United States Patent [19]

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[54] **AIR SQUEEZE WARE TESTER**

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[52] **U.S. Cl.** **73/94**
[51] **Int. Cl.** **G01n 3/00**
[58] **Field of Search**..... 73/94; 209/79, 88 R; 198/40; 101/38 A, 38 R, 39, 40

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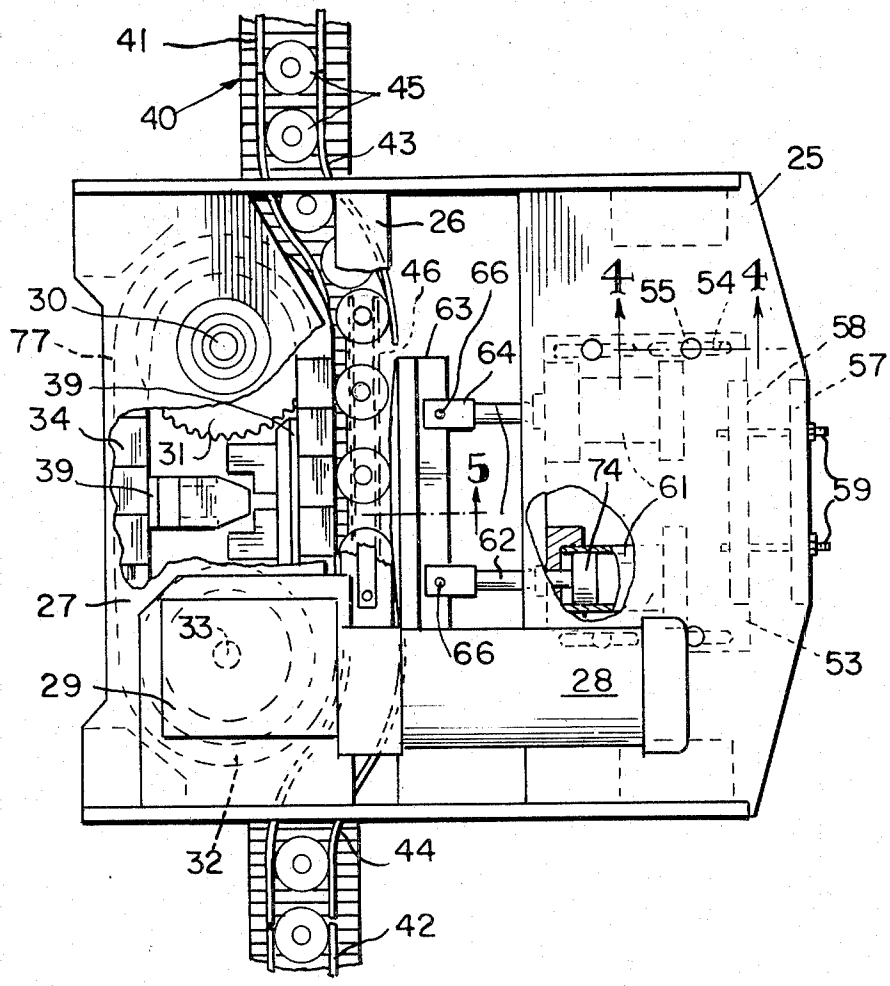
[57] **ABSTRACT**

Apparatus for impressing a transaxial crushing force of predetermined value successively upon a series of substantially identical pieces of frangible ware for the purpose of discarding pieces of defective strength, including a pneumatically loaded presser head in opposed registration with a vertically disposed face of a conveyor or impeller, the same being so disposed that pieces of ware, while being subjected to transaxial pressure, are supported in unstable condition upon a moving platform so that, upon fracture of a piece of ware, substantially all fragments of such piece will fall from the platform, means being provided for cooperation with the upper regions of undamaged ware to support such ware against toppling from the platform. The active face of the presser head is formed of synthetic material, that portion thereof below a level at least equal to the transaxial dimension of a piece of ware above the platform having a coefficient of friction significantly less than that of the portion of the face above that level to facilitate the free movement of a prostrate ware piece past the presser head.

