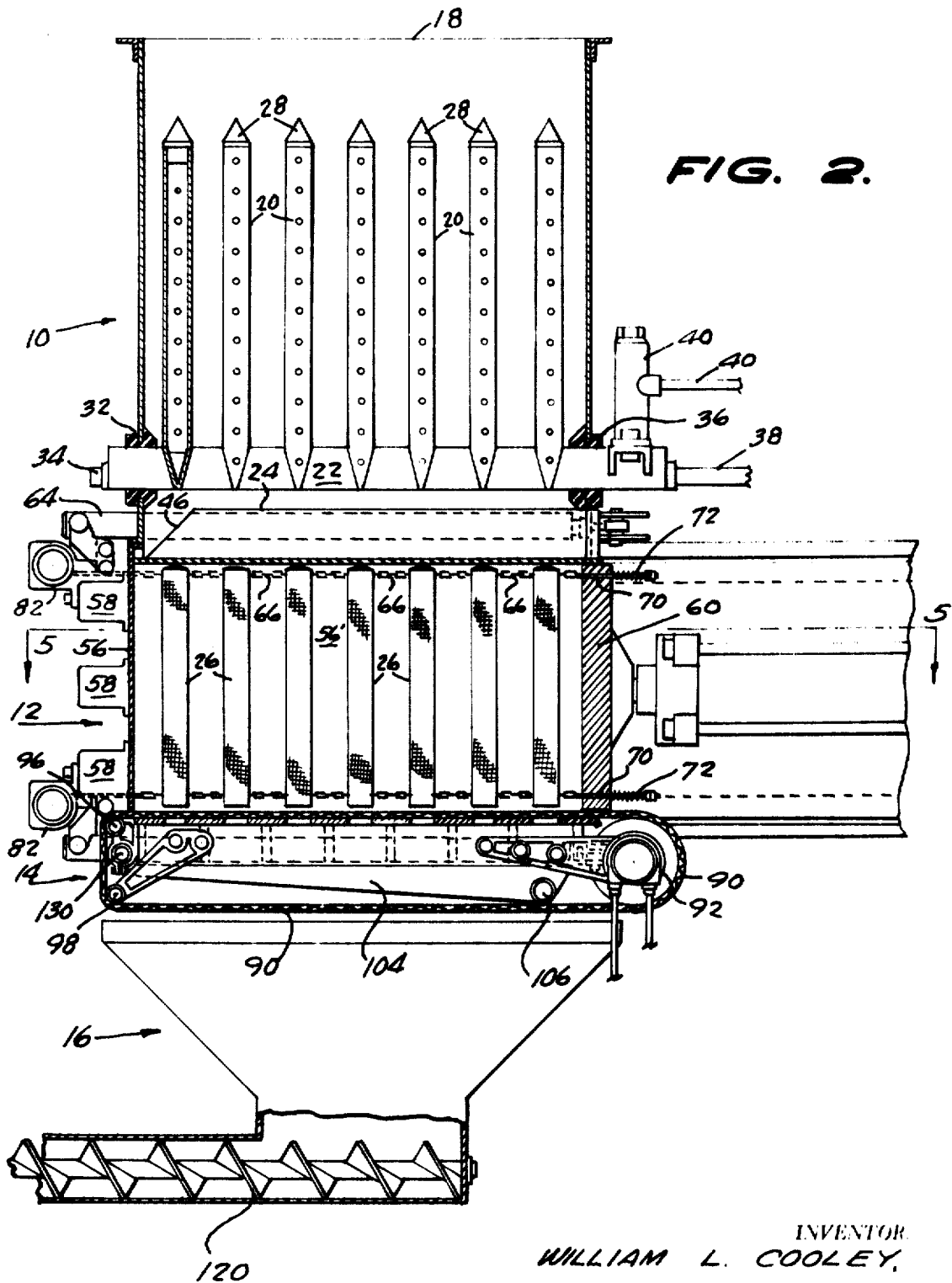


FIG. 7.



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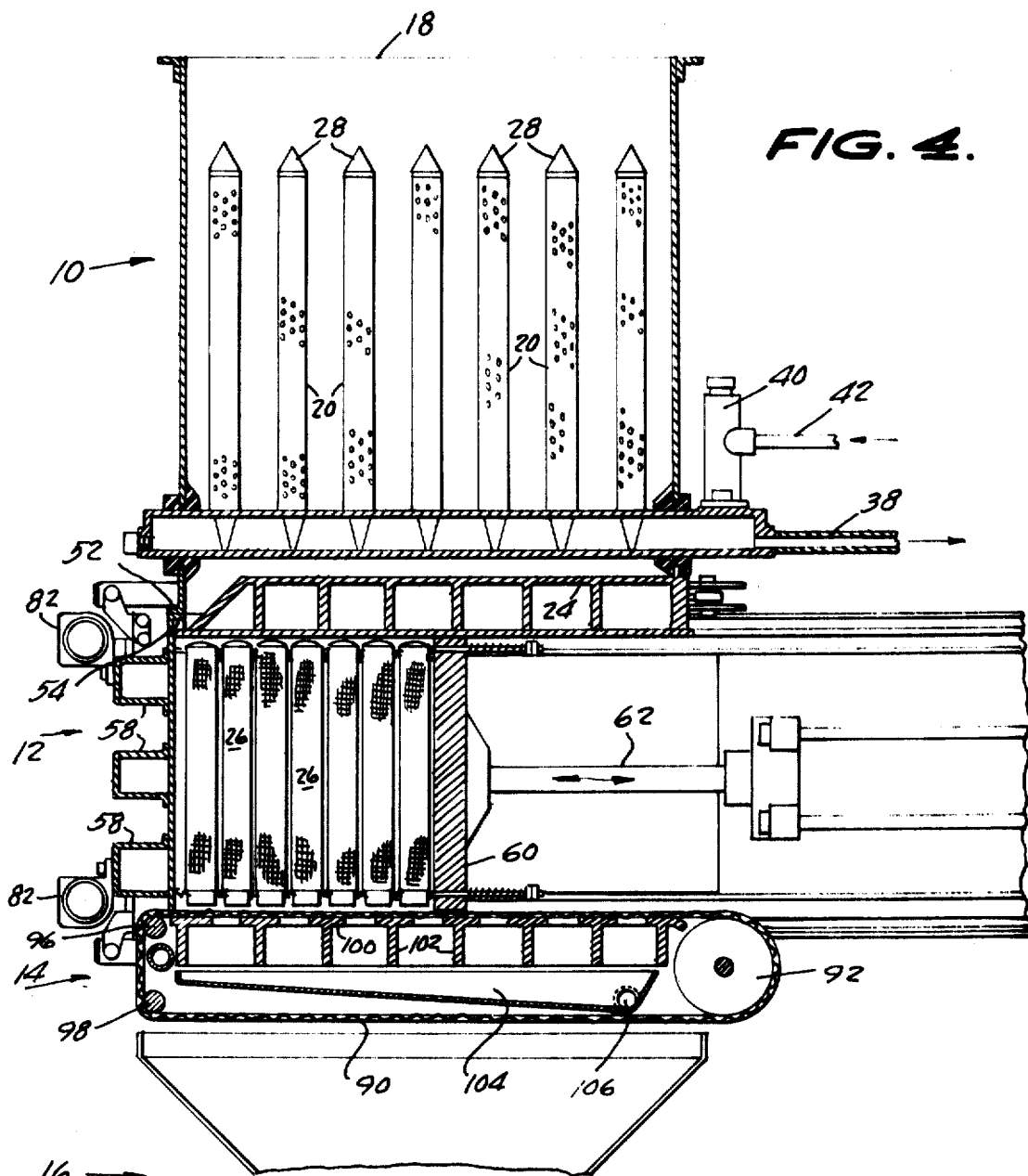
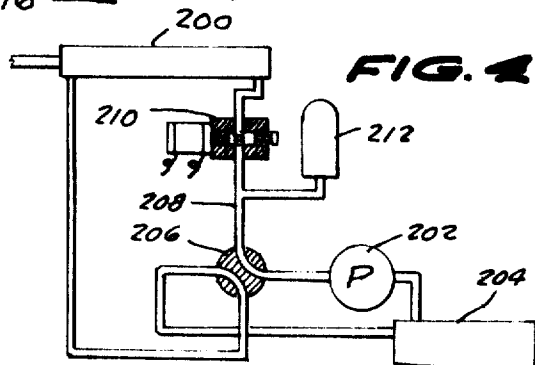


FIG. 4.