21 Claims, 10 Drawing Figures



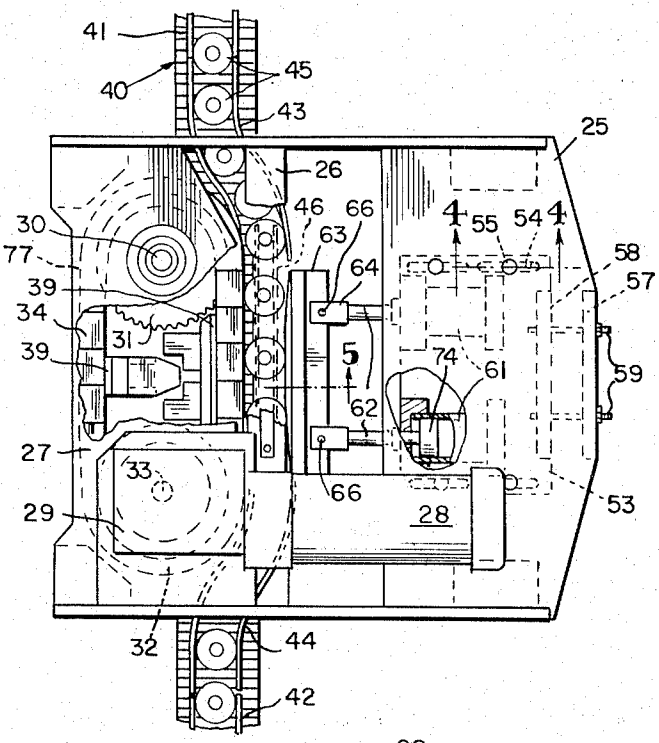


Fig. 1

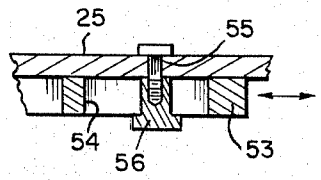


Fig. 4

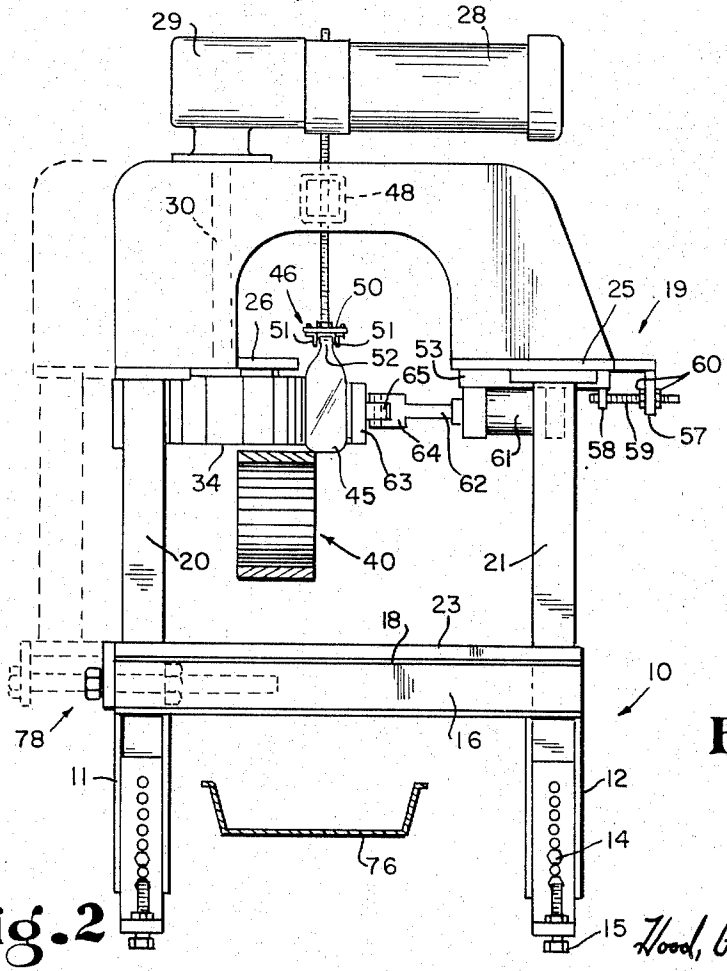


Fig. 2

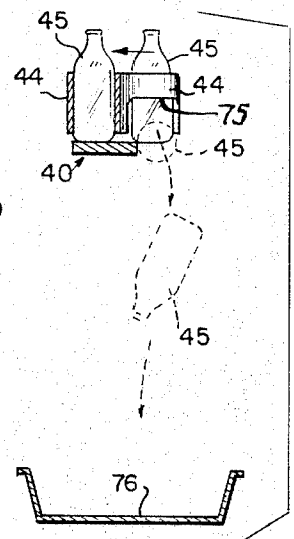


Fig. 7

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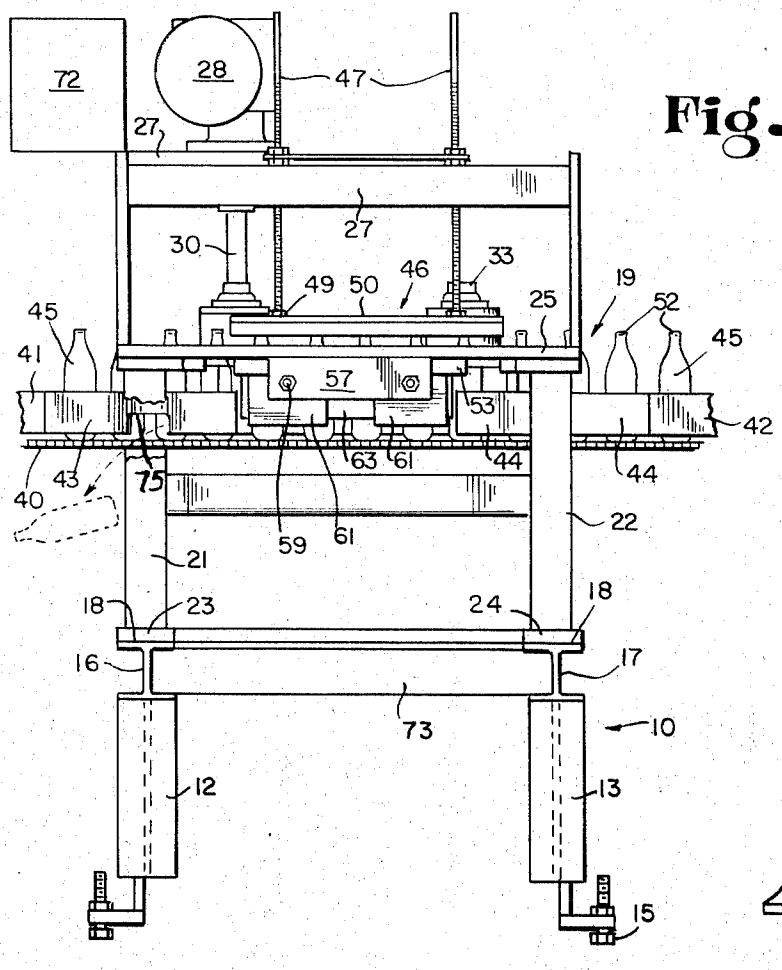