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FIG. 5.

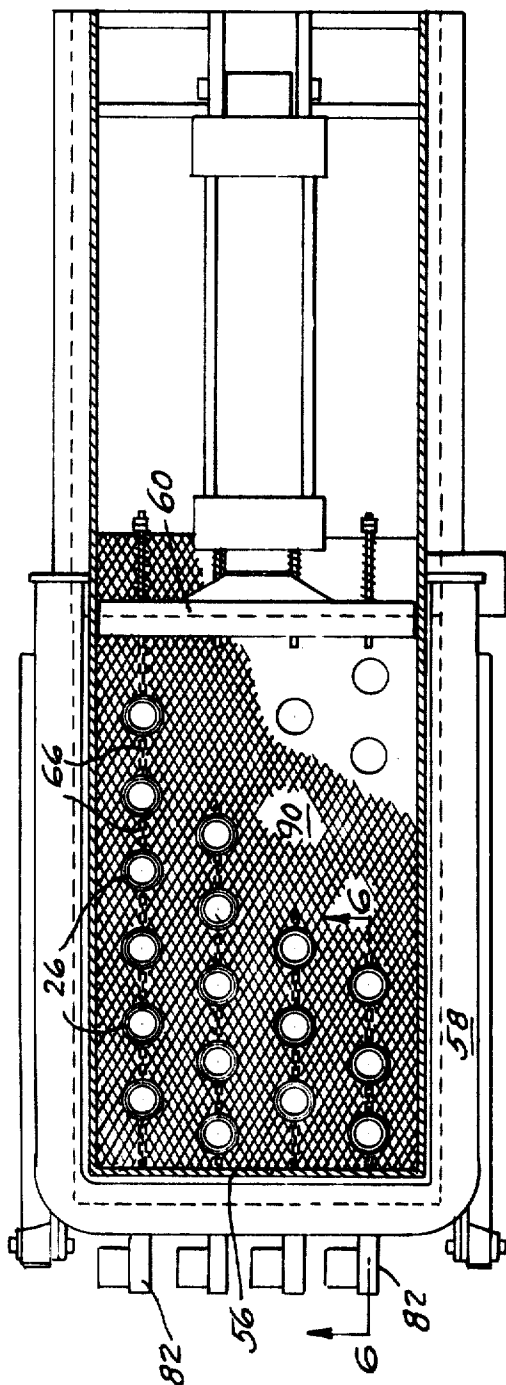
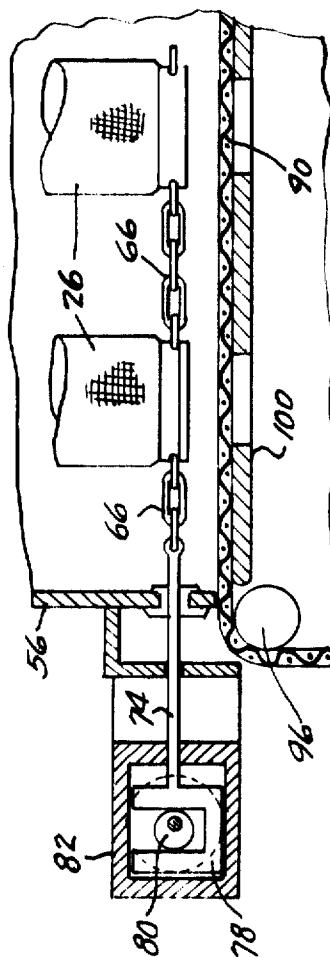


FIG. 6.