Fig. 3

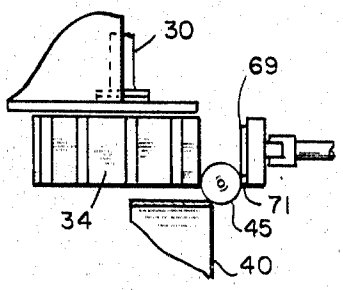

Fig. 6

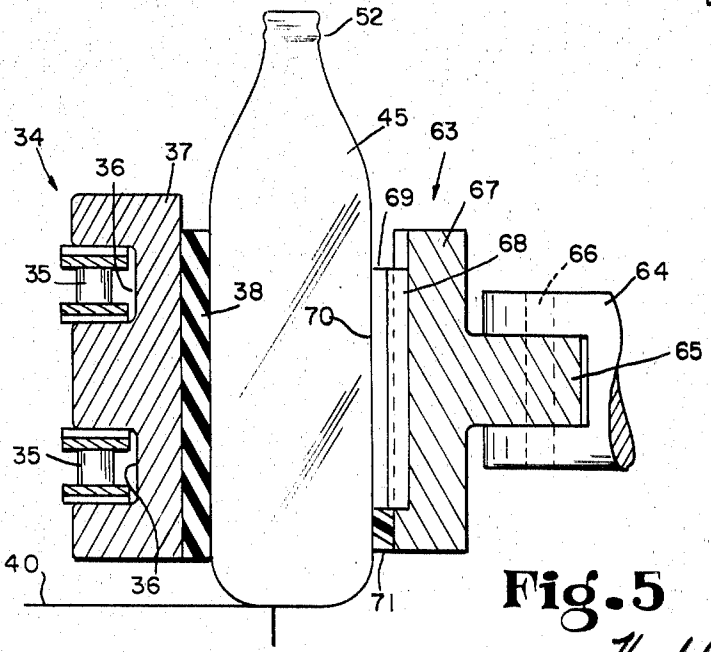

Fig. 5

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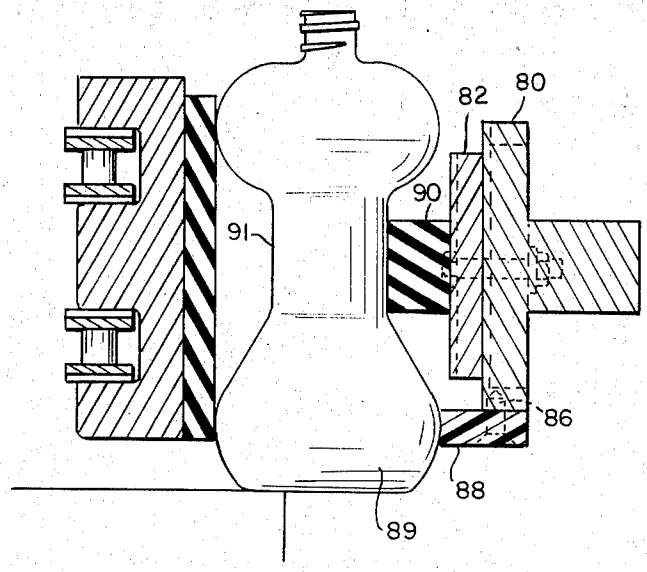

Fig. 8

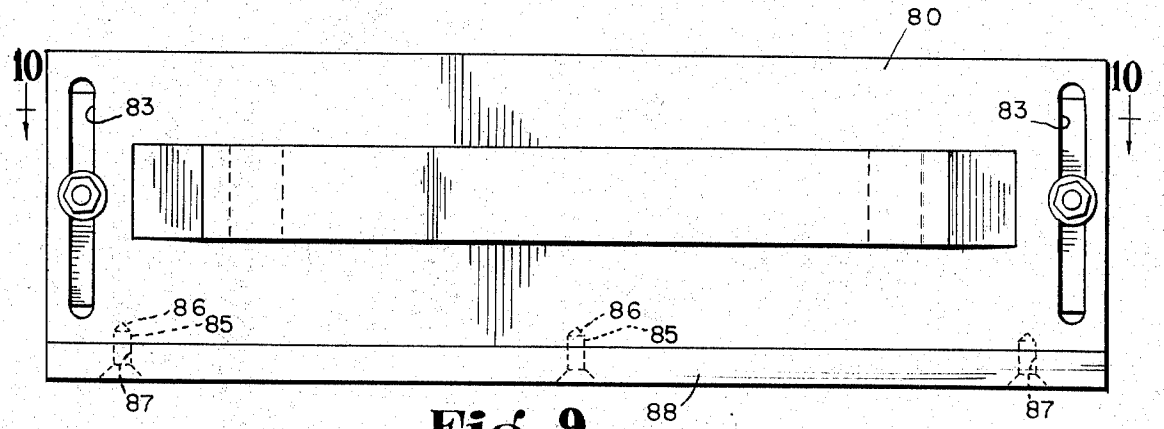

Fig. 9

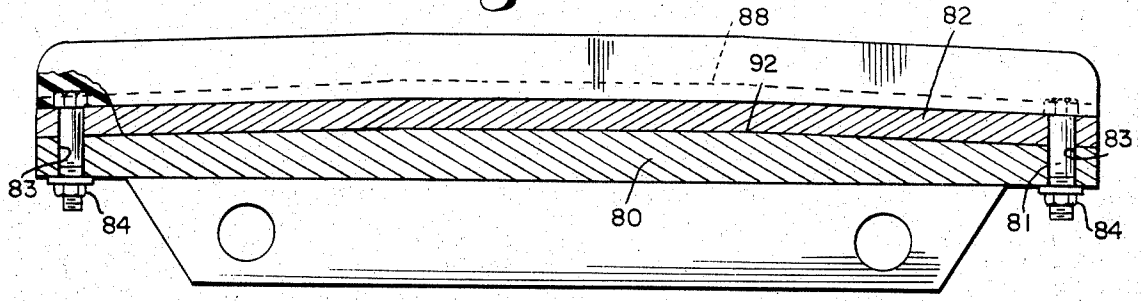

Fig. 10

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AIR SQUEEZE WARE TESTER

Hollow glassware, and certain other ware made from frangible material, must be capable of withstanding transaxial pressures up to specified minimums in order to be commercially acceptable; and it is therefore customary for manufacturers to subject such ware to calibrated pressure, whereby substandard ware is shattered and discarded, before delivering the ware. Heretofore, devices for so testing the ware have relied upon spring means for applying the pressure, whereby accurate calibration for containers of various sizes has been impossible. Furthermore, previously known devices for so testing ware have been relatively complicated and expensive and have been of such construction that fragments of shattered pieces have sometimes entered unbroken containers or have clogged the machinery.

The primary object of the present invention is to provide simple, inexpensive mechanism, readily introduced into a conventional conveyor line, for applying accurately calibrated transaxial pressure to each one of an advancing series of substantially identical articles of frangible ware. A further object of the invention is to provide such a device which is readily shiftable into a position in which the ware will by-pass the pressure-applying means.

Still another object of the invention is to provide such a device which includes means for shifting the ware, as it approaches the pressure-applying means, to an unstable position upon the conveyor means whereby, if any article is broken, all of its fragments will fall away from the mechanism and the conveyor. Another object of the invention is to provide, in connection with such shifting means, guide means cooperative with the upper ends of the pieces to restrain unbroken pieces against falling laterally from the conveyor.

Still another object of the invention is to provide, in connection with such apparatus, means whereby a piece of ware which has fallen into a prostrate position aligned with the direction of movement of the conveyor, will continue to move freely past the squeezing station without clogging the machinery, and will then be discarded from the line.

It is a further object of the invention to provide means whereby such a machine may be readily adapted to handle articles of various shapes, sizes and contours.

Still further objects of the invention will appear as the description proceeds.

To the accomplishment of the above and related objects, my invention may be embodied in the forms illustrated in the accompanying drawings, attention being called to the fact, however, that the drawings are illustrative only, and that change may be made in the specific constructions illustrated and described, so long as the scope of the appended claims is not violated.

In the drawings:

FIG. 1 is a plan view of an air squeeze ware tester constructed in accordance with the present invention, parts being broken away for clarity of illustration;

FIG. 2 is an end elevation of the same as viewed from the bottom of FIG. 1;

FIG. 3 is a side elevation taken from the right of FIG. 1;

FIG. 4 is an enlarged, fragmentary sectional view taken substantially on the line 4—4 of FIG. 1;

FIG. 5 is an enlarged, fragmentary, sectional view, taken substantially on the line 5 of FIG. 1;

FIG. 6 is a fragmentary view illustrating means for facilitating travel of a ware piece in prostrate position past the presser head;

FIG. 7 is a fragmentary view illustrating means whereby such a prostrate piece will be discarded from the travelling line of ware;

FIG. 8 is a view similar to FIG. 5 but showing a modified form of pressure head associated with a bottle of "fancy" configuration;

FIG. 9 is an elevation taken from the right of FIG. 8; and

FIG. 10 is a top plan view of the presser head of FIG. 9, shown partly in horizontal section.