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APPARATUS FOR EXTRACTING JUICE FROM FRUIT AND THE LIKE

It is well known that the flavor of fruit juices, particularly those intended for the production of wine, is sensitive to the mechanical treatment to which the fruit is subjected. This is why the best vintage wines are produced by the ancient method of treading on the grapes. Present day costs, as well as present day standards of sanitation, prohibit the use of this probably optimum treatment.

It is an object of this invention, therefore, to provide an apparatus for extracting juices from fruit and the like in which the severity of mechanical treatment and compression is minimized.

It is a further object of this invention to provide a means as aforesaid in which the total output is divided into two parts, one of which undergoes a minimum of mechanical treatment and the second stage of which extracts a maximum possible amount of juice from the material originally supplied. This enables the first output which has received the most gentle treatment to be reserved for high-quality product and the output of the second stage to be put into a product of less-demanding quality. For example, in pressing grapes, the best output can go into quality wine with the second output going to wine of lesser quality or into jellies. At the same time, this method and apparatus, considered as a whole, performs the job of absolute maximum extraction of juice from the particular material.

The above and other objects will be made clear from the following detailed description taken in connection with the annexed drawings, in which:

FIG. 1 is a front elevation of the machine as a whole;

FIG. 2 is a section on the line 2-2 of FIG. 1;

FIG. 3 is a side elevation partly in section, similar to FIG. 2, but showing the parts in press-dumping position;

FIG. 4 is a view similar to FIG. 2, showing the parts in the position occupied at the conclusion of the pressing cycle;

FIG. 4A is a schematic diagram illustrating means for applying high frequency vibrations to the pressing platen;

FIG. 5 is a section on the line 5-5 of FIG. 2;

FIG. 6 is a section on the line 6-6 of FIG. 5; and

FIG. 7 is an elevation partly in section showing the details of one of the drainage tubes of the press section.

Referring now to FIG. 1, which is an external front elevation of the machine as a whole, a vat section is generally designated 10, a press section is generally designated 12, a drainage section is generally designated 14, and a waste receiver is generally designated 16. The vat section has an open top 18 through which material to be treated is fed either in batches or continuously, though for most purposes and for reasons which will appear hereinafter continuous-feed is preferred.

A plurality of perforated drainage tubes 20 are arranged in the vat section 10 and drain to a common manifold 22. A gate 24 separates the vat section 10 from the press section 12. The drainage section 14 and the waste receptacle 16 will be discussed in detail in connection with other views.

The press section 12 also contains a plurality of perforated drainage tubes 26, one of which is illustrated in detail in FIG. 7 adjacent FIG. 1 and will be described in detail hereinafter.

Before proceeding to a detailed consideration of the subsequent figures of the drawings, it probably will be well to explain that almost without exception any fruit, before it is subjected to the juice-extracting process, is given some preliminary treatment. In the case of grapes, usually the stems will be removed and the grapes given some sort of classification amounting to the removal of overripe or underripe fruit. In the case of apples, there would certainly be at least a maceration process. In the case of tomatoes, quite probably there will be a peeling process, with possible maceration. In any of these cases, in all probability, the fruit or other material comes from the prepress treatment rather continuously. For this reason, it is preferred that the prepared fruit be continuously conveyed

and dropped into the open top 18 of the vat section 10. A cube capacity of the vat section 10 is considerably greater than that of the press section 12 so, in timing the press cycle, it is perfectly possible to adjust the rate of supply with the cycle of the press so that the vat section 10, except for brief intervals, when the press section 12 is being filled, maintains a relatively constant depth of prepared fruit. The depth of fruit in the vat section 10 is great enough so that adjacent at least the lower half, probably throughout the length of the vat tubes 20, the fruit is under a substantial static pressure head.

Referring to FIG. 2, the vat section 10 is simply a rectangular tube of conventional structure open at both top and bottom. As a comparison of FIGS. 1 and 2 will reveal, tubes 20 are arranged in four lengthwise rows with seven tubes in each row. This is purely arbitrary since the number of rows and the number of tubes in each row is not at all critical. Each tube 20 has a pointed conical solid top 28. These assist in distributing a prepared fruit as it is dumped into the vat section 10. Each tube 20 has in its cylindrical area a plurality of perforations 30 which receive the prime juice from the prepared fruit under the pressure of the static head above mentioned.