Referring more particularly to the drawings, it will be seen that the illustrated embodiment of my tester includes a base frame indicated generally by the reference numeral 10 comprising four upstanding legs, three of which, 11, 12 and 13 are illustrated in FIGS. 2 and 3. Each leg includes rough adjustment means 14 and fine adjustment means 15 whereby a beam 16 spanning and joining the upper end of legs 11 and 12, and a beam 17 spanning and joining the upper ends of leg 13 and the unillustrated leg, may be leveled so that their upwardly presented surfaces 18, 18 will lie in a common, horizontal plane. Beams 16 and 17 may be joined as by spanners 73.

The tester comprises further an auxiliary frame indicated generally by the reference numeral 19. Four upstanding legs, three of which are illustrated at 20, 21 and 22, are adapted to register substantially with legs 11, 12 and 13, and the unillustrated leg, of the base frame 10. The legs 20 and 21 are supported from a slide rail 23, slidably mounted on the surface 18 of the beam 16, while the leg 22 and the unillustrated leg are supported from a similar slide rail 24 mounted to slide on the surface 18 of the beam 17. Thus, it may be conceived that the legs 21 and 22 constitute a first laterally spaced pair while the leg 20 and the unillustrated leg constitute a second laterally spaced pair.

A horizontal table 25 is supported from the leg pair 21–22 and a separate but coplanar table 26 is supported from the second leg pair. An upper shelf 27 supports the driving motor 28 which, through a speed varying device 29 of any kind is connected to drive a vertical shaft 30 which carries and directly drives a pulley or sprocket 31. A similar pulley or sprocket 32 is supported, in a common horizontal plane with the sprocket 31, upon a shaft 33 whose axis is parallel with the shaft 30; and a continuous belt conveyor 34 is trained about the sprockets 31 and 32.

In the optimum form, as illustrated, the conveyor comprises a pair of endless roller chains 35 and a series of blocks 37 each of which is formed, on its inner surface, with a pair of transverse sockets 36 receiving the chains 35 and secured thereto on the axes of the chain rollers. The outer surface of each block 37 carries a pad 38 of rubberoid or other frictional material. In the space between the sprockets 31 and 32, there are mounted back-up shoes 39, 39 bearing respectively, upon the inner surfaces of the active and inactive runs of the conveyor belt 34.

In FIGS. 1 and 2, I have illustrated a rectilinear fragment of a conventional, continuous belt conveyor 40. A conventional guideway 41, cooperative with the base portions of a continuous series of pieces of ware 45 movable on the conveyor 40 extends from a supply location (not shown) to a point near the entry side of the

tester, while a similar guideway 42 extends from a point near the exit side of the tester to a delivery point. An S-shaped section 43 of similar guide means extends from the terminus of the section 41 to a point near the active run of the conveyor 34; and a similar S-shaped section 44 extends from a point near the exit end of the conveyor 34 into registry with the guideway section 42. It will be seen, upon inspection of FIGS. 1 and 2, that guideway sections 41 and 42 are substantially centered relative to the platform or carrying surface of the conveyor 40, while the guideway sections 43 and 44 will cause advancing pieces of ware to move laterally relative to the conveyor 40 to an unstable position hanging over one edge of the conveyor 40, and thence back to a stable position.

Between the adjacent ends of the guideway sections 43 and 44 there is arranged a second guide means 46 adapted to cooperate with the upper ends of the pieces of ware 45 moving between the guideway sections 43 and 44. Said guide means 46 comprises a pair of screws 47 threadedly mounted in a frame element 48 for vertical adjustment and supporting, through swivel connections 49, a plate or bar 50 which closely overlies the open upper ends of ware pieces 45 as they pass between the adjacent ends of the guideway sections 43 and 44. Depending from the bar 50 and supported therefrom for adjustment toward and away from each other are the lips 51 which straddle the upper regions (for instance, the finish 52 of a bottle) of the articles 45 to hold them against lateral tilting.

A plate 53 is adjustably supported from the lower surface of the table 25. As is most clearly to be seen in FIGS. 1 and 4, each end of the plate 53 is formed with a pair of aligned, elongated slots 54. For each such slot, the table 25 is penetrated by a screw 55 whose shank receives a headed nut 56, the shank of said nut being guidingly received in the corresponding slot and the head thereof spanning its associated slot, whereby said plate is supported. It will be clear that the threaded engagement between the screw 55 and its nut 56 will clamp the plate 53 in any selected position of adjustment and that, upon loosening such threaded connection, the plate 53 may be adjusted toward and away from the active run of the conveyor 40.

As is most clearly to be seen in FIG. 2, a flange 57 depends from the terminal edge of the table 25 and a similar flange 58 depends from the adjacent end of the plate 53. Two parallel screws 59 are operatively engaged between the flanges 57 and 58 for shifting the plate 53. As shown, the screws are threaded through the flange 57 and have swivel connections with the flange 58; and lock nuts 60 may be threaded on the screws 59 for clamping engagement on opposite sides of the flange 57 to maintain any selected position of adjustment of said screws.

Two fluid motors 61, 61 are fixedly secured upon parallel axes to the lower surface of the plate 53. Each such motor, of course, includes a cylinder and a piston 74 reciprocable therein. Piston rods 62 project through corresponding ends of the motors 61 to support a presser head 63. As shown and preferably, each piston rod carries a clevis 64 (FIGS. 1 and 5) constructed and arranged to straddle a flange 65 of a base member 67, the clevises being secured to said flange by pivot pins 66 disposed upon axes parallel with the working surface of the active run of the conveyor 34.

A block 68 is suitably carried on that face of the base 67 remote from the flange 65, and a pad 69 of synthetic material is fixed to said block and presents a friction surface 70 toward the friction pads 38 of the blocks 37 of the conveyor 34, said surface 70 being generally parallel to the friction surfaces of the pads 38. Preferably, however, the opposite end regions of the pad surface 70 will retreat from the plane of the pads 38 as is clearly shown in FIG. 1, to facilitate entry of ware pieces between the pads 38 and 69, and departure therefrom.

For a purpose which will appear hereinafter, it is desirable that the lower region of the pad 69 shall have a coefficient of friction significantly less than that of the upper, major region of the pad. I have found that sheet urethane is a highly satisfactory material for the major portion of the pad 69, but that the lower region 71 should preferably be formed of a low-friction material such as Teflon.

The upward extent of the region 71 should be at least equal to the radius of the maximum transverse section of the ware pieces 45 being tested. Thus, if a ware piece should fall on the conveyor, so that it lies prostrate with its axis extending in the direction of travel of the conveyor 40, as suggested in FIG. 6, it will continue to travel freely with said conveyor with minimum frictional resistance to such travel. It will be clear that, so long as the ware pieces stand with their axes vertical, they will be urged to rotate upon their axes, not only by the force exerted against their sides by the traveling pads 38, but also by the frictional drag exerted upon them by the major areas of the pad 69. When, however, a ware piece falls into the prostrate position of FIG. 6, any frictional drag exerted by the presser head 63 would tend to resist movement of the piece under the influence of the conveyor 34; and the provision of the low-friction strip 71 obviates that tendency.

A control panel or box for the mechanism is suggested at 72 in FIG. 3. When the tester is to be used, the legs 21 and 22 are removed, carrying with them the table 25 and the presser head assembly including the plate 53 and the motors 61. Now, the machine is brought to a selected rectilinear portion of the conveyor 40 and is moved, from left to right as viewed in FIG. 1, into a position in which the conveyor 34 largely overlies the conveyor 40 with the active, vertical surface of the conveyor 34 disposed just above the upper surface of the conveyor 40 and close to the inner edge of the latter. Now, the legs 21 and 22 and their supported mechanism will be replaced. Guide sections 41 and 42, sized for supporting and guiding association with the lower regions of the ware to be processed are associated with the conveyor 40 and suitable guide sections 43 and 44 are also installed. The lips 51 of guide means 46 will be adjusted so that they will barely clear the upper regions of the ware to be processed, and screws 47 are adjusted to bring the plate or bar 50 to a level which will barely clear the upper extremities of the ware to be processed.

Now, the plate 53 will be adjusted by manipulation of the screws 59 to bring the surface 70 into a postion spaced from the pads 38 by a little less (perhaps one-eighth inch) than the diameter of the ware pieces when the pistons 74 are fully advanced, and the plate 53 is suitably locked or clamped in that position.

Now, the driving motors for the conveyors 40 and 34 are energized, and the speed varying means 29 is ad-

justed so that the longitudinal speed of the conveyor **34** is preferably slightly greater than that of the conveyor **40**; and ware pieces **45** are fed to the conveyor **40** at the above-mentioned remote source of supply.

Ware pieces will travel, substantially centrally located, upon the conveyor **40** until they encounter the guide means section **43** whereby, as they advance, they will be shifted laterally until they overhang the inner edge of the conveyor **40**, at which time their upper ends attain cooperative association with the lips **51** of the guide means **46**. At about this point, each ware piece will come into contact with the pads **38** of the active run of the conveyor **34**. Thus, the conveyor **40** and the conveyor **34** cooperate to introduce the ware pieces successively to the inclined surface at the end of the presser head pad **69**. It will be understood, of course, that gas (preferably air) under pressure of preselected value will have been introduced into the proximal ends of the cylinders **61** to press the pistons **74** into their limiting positions of projection of the head **63**. As a ware piece enters between the conveyor **34** and the presser head **63**, first one and then the other piston will be pushed toward the right as viewed in FIG. **1** until they occupy substantially the position suggested in that FIGURE. figure. the presser head will exert upon the ware pieces a force tending to crush the ware pieces, the degree of such force being dependent upon the controlled pressure of the gas supplied to the motors **61**. It will be appreciated, of course, that the force so applied to the ware will remain constant, regardless of the degree of movement of the pistons **74**, since the pressure within the motors **61** will remain constant at the supply value.