If, as will be discussed hereinafter with reference to FIG. 7, the tubes are given a fabric cover, the perforations 30 may be quite large. If the covers are omitted, and usually they will be, then depending on the material being treated, the perforations 30 would vary from one-eighth inch to three-eighths inch in diameter. At their lower ends, each of the tubes 20 is suitably split and welded to a lengthwise extending manifold 22. Each of the manifolds 22 extends through a gasket 32 in the end wall of the vat section and is closed by a removable cleaning plug 34. At their opposite ends, the manifolds 22 also pass through gaskets 36 into a common transverse manifold which feeds a drain pipe 38.

The tubes 20, manifolds 22 and drain pipe 38 constitute a unitary rigid structure. The gaskets 32 are formed of resilient material and there is provided adjacent the drainage tube 38 a pneumatic vibrator 40 supplied by an air line 42 which applies vibrations with a frequency approximately in the audible sonic range, which vibrations are transmitted throughout the rigid structure of tubes 20, manifolds 22 and drainage tube 38. Such transmission is possible without damage to the overall structure because of the resilient gaskets 32 which insulate the main structure from the vibrations of the rigid composite structure just referred to. The vibrator operates constantly and, as will appear hereinafter, consists in dumping partly drained fruit from the vat section 10 into the press section 12. It has been noted that the vibrator 40 greatly improves the recovery of prime juice, increasing the yield. This is believed to be because the vibrations to minimize the effect of surface tension of the fluids in the mass, thereby making it easier for the prime juice to enter the tube and manifold system.

The gate 24 requires consideration of FIGS. 1, 2, 3 and 4. As best seen in FIG. 4, the gate 24 consists of a top plate 24 cut, folded and welded to provide a beveled forward edge 44 and, as seen in dotted outline in FIG. 1, beveled sides 46. The edges of the sides 46 and the front wall 44 are joined as by welding to a bottom plate 48 which extends slightly beyond the lower edge of the front plate 44. The front end wall 50 of the vat section 10 has its lower edge bent into a horizontal flange 52 which engages an inwardly directed mating flange 54 of the press section 12. The flange 54 is bent from the front wall 56 of the press section 12.

As will be seen in FIGS. 1-4, the press section 12 is surrounded on three sides by stiffening ribs 58, all of which are identical and are secured by welding to the front wall 56 and sidewalls 56' of the press section 12.

As best seen in FIGS. 2 and 4, the fourth wall of the press section 12 comprises a platen 60 which is controlled by a piston rod 62 (FIG. 4) which in turn is under the control of a conventional hydraulic cylinder.

As will be clear from FIGS. 2, 3 and 4, the gate 24 is under the control of a pair of hydraulic cylinders 64. With the parts in the position of Figure 2, the cylinders 64 thrust the gate 24

to the right of FIG. 2, permitting the lower portion of the charge in the vat section 10 to drop into the press section 12. Once this is accomplished, the cylinders 64 withdraw the gate 24 back to the position shown in FIG. 2.

The perforated pipes 26 in the press section 12 are secured together in each longitudinal row by means of chains 66 and collars 68, for which see Figure 7.

The platen 60 carries slidably mounted rods 70 adjacent the top and bottom of the platen 60 with a set for each row of perforated tubes 26. The rods 70 are biased to the right of FIG. 2 by conventional springs 72.

At the opposite end of the press section 12, the chains 66 are secured to rods 74 which pass through gaskets 76 in the front wall 56 and have at their outer extremities formations in the nature of Scotch yokes 78, each of which engages a rotary eccentric 80 in a housing 82, the eccentrics at top and bottom being driven by a motor, not shown.

When the cams 80 are rotating, the rods 74 are reciprocated, drawing the chains 66, the collars 68 and the tubes 26 rapidly back and forth against the resistance of the springs 72 transmitted through the rods 70 which pass through the platen 60. Obviously, this vibratory reciprocation of the tubes 26 does not operate at all times. The vibration starts only when the platen 60 is in the position shown in FIG. 2. It continues while the gate 24 is opened to dump a fresh load from the vat section 10 to the press section 12 and such vibration is of material assistance in securing even distribution of the fruit throughout the press section 12. When the gate 24 closes, the piston rods 62 advance the platen 60 from the position illustrated in FIG. 2 to the position shown in FIG. 4, during which time the eccentric 80 is stopped and during this time the bulk of the juice passes into the tubes 26, though a substantial portion is forced downwardly between the tubes.

The drainage section 14 lying immediately below the press section 12 will now be described. It is primarily an endless wire mesh belt 90 which, at its rearward end is driven by a hydraulic motor 92. At its forward end, the belt 90 passes over idler rolls 96 and 98 and its upper pass is supported by a perforated plate 100 to which are attached transverse strengthening ribs 102 overlying a drainage trough 104 having a drainage outlet 106 which emerges laterally from the confines of the belt 90.

The entire drainage unit 14, as thus far described, is slidable from the position of FIG. 2 to the position of FIG. 3 under the impetus of piston rods 108 at each side of the unit 14, each of said rods being under the control of a cylinder 110. FIG. 4 represents the conclusion of a pressing cycle. When this position is reached, the platen 60 is withdrawn to the position shown in FIG. 2 while the drainage unit 14 simultaneously is withdrawn to the position illustrated in FIG. 3. At this point, the cams 80 start rotating and the tubes 26 vibrate until the beginning of the next compression stroke. The vibrations of the tubes 26 with the drainage section 14 in the position of FIG. 3 assists in dumping the squeezed residue into the discard section 16 from which it is removed as desired by a screw conveyor 120, best seen in FIGS. 1 and 2.

Referring particularly to FIGS. 2, 3 and 4, it will be seen that the chain mesh belt 90 has a vertical pass at its forward end between the idlers 96 and 98. A pipe 130 runs transverse the drainage unit 14 adjacent the forward vertical pass of the belt 90, and is either perforated or supplied with nozzles directed against the inside of the belt 90. When the drainage unit 14 is withdrawn to the position of FIG. 3, the hydraulic motor 92 drives the belt and the pipe 130 supplies wash liquid directed to the inside of the belt, knocking off any residue which may have stuck to the belt and delivering the residue to the discard unit 16, so that when the drainage unit 14 returns to the position of FIG. 2, the belt 90 has been cleaned and is ready for further pressing operation.

The drainage pipe 106, which receives juice extracted by the press unit 12, and delivered to the trough 104, is connected to a collection vat, not shown, by flexible inert plastic tubing. The primary or premium juice is, of course, collected

through the outlet 38 from the vat unit 10, while secondary juice which has been more violently treated in the press section 12 is collected through the outlet 106. The juices are thus automatically classified as to quality and, if desired, may be diverted to different uses.

It has been found advantageous to apply pressing pressure to the platen 60 as a series of high-pressure impulses, rather than continuously. This has been found to decrease the compression time by as much as 20 percent without decreasing the yield or lowering its quality.

FIG. 4A shows a schematic diagram of one way of accomplishing this result. In FIG. 4A, a hydraulic cylinder for advancing and retracting the platen 60 is designated 200. The system is provided with a pump 202 and a sump 204. Advance and retraction are under the control of a conventional four-way valve 206. A line 208 is used to deliver fluid to the cylinder 200 on the pressure stroke and to drain that end of the cylinder 200 during the return stroke. A vibrating valve generally designated 210 is inserted in the line 208 and since the pump 202 operates constantly during the compression stroke, it is necessary to insert a pulsation absorber 212 in the line 208 between the pump and the vibrating valve 210. The valve 210 is of a balanced pressure type, spring-biased to open position and intermittently at any desired frequency is drawn to closed position by means of a conventional solenoid. During the return stroke in the cylinder, the solenoid is shut off, the valve therefore is open and return flow is unrestricted.

The structure generally designated 26 in FIG. 7 comprises an inner stainless tube 26' which has throughout its area perforations 27. Each of the bottom rings for each of the tubes 26 has an upwardly extending internal collar 67. The top of each tube is closed by a plastic cap 71 having an internal annular flange 73. A fabric sleeve 75 which may be knitted or woven, and preferably is made up of Dacron or nylon fibers, surrounds the metal perforated tube 26' and is deliberately made of greater diameter than the tube 26' so that during the period of vibration, during which dumping occurs in the position of FIG. 3, any material which is caked on the sleeve, is largely shaken free and proceeds to the disposal section 16. This tends to keep the tube assemblies 26 free-flowing through many cycles of operation.

The sleeve 75 is also of greater length than the metal tube 26' and at each end of the tube 26' the sleeve 75 is folded around the end and clamped between the ring 68 and at the top the internal flange 73 of the cap member 71 or the internal flange 67 of the lower ring 68. Clearly, it is no great chore to disassemble the structure of FIG. 7 for thorough cleaning operations when this becomes necessary.

When prepared fruit is supplied continuously through the top 18 of the vat section 10, the machine as a whole lends itself very easily to automated, cyclic operation. The means for producing such an automated cycle are entirely conventional and need not be disclosed in detail here. The various hydraulic lines are under the control of conventional four-way valves which may be solenoid operated. The same is true of the hydraulic motor 92 in the drainage station 14 and with the motor or motors controlling the cams 80. It is, therefore, simple to provide a series switch which, if desired, may be programmed to predetermine the sequence and duration of operation of the several parts and which will automatically repeat the cycle as many times as desired. The machine, therefore, will operate automatically for long periods without requiring more than occasional and casual attention on the part of the operator who may easily serve several of such machines.

I claim:

1. Apparatus for extracting juice from fruit and the like, said apparatus comprising: a vat to receive material to be treated; a plurality of laterally spaced vertical perforated drainage tubes in said vat; manifolds receiving juice from said vertical tubes; an outlet connected to said manifolds; a gate forming a bottom for said vat; means for moving said gate into and out of position whereby to dump at least the lower portion of the materi-

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al in said vat when said gate is out of its vat-bottoming position; a press-receiving material from said vat; a plurality of vertical drainage tubes in laterally spaced rows in said press; drainage means below said tubes; means for separating said drainage means from said press whereby to permit dumping of the residue from said tubes and means to compress material inside said press and to bring said tubes into mutual close juxtaposition.

2. The apparatus of claim 1, including means to vibrate the drainage tubes of said press.

3. The apparatus of claim 1, including a drainage section underlying said press and comprising an endless foraminous belt having upper and lower passes; a juice-collecting trough between upper and lower passes of said belt and means for driving said belt.

4. The apparatus of claim 3, including means to move said drainage section away from under said press to permit dumping the press.

5. The apparatus of claim 4, including jet means operable from the inner side of said belt for cleaning said belt.

6. The apparatus of claim 4, including a pressed-residue-receiving means below said drainage section to receive residue from said press.

7. For use in the press of claim 1, a drainage tube comprising: a hollow, perforated member; a fabric sleeve surrounding said member; a removable cap for the upper end of said member; a ring surrounding the upper end of said member, said sleeve having its upper end clamped between said ring and a portion of said cap, said ring having means to engage flexible means to connect the upper end of said drainage tube to adjacent tubes in alignment therewith.

8. The drainage tube of claim 7, including a ring at the bottom of said member, said ring having means to clamp the lower end of said sleeve to said member, said ring having means to engage flexible means to connect the lower end of said drainage tube to adjacent tubes in alignment therewith.

9. The apparatus of claim 1 including: means to vibrate the tubes and manifolds in said vat at a frequency approximately in the sonic range.

10. The apparatus of claim 1 including: means to advance said material-compressing means by pulsations of a frequency approximately in the sonic range.

11. The apparatus of claim 10 including: means to vibrate the tubes and manifolds in said vat at a frequency approximately in the sonic range.

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