It will be appreciated, of course, that the presser head **63** is disposed in opposing registration with the active run of the conveyor **34** and that the back-up shoe **39** sustains the pressure which will be exerted by the presser head against the ware pieces **45** as they pass the testing station. The degree of pressure so exerted upon the ware will depend directly upon the pressure at which air, for instance, is supplied to the right hand ends of the cylinders **61**, since the plate **53** is adjusted to conform to the diameter of the ware pieces being tested in such fashion that, when at least one piece of ware is disposed between the active run of the conveyor **34** and the presser head **63**, the pistons **74** will be backed away from the adjacent ends of their cylinders.

So long as every piece of ware passing the presser head **63** is sufficiently strong to withstand the selected pressure applied thereto, ware will move sedately and without incident along the conveyor **40** past the testing station and to the remote end of conveyor **40**. If, through some mishap, a piece of ware should topple into the position suggested in FIG. **6**, it will be carried smoothly in its prostrate position past the presser head **63** to a point at the ingress end of the guideway section **44**, where that section is formed with a cutout **75** in the lower edge of its outer rail, sized to permit a prostrate piece to pass therethrough and roll off the outer edge of the conveyor **40** to drop into the pan, chute, conveyor or the like **76**. It is necessary, of course, to reject a piece of ware which has passed the tester in such a condition because it has not been subjected to the test pressure in the proper way. Pieces thus rejected, and which are not damaged when so rejected may, of course, be salvaged from among the fragments deposited in the pan **76**, to be rerouted through the tester at a later time.

When a defectively weak piece of ware is subjected to test pressure, it will be smashed. Its upper region will thus be withdrawn from the guide means **46** and, because the piece was located in an unstable position on the conveyor **40**, the fragments will all fall away from that conveyor and into the pan **76** for discard.

If desired, a stiff-bristled brush (not shown) may be mounted upon the auxiliary frame **19** with its bristles bearing upon the outer surface of the return run **77** of the conveyor **34** to remove any fragments which may adhere to the blocks **38**.

If, on occasion, it should be desired to refrain from subjecting a particular run of ware to the squeeze test, the guideway sections **43** and **44** may be removed, the legs **21** and **22** with the table **25** and its suspended parts may be removed, and the auxiliary frame **19** may be bodily shifted to the position illustrated in broken lines in FIG. **2**. Thereby, the conveyor **34** will be removed from its overlying relationship to the conveyor **40**, a straight section (not shown) of guideway may be inserted to connect sections **41** and **42**, the guideway **46** may be elevated to inoperative position and thereafter, of course, ware may be moved along the conveyor **40** without being subjected to the squeeze test and without interference by the parts of the ware tester disclosed herein.

Suitable means of any desired character may, if desired, be provided for shifting the frame **19** relative to frame **12** and/or for retaining the same in any position of adjustment, such a means being indicated by the reference numeral **78** in FIG. **2**. When, thereafter, it is desired to restore the tester to service, return of the auxiliary frame **19** to its original registry with the main frame **10** will, of course, reestablish the original relationship of the tester parts to the conveyor **40**.

In FIGS. **8** to **10**, I have illustrated a modified form of presser head designed to facilitate adaptation of the tester to bottles or other containers of unconventional contour. The reference numeral **80** indicates a base which is functionally similar to the base **67** of FIG. **5**. However, the base is formed, adjacent its opposite ends, with vertically elongated slots **83, 83** which receive screws **81, 81** projecting from the rearward face of a block **82** and nuts **84** threaded onto the screws **81** are effective to retain the block **82** in any selected position of vertical adjustment relative to the base **80**. A pad **90** of synthetic material similar to that of the pads **69** is bonded to the forward face of the block **82** and is suitably contoured to bear upon a selected surface, such as the waist **91**, of the bottle **89** illustrated in FIG. **8** to exert test pressure upon that selected portion of the article's surface. As shown, the lower edge of the base **80** may be provided with tapped holes **85** to receive screws **86** passing through holes **87** in a Teflon pad **88**, constructed and designed to bear upon another surface of the bottle **89** and to serve the purpose of the strip **71** of FIG. **5**.

Obviously, the adjustable mounting of the block **82** on the base **80** inherently affords flexibility in the use of the presser head assembly with various shapes of ware. Thus, a manufacturer may maintain a supply of block-and-pad elements which may be selectively used with a base **80** for cooperation with various stock sizes and shapes of ware to be tested.

In this form of presser head, the taper or retreat at the opposite ends of the presser head may be achieved by curving the face **92** of the cast base **80** and bending,

or even flexing, the block **82** and the pad **90** to conform to that curve, thus avoiding the necessity of forming the pad to varying thicknesses. Obviously, the same expedient may be used in the assembly illustrated in FIG. **5**.

I claim as my invention:

1. An air squeeze ware tester comprising an elongated, substantially horizontal platform for supporting, during transit, a succession of pieces of frangible ware in a substantially upright attitude, endless belt conveyor means with one run having a surface arranged to parallel the length of said platform and disposed substantially in a vertical plane and closely above the plane of said platform, a presser head having a surface disposed in registering opposition to said conveyor run, pneumatic means for urging said presser head toward said conveyor run, and means for driving said conveyor to move such pieces successively between and past said surfaces.

2. The tester of claim **1** including guide means cooperative with such pieces to move them laterally, as they advance, to overhang a lateral edge of said platform in an unbalanced condition when they are located between said surfaces.

3. The tester of claim **1** in which said pneumatic means comprises a cylinder supported near said platform on an axis transverse relative to the longitudinal dimension of said platform, a piston reciprocable in said cylinder and having a rod penetrating an end of said cylinder and extending toward said conveyor run, means operatively connecting said piston rod to said presser head, and means for supplying gas under controlled pressure to that end of said cylinder remote from said conveyor run.

4. The tester of claim **3** including means operable to shift said cylinder bodily toward and away from said conveyor run.

5. The tester of claim **3** in which said means operatively connecting said piston rod to said presser head includes a pivotal connection on a substantially vertical axis.

6. The tester of claim **5** in which said presser head is elongated in the direction of length of said platform and in which said presser head surface retreats from said conveyor run at each end of said surface.

7. The tester of claim **1** in which said presser head is elongated in the direction of length of said platform, said pneumatic means comprising a pair of cylinders, spaced apart in the direction of length of said platform and supported near said platform on parallel axes transverse relative to the longitudinal dimension of said platform, a piston reciprocable in each cylinder and having a rod penetrating an end of its cylinder and extending toward said conveyor run, pivot means for each piston rod, said pivot means being disposed on substantially vertical axes and connecting said piston rods respectively to said presser head adjacent opposite ends of said presser head, and means for supplying gas under substantially the same pressure to those ends of said cylinders remote from said conveyor run.

8. The tester of claim **7** in which said cylinders are supported from a common carriage, and means operable to shift said carriage, and therefore said cylinders, toward and away from said conveyor run.

9. The tester of claim **8** in which said presser head surface retreats from said conveyor run at each end of said surface.

10. The tester of claim **1** in which said platform is a second conveyor, and means for driving said second conveyor in the direction of travel of said one conveyor run.

11. The tester of claim **10** in which the driving means for one of said conveyors includes speed-varying means.

12. The tester of claim **10** including guide means paralleling said second conveyor beyond both ends of said first-named conveyor and cooperating with the lower portions of such pieces moving on said second conveyor to hold them near the longitudinal center line of said second conveyor, second guide means between said first-named guide means and each end of said presser head and cooperating with the lower portions of moving pieces to move them laterally relative to said second conveyor to an unstable position overhanging one edge of said second conveyor before they encounter said first-named conveyor and then back substantially to the center line of said second conveyor after they depart from said first-named conveyor, and third guide means cooperating with the upper portions of such pieces while they are between said surfaces to restrain them against lateral tilting.

13. The tester of claim **10** in which the major transverse dimension of each such piece is substantially circular in transverse section and the lowermost portion of said presser surface is anti-friction.

14. The tester of claim **10** in which such pieces are substantially cylindrical in transverse section and the lowermost portion of said presser surface, to a height above said platform at least equal to one-half the transverse dimension of said pieces, has a coefficient of friction less than that of said second conveyor.

15. The tester of claim **10** in which such pieces are substantially cylindrical in transverse section and the lowermost portion of said presser surface, to a height above said platform at least equal to one-half the transverse dimension of said pieces, has a coefficient of friction less than that of the remainder of said surface.

16. The tester of claim **10** in which such pieces are substantially cylindrical in transverse section and the lowermost portion of said presser surface, to a height above said platform at least equal to one-half the transverse dimension of said pieces, has a coefficient of friction less than those of the remainder of said surface, said second conveyor and said first-named conveyor.

17. The tester of claim **1** in which said presser head comprises a base, a block secured to said base, and pad means of synthetic material secured to said block to define said presser head surface, the upper portion of said pad having a coefficient of friction significantly higher than that of the lower portion thereof.

18. The tester of claim **17** in which said pad means is vertically adjustably supported relative to said base.

19. The tester of claim **17** in which said block is vertically adjustably carried by said base.

20. In a squeeze ware tester according to claim **1**, a base frame including a pair of beams supported from legs and formed to provide parallel, horizontal, upwardly presented surfaces elongated in a direction transverse to the direction of movement of such pieces of ware, said beam surfaces being disposed below the level of said platform, and an auxiliary frame comprising rail means longitudinally slidably disposed on each such beam surface, and leg means upstandingly supported on said rail means and supporting said conveyor

means, said presser head, said pneumatic means and said conveyor driving means above the level of said platform.

21. The assembly of claim **20** in which said auxiliary frame leg means comprises a first pair of legs and a second pair of legs, one leg of each pair being supported from one rail and the other leg of each pair being supported from the other rail, said presser head and said pneumatic means being supported from, and readily removable with, said first pair of legs.

* * * * *

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,777,556 Dated December 11, 1973

Inventor(s) Anthony T. Zappia

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

Column 2, line 8, "pressure" should be -- presser --; line 21, "end" should be -- ends --.

Column 5, lines 24 and 25, cancel "FIGURE."

Column 5, line 25, after "figure.", insert -- Thereby, --.

Signed and sealed this 23rd day of July 1974.

(SEAL)
Attest:

McCOY M. GIBSON, JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents