Sept. 29, 1964 M. D'APOLITO ETAL 3,150,806

MEANS AND METHOD FOR SELECTIVELY BREAKING FRAGILE MEMBERS

Filed April 10, 1962 7 Sheets-Sheet 1

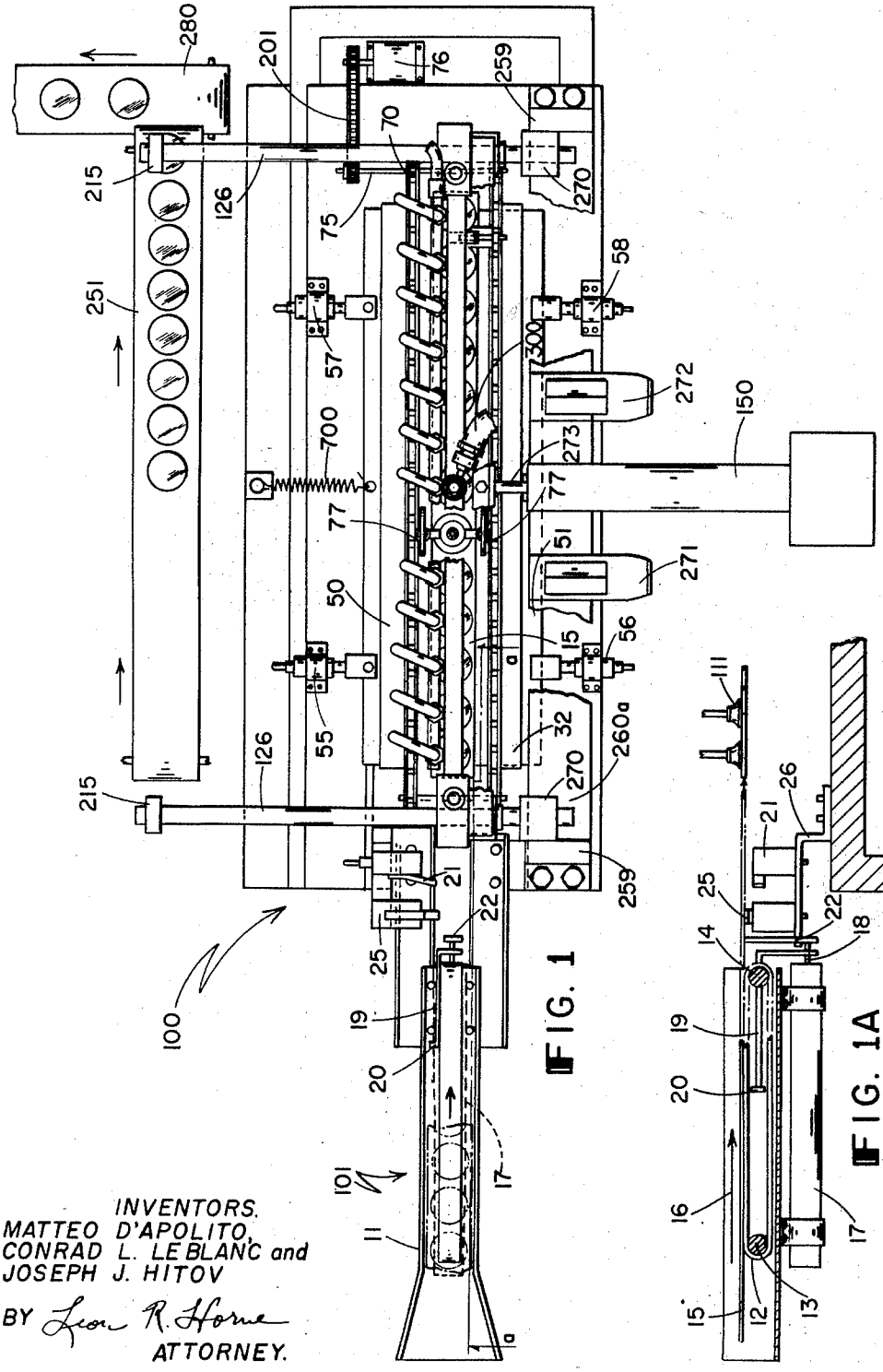

FIG. 1

FIG. 1A

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MEANS AND METHOD FOR SELECTIVELY BREAKING FRAGILE MEMBERS

Filed April 10, 1962 7 Sheets-Sheet 2

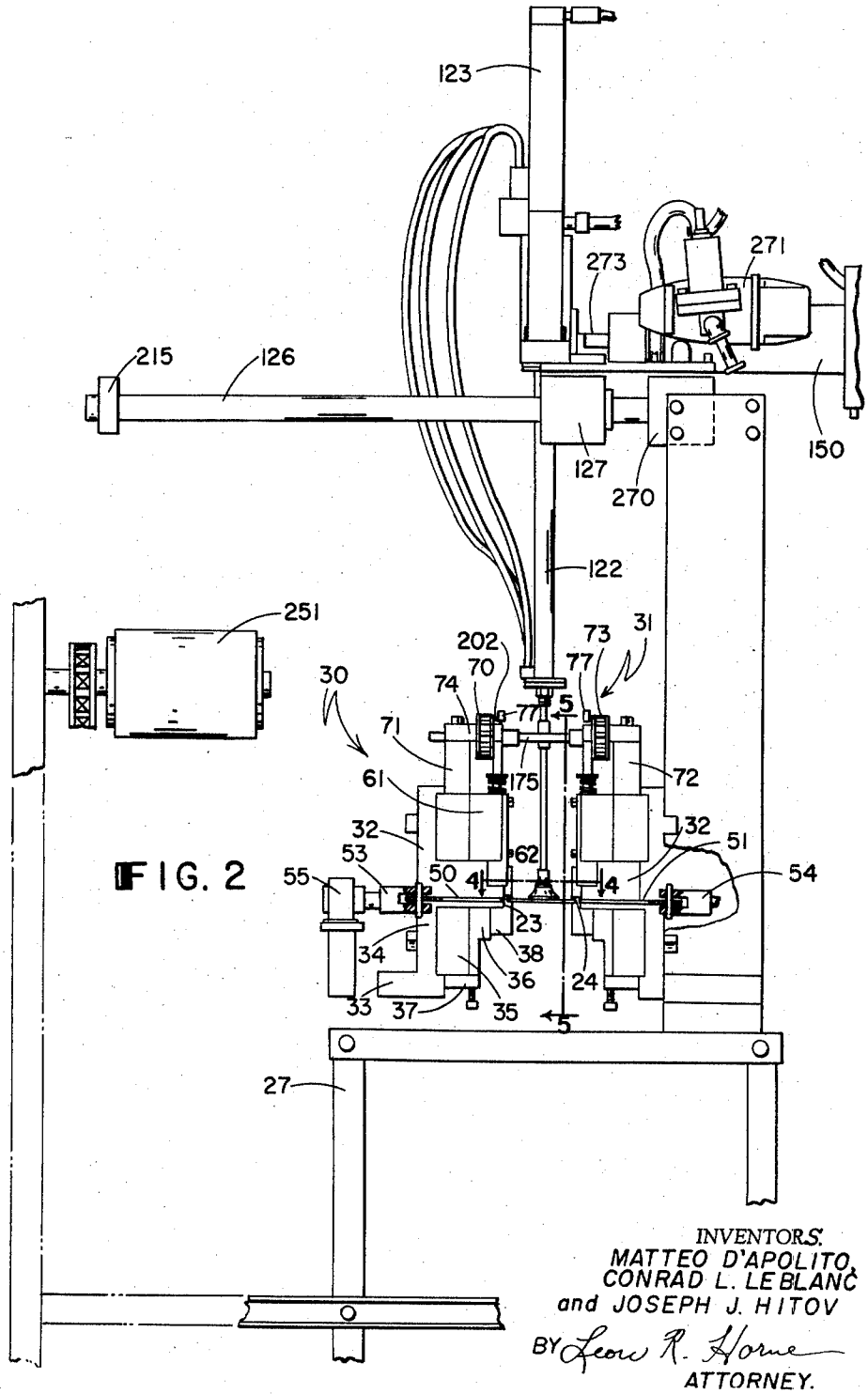

FIG. 2

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MEANS AND METHOD FOR SELECTIVELY BREAKING FRAGILE MEMBERS

Filed April 10, 1962 7 Sheets-Sheet 3

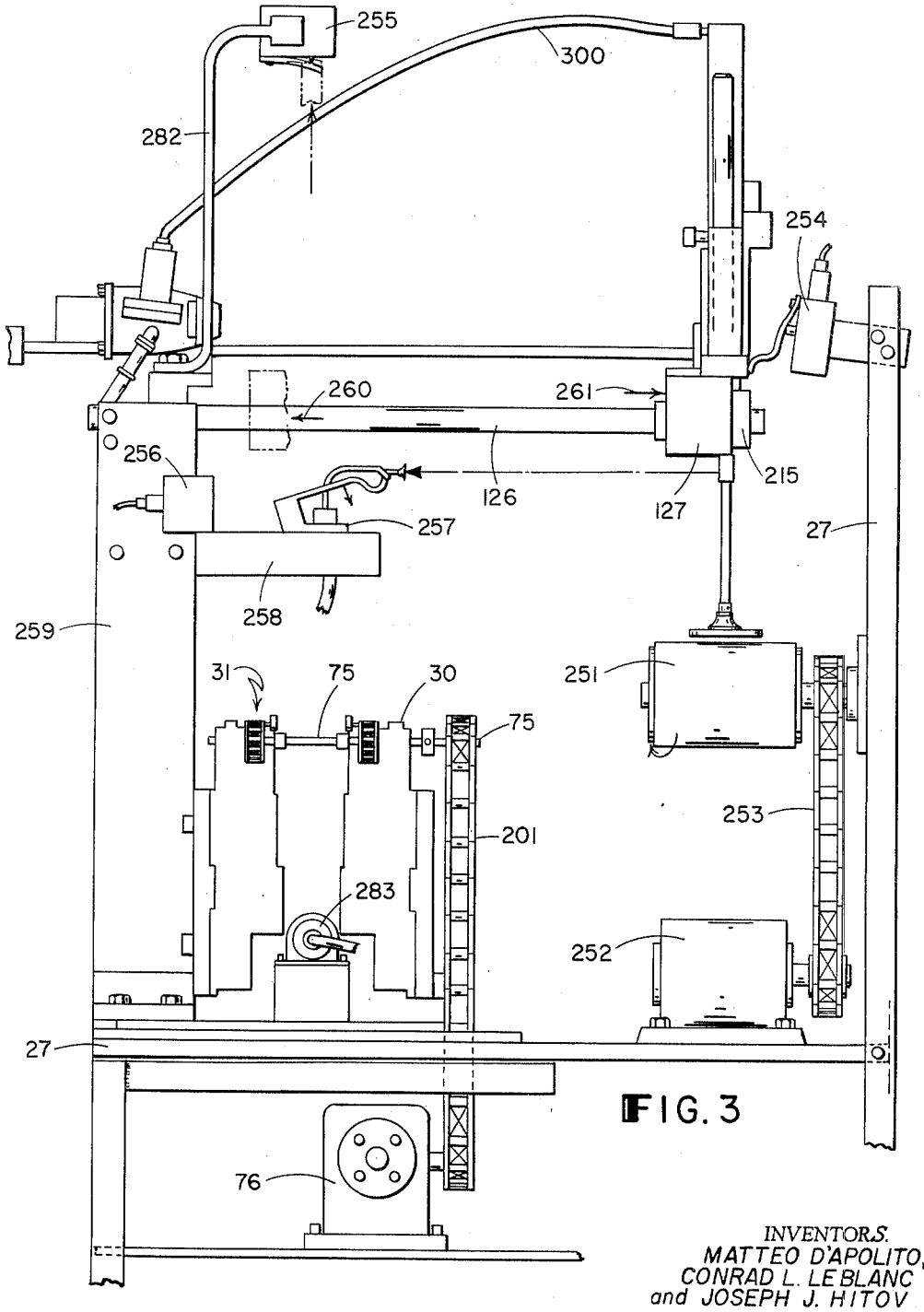

FIG. 3

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MEANS AND METHOD FOR SELECTIVELY BREAKING FRAGILE MEMBERS

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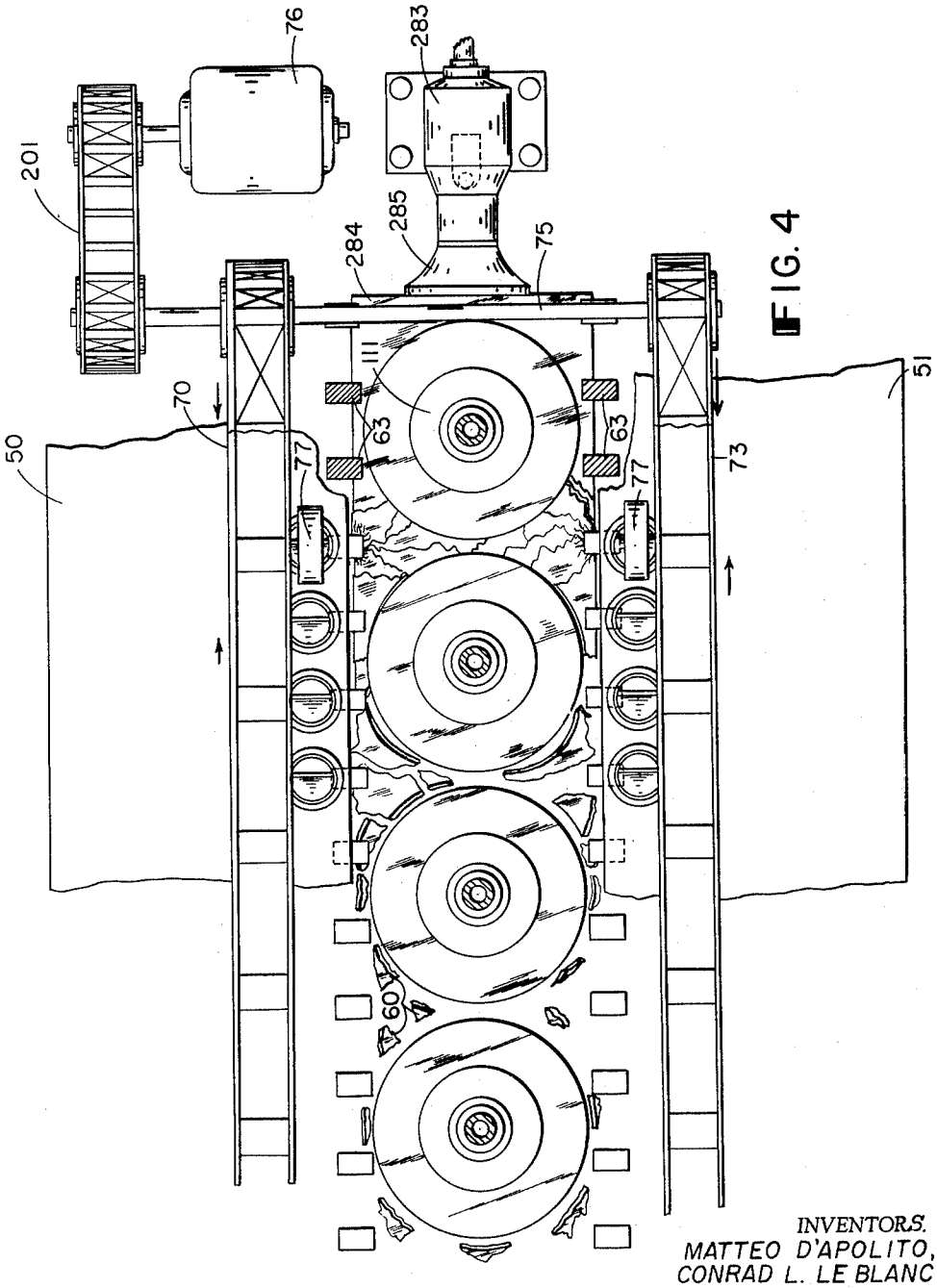

FIG. 4

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MEANS AND METHOD FOR SELECTIVELY BREAKING FRAGILE MEMBERS

Filed April 10, 1962 7 Sheets-Sheet 5

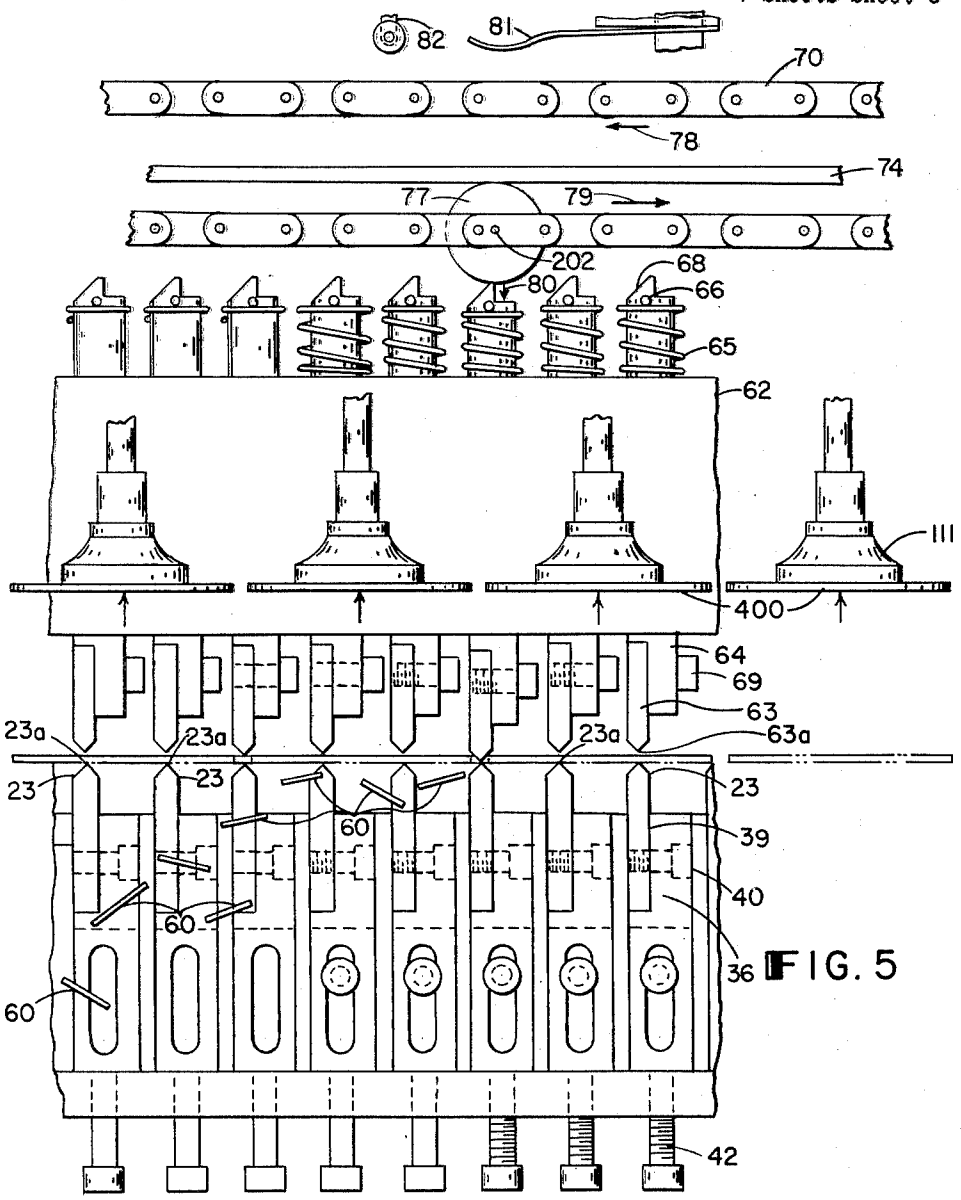

FIG. 5

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Sept. 29, 1964 M. D'APOLITO ETAL 3,150,806

MEANS AND METHOD FOR SELECTIVELY BREAKING FRAGILE MEMBERS

Filed April 10, 1962 7 Sheets-Sheet 6

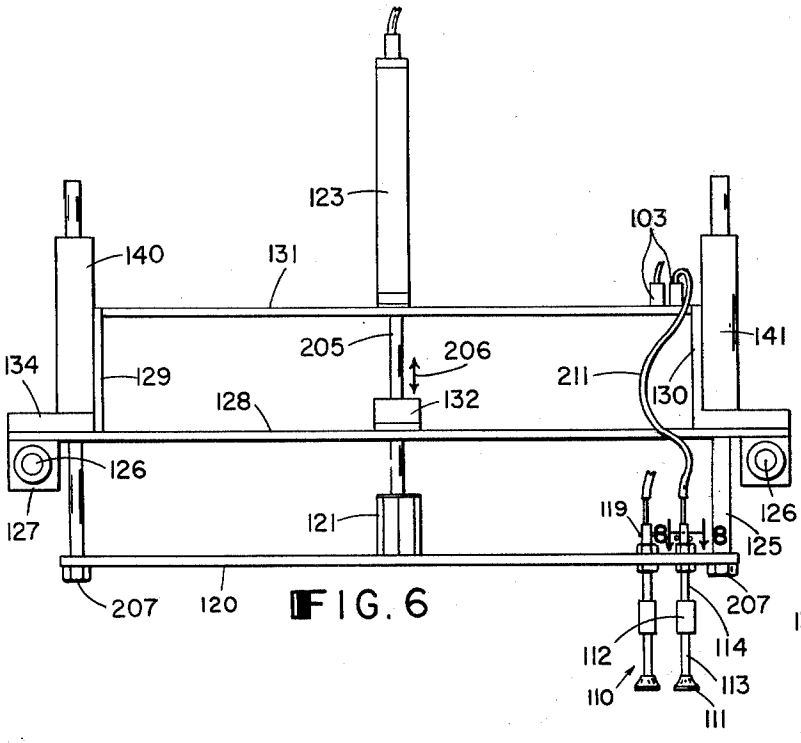

FIG. 6

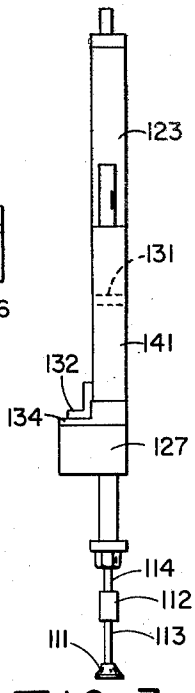

FIG. 7

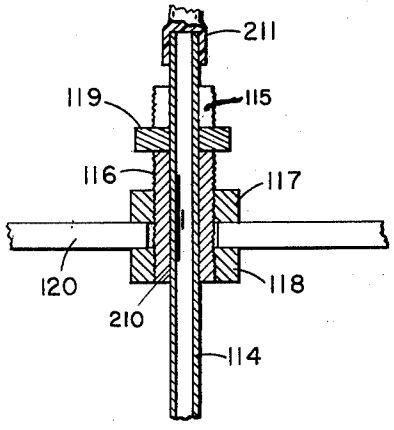

FIG. 9

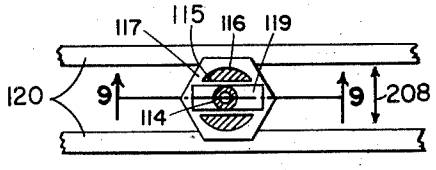

FIG. 8

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Sept. 29, 1964 M. D'APOLITO ETAL 3,150,806

MEANS AND METHOD FOR SELECTIVELY BREAKING FRAGILE MEMBERS

Filed April 10, 1962 7 Sheets-Sheet 7

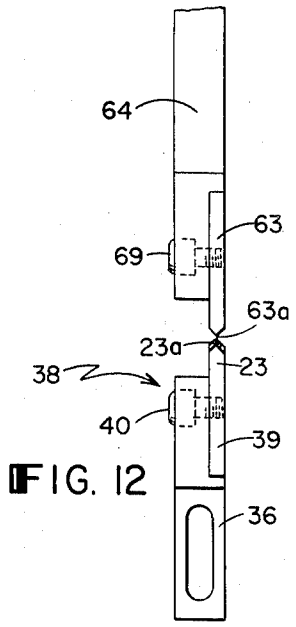

FIG. 12

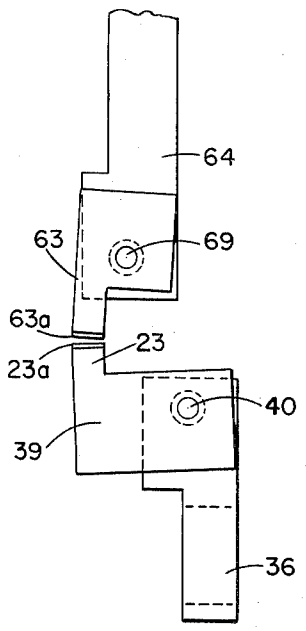

FIG. 11

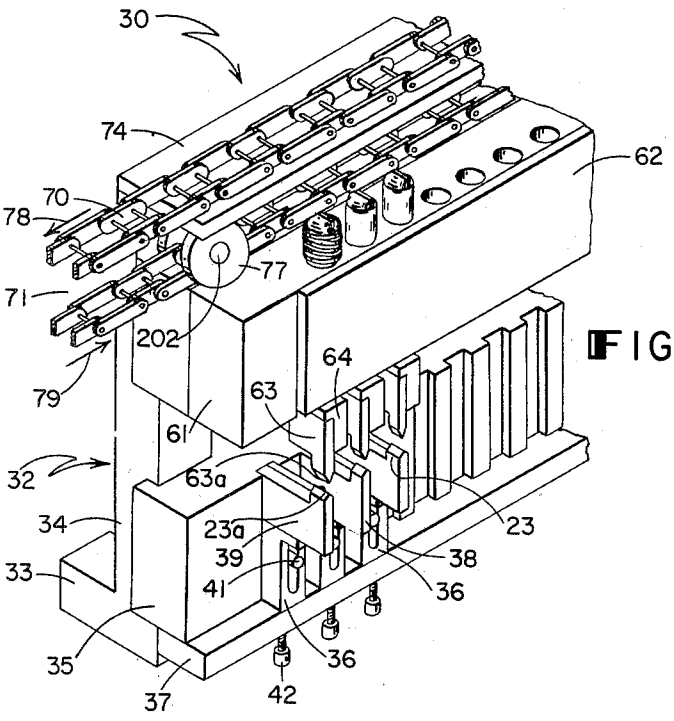

FIG. 10

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United States Patent Office 3,150,806 Patented Sept. 29, 1964

3,150,806

MEANS AND METHOD FOR SELECTIVELY BREAKING FRAGILE MEMBERS

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Filed Apr. 10, 1962, Ser. No. 186,398
12 Claims. (Cl. 225—2)

The present invention relates generally to a means and method for seletively breaking frangible members. More specifically, this invention relates to a novel and improved machine and method for breaking glass members along prescored lines to obtain shaped glass articles.

It is well known that forming or breaking predetermined shaped glass articles from glass sheets or members is a delicate procedure. Due to the highly frangible nature of glass, many problems have been met in designing machines and method for automatically breaking glass to form predetermined shaped articles. For example, breakage of the articles, poor efficiency and erratic operation commonly occur. These problems are compounded when the glass articles to be formed are completely surrounded by the glass to be separated or broken therefrom. In many cases the problems have been insurmountable and inefficient hand operated devices must be employed.

Accordingly it is an object of this invention to provide a novel and improved machine for forming or breaking predetermined shaped glass articles from scored glass sheets.

It is another object of this invention to provide a novel and improved machine for forming or breaking predetermined shaped articles from scored glass sheets and having means for removing the articles from the machine. The machine of this invention is designed to operate with certainty to successively and efficiently break predetermined shaped glass articles from scored glass sheets. The machine is also designed to be relatively simply constructed with a minimum of expense.

The invention also has as an object the provision of a novel and improved method for forming or breaking predetermined shaped glass articles from scored glass sheets.

The device of this invention is relatively low in cost and may function for long periods of time without changes or adjustment of components. The device may be employed to break or form a variety of different shapes without any need for adjusting members of the machine. The machine of this invention is particularly useful for forming circular, oval or other curved, substantially planar shapes for use in eye or sun glass lenses, clock faces, microscope cover slips, etc.

The machine of this invention basically comprises a breaking means for applying a breaking force to selected successive areas of glass members, a retaining and removal means for holding scored glass articles prior to formation thereof from a glass member and for removing and transferring the glass articles after formation thereof from one section of the machine to a second section of the machine. In a preferred form, the breaking means comprises a plurality of individually activated breaking jaws positioned on either side of a scored glass member during operation of the machine. A series of switches and controls may be employed to activate various movements of the machine.

The novel and advantageous method of this invention basically comprises the steps of positioning a glass member having prescored areas thereon in a breaking machine, applying a retaining means on the prescored areas which exert a slight downward force to these areas, successively breaking glass portions outside of the scored areas by employing a pinching force and allowing the formed pre-

scored areas to drop slightly due to the force exerted thereon.

Numerous other features, objects and advantages of the present invention will become apparent from the following specification when read in connection with the accompanying drawing, in which:

FIG. 1 is a top plan view of a preferred embodiment of the machine of this invention;

FIG. 1*a* is a side sectional view taken through line *a*—*a* of FIG. 1;

FIG. 2 is a left side view of the machine of this invention;

FIG. 3 is a right side view thereof;

FIG. 4 is a fragmentary top cross sectional view taken through line 4—4 of FIG. 2 and showing certain related elements;

FIG. 5 is a fragmentary cross sectional view taken through line 5—5 of FIG. 2;

FIG. 6 is a fragmentary cross sectional view of an element of the preferred embodiment of this invention;

FIG. 7 is a side view of the element shown in FIG. 6;

FIG. 8 is a top plan view taken through line 8—8 of FIG. 6;

FIG. 9 is a side cross sectional view taken through line 9—9 of FIG. 8;

FIG. 10 is a fragmentary perspective view of an assembly of this invention;

FIG. 11 is a side view of a portion thereof; and,

FIG. 12 is a front view thereof.

The preferred embodiment of the machine of this invention is designated generally at 100 in FIG. 1. A feeding means designated generally at 101 is shown associated with the machine. The machine 100 is designed to break circular glass lenses from a glass strip or member approximately 26" long and 2½" wide having a thickness of 0.053". Glass strips of this type are successively scored with twelve circular lenses 400 and directed to the feeding means 101 by any conventional feeding device. Feeding means 101 comprises an outwardly flared funnel shaped guide channel 11 and an endless belt 12 mounted on shafts 13 and 14. Scored glass strips 15 are successively fed to the edge of the endless belt 12 which carries them forward in the direction of the arrow shown at 16. An air cylinder 17 having a reciprocal piston 18 is mounted on the underside of guide channel 11. An integral angle extension 19 is provided on the forward end of the piston 18 having an actuating lip 20 for actuating a lever of a microswitch 21. A flat plate 22 extends upwardly from and is integrally affixed to the forward end of the piston 18 and has an upper edge which is aligned with the plane of the endless belt 12 as clearly seen in FIG. 1*a*. The glass strip 15 is moved by the belt 12 into the machine and is supported within the machine by a lower aligned series of jaws 23 and 24 as best seen in FIG. 2. When the glass strip 15 has been pushed partially into the machine by the conveyor belt 12, the rear edge thereof tends to drop slightly as it leaves the end of the conveyor belt nearest the machine and thus trips a lever of a microswitch 25 supported on a bracket 26 of the machine frame 27. The microswitch 25 actuates the air cylinder 17 causing piston 18 to move forward. The forward motion of the piston 18 causes plate 22 to push the glass strip 15 into the machine into its final position shown in FIGS. 1 and 4. At the forward stroke of the piston 18, the lip 20 trips microswitch 21 which starts the action of the glass breaking machine as will be described more fully hereinafter.

The breaking means of the machine comprises two breaking sections 30 and 31 which are mirror images of each other. In order to simplify the description only breaking section 30 will be discussed in full, but it should be understood that breaking section 31 is composed of

similar elements. The breaking section 30 has a casting 32 which forms a mounting for mounting the section 30 on the frame 27 of the machine. The particular shape of the casting 32 may vary in accordance with established mechanical procedures. Preferably the casting 32 comprises a lower outwardly extending mounting flange 33 suitably affixed to frame 27 and an upright member 34, a housing block 35, and a bottom screw mounting plate 37. Lower breaking die or jaw members 38 are fixedly mounted in the housing block 35 by plate 37 and breaker holders 36. As best seen in FIGS. 5 and 10 each lower die member 38 comprises a section 39, fixedly attached by bolts 40 to a holder 36 which is slidable within vertical grooves in the housing block 35. The location of the sections 39 may be vertically adjusted by means of set screws 42 mounted on the lower plate 37 and set screws 41 mounted on block 35. At the top of each section 39 is a cutting or breaking jaw or die portion 23 which extends above the section 39 as most clearly seen in FIGS. 2 and 10. The breaking jaw 23 is preferably composed of a hardened steel material and is adapted to apply a sharp breaking force to a glass member along a substantially straight edge 23*a*. A total of 42 breaking jaws 23 are employed in section 30 in the preferred embodiment of the machine. All of the breaking jaws 23 are axially aligned with corresponding upper cutting or breaking members as will be discussed hereinafter. Further the breaking jaws are arranged so as to lie substantially within the same plane throughout the length of the machine as best seen in FIG. 5. When a glass strip is placed in the machine it lies on and is supported by a series of breaking jaws 23 and 24 in the sections 30 and 31 respectively as most clearly shown in FIGS. 2 and 5.

Centering and glass clearing plates 50 and 51 are provided in sections 30 and 31 respectively and provide a means for positioning glass members in the machine. The plates 50 and 51 are substantially rectangular, planar metallic members which are respectively mounted on forked end pistons 53 and 54 of air cylinders 55 and 56 at one end of the machine. At the other end of the machine, the plates 50 and 51 are respectively mounted in the same manner on air cylinders 57 and 58. The inner edges of plates 50 and 51 lie on the breaking jaws 23 and 24 and are substantially parallel to each other, as clearly shown in FIG. 2. These plates are adapted to reciprocate horizontally into and out of a central area of the machine between sections 30 and 31. Upon actuation of one of the plates, the glass strip positioned in the machine is forced into engagement with the inner edges of plates 50 and 51 thereby properly positioning the glass member within the machine for subsequent processing. At the completion of the breaking cycle, as will be more fully described hereinafter, both plates 50 and 51 are actuated to move inwardly thereby clearing any broken glass that may tend to lock between the jaws 23 or the jaws 24. Broken glass is then removed from the machine by the force of gravity as clearly seen in FIG. 5 wherein glass fragments 60 are shown falling between the sections 30 and 31. These glass fragments may be collected in a collection receptacle placed under the frame of the machine.

The upper portion of section 30 provides an upper housing block 61 and a cover plate 62. As was clearly shown in FIGS. 5 and 10 a series of upper breaking die or jaw members 63 are each firmly affixed to reciprocal shafts 64 by means of lock screws 69. Each jaw member has a substantially straight breaking edge 63*a*. The shafts 64 and jaw members 63 are spring biased by springs 65 which bear against the mounting block 61 at one end thereof and a retaining pin 66 at a further end thereof. In FIG. 10 the springs 65 are not shown. The upper ends of the shafts 64 are angled as shown at end 68.

It can be readily seen that as each end 68 is forced downward the jaw members 63 will be brought towards section 39. Downward movement of each jaw member 63 causes a breaking force to be applied to a glass strip lying between breaking edges 23*a* and 63*a*.

The breaking or cutting edges 23*a* and 63*a* are formed by V-shaped ends of jaws 23 and 63 respectively and are planarly aligned as shown in FIG. 12, preferably in a vertical plane. The cutting edges are also tilted with respect to each other as clearly shown in FIG. 11, so that they would meet at an acute angle if extended. The planar alignment and angular relationship are important and coact to provide a squeezing or pinching action to glass members when the edges 23*a* and 63*a* are brought toward each other. It is also important that sharp impact of the edges 23*a* with the glass members be avoided as will be discussed hereinafter.

An actuating means for successively activating individual sets of jaw members is provided on an upstanding support bar 71 of section 30 and an upstanding support bar 72 of section 31. The actuating means comprises an endless chain 70 supported on section 30 and a similar chain 73 supported on section 31. The actuating means for each of the sections is identical and only the actuating means for section 30 will be described for purposes of simplifying the specification. The chain 70 extends throughout the length of the machine as clearly shown in FIG. 1 and is mounted at the forward end of the machine by a freely rotating sprocket not shown, which is mounted on a shaft 175 which extends between sections 30 and 31 and is suitably journaled in these sections by conventional means. The other end of the chain drive is mounted on a sprocket, not shown, and suitably journaled on a rotating drive shaft 75 which is suitably journaled in conventional journals mounted on sections 30 and 31. Drive shaft 75 is actuated by a belt or chain drive 201 which is driven by a motor 76 as clearly shown in FIG. 3. A cam 77 is attached to one link of the chain 70. In the embodiment shown cam 77 is a rotatable wheel pivotably mounted on a link of chain 70 by a pivot pin 202. A back-up plate 74 is located between upper and lower lengths of the chain 70 as clearly shown in FIGS. 5 and 10. The plate 74 is mounted on the upstanding support 71. Upon actuation of the chain 70 in a direction shown by the arrows 78 and 79, the cam 77 successively actuates the upper jaw members 63 by pushing each one of these members downwardly in the direction of the arrow shown at 80 as the chain rotates. As is clearly shown in FIGS. 5 and 10, the angled ends 68 allow each jaw member 63 to be steadily lowered into engagement with an underlying glass member without application of a sharp impact force. It should be noted that cams 77 on each section 30 and 31 act to simultaneously depress directly opposed jaw members on each side of the machine.

The cam 77 has a further function in that when it reaches a lever of a microswitch 81 shown diagrammatically in FIG. 1 it deactivates the drive or actuating motor 76.

Another important section of the machine comprises a means for holding scored glass areas of the glass strip during the breaking process and for removing and transferring shaped completed glass articles from the breaking area to a collection zone. This means is shown most clearly in FIGS. 6–9. A frame section is provided comprising an upper horizontal brace bar 131 fixedly attached at its ends to vertical brace bars 129 and 130 which are in turn fixedly attached to a lower horizontal brace bar 128. Ends of brace bar 128 are affixed to sliding horizontal reciprocal blocks 127. Tubular sliding guides 140 and 141 are vertically positioned and affixed to brace bar 128 by suitable means such as angle iron members 134. Vertical guide shafts 125 are slidably mounted in guides 140 and affixed as by bolts 207 to either end of a lower cross bar 120. Conventional means such as brazing, welding or bolting may be employed to form fixed joints between the affixed members of the machine.

A vertical air cylinder **123** is affixed to upper brace bar **131** and has a reciprocal piston **205** slidably mounted within a bore of an attachment block **132** affixed to brace bar **128**. The piston **205** is affixed by an attachment nut **121** to the lower cross bar **120**. Movement of piston **205** in the directions shown at **206** causes cross bar **120** to move up or down along with vertical guide shafts **124**.

The cross bar **120** preferably has an elongated notch **208** for mounting of suction units **110**. The suction units **110** each comprises a suction cup **111** attached to a rigid tube **113**. The rigid tube **113** is connected to a rigid tube **114** by means of a thin resilient rubber hose **112**. The rigid tubes are preferably formed of metal or rigid plastics. The rubber hose may be composed of any resilient material which allows a small degree of movement between tubes **113** and **114** thereby enabling the hose to act as a shock absorber when the suction units are dropped onto the glass member.

The upper end of tube **114** is mounted on cross bar **120** by a threaded ferrule **116**. The outer threads of the ferrule carry nuts **117** and **118** which lock the ferrule on bar **120** at predetermined points in a slot or notch **208** as most clearly seen in FIG. 9. A hollow bore **210** slidably received tube **114**. A slide detent **119** is affixed to tube **114** and normally rests at the bottom of a U-shaped vertically arranged slot in ferrule **116**. When an upwardly directed force is applied to suction cup **111** the tube **114** and slide detent **119** move upwardly in bore **210**. When the force is released, gravity pulls the elements back to their normal position as shown in the drawings.

A flexible air suction tube **211** connects tube **114** to an air suction fitting **103** mounted on bar **131**. In FIG. 1, bar **131** is offset and bar **128** broken in order to clarify and simplify the understanding of the invention. A plurality of suction fittings **103** are provided on bar **131** corresponding in number to the tube suction units. Each fitting is connected to an air suction bore (not shown) in bar **131** which is in turn connected to an air suction source.

The horizontally reciprocal sliding blocks **127** are bored and slidably mounted on horizontal, parallel aligned guide shafts **126**. This mounting provides for horizontal movement of the suction unit as best shown in FIG. 3. The suction unit moves from the position shown at **260** to the position indicated in full lines in FIG. 3. The unit is reciprocal in the directions of the arrows shown at **260** and **261**. The guide shafts **126** are each fixedly mounted to mounting blocks **270** which are suspended from and fixedly attached to vertical rising support member **259** which are in turn affixed to the frame **27** of the machine. A flat plate **260***a*, shown broken away in FIG. 1, provides a bracing means for the top edges of the vertical rising support members **259**. The bracing plate **260***a* further carries appropriate air valves **271** and **272** which are linked to the air suction system of the machine.

Affixed to the bracing plate **260***a* is a horizontally located air cylinder **150** having a piston **273** which is normal to the lower brace bar **128** and firmly affixed to the horizontal attachment block **132** thereon. Reciprocal movement of the piston **273** in a direction axial to the cylinder **150** actuates the suction units to move horizontally as described above with reference to FIG. 3. This movement is actuated after breaking of the prescored glass areas of the glass member in the machine and lifting of these elements to a stop position as will be described more fully hereinafter.

Stop members **215** limit travel of the suction units in the direction of the arrow shown at **261**. When the suction units reach the stop members **215** the scored glass areas which have been separated and broken from the glass grip member are positioned directly above a conveyor belt **251** which is driven by a suitable chain and motor mechanism as shown at **253** and **252**, respectively, in FIG. 3. In this position a microswitch **254** is actuated by abutment of brace bar **128** with a lever arm thereof, causing a cut off of the air suction supply to the suction cups **111**. At this time, the shaped glass areas will drop onto the endless belt conveyor **251** and be carried away from the machine. The suction unit is then free to move back to its original position directly between sections **30** and **31**. When the original position is reached, the suction cups are free to move downwardly upon actuation by air cylinder **123** and piston **205** to grip a glass member which may be supplied to the machine.

The separated prescored glass areas or lenses are deposited by the belt **251** onto a second endless belt **280** which remove the lenses to other areas for further operation.

Microswitches **255**, **256** and **257** are provided mounted on vertical support members such as **282**, **258** and **259** at the right side of the machine. The operation of these microswitches will be described hereinafter.

Also provided in the machine is a stop unit **283** which preferably comprise a suction cup or rubber stopper **285** which is adjustable by means of the piston of an air cylinder (not shown) mounted in the stop unit **283**. The front edge of the rubber stopper **285** provides a stop means for limiting the travel of the front edge **284** of the glass strip **15** into the machine. Preferably the stopper **285** retracts after the glass strip **15** is positioned in the machine and returns to its original position after the breaking operation.

The operation of the machine of this invention is simple, efficient and accurate. In the resting position the suction units of the machine are vertically aligned with a plane drawn through the center of the space between sections **30** and **31**. The face of the suction cups **111** are horizontally located slightly above the plane formed by the top surface of the conveyor belt **251**. The machine is actuated by applying suction in line **300** to the suction cups **111** while they are in the resting position. Conveyor belt **12** is then actuated to move in a clockwise direction and a glass strip **15** approximately 2½" wide and 26" long and having approximately twelve generally circular areas or lenses scored thereon is fed into the funnel end of channel **11** and is carried forward towards the machine by conveyor belt **12**. When the rear edge of the glass strip has been pushed off the conveyor belt it tends to slide toward the machine and drop slightly. The glass strip **15** is steadily pushed into the machine and slides along breaking jaws **23** and **24** as most clearly seen in FIGS. 1 and 2. When the rear edge of the glass strip leaves the conveyor belt **12** the inertia imparted by the conveyor belt causes the glass strip to slide forward in front of the lip **22** and to drop slightly thus activating microswitch **25**. The microswitch **25** activates air cylinder **17** causing the piston **18** to move forward and lip **22** pushes the glass strip into its final position with its leading edge **284** abutting stop **285**.

Lip **20** affixed to the piston **18** also moves forward and engages the lever arm of microswitch **21** which activates the suction unit to move downwardly. The microswitch **21** further activates an electric timer which causes the controls to the air cylinder **123** to allow the piston **205** to move downwardly for a predetermined time and then automatically move upwardly to its original position after a slight pause in its lowermost position when the suction cups **111** are resting on and affixed to the glass member **15**. Just before the suction cups **111** reach the glass strip **15**, the lower cross bar **120** trips a lever of microswitch **256** thus activating motor **76** and causing the chains **70** and **73** to rotate. At this point the suction cups **111** become firmly attached to the lenses due to the suction applied. The chain drive causes cam **77** which is normally positioned just between the air valve **82** and the microswitch **81**, to activate the air valve **82**. The air valve **82** in turn activates air cylinders **56** and **58** which causes the plate **51** to move towards the center of the machine and firmly position a glass strip

member 15 between the plates 50 and 51. It should be noted that cams 77 on each of sections 30 and 31 move simultaneously and are arranged to activate directly opposed upper breaking jaws 63 of the sections 30 and 31 simultaneously. The breaking jaws 63 are activated, one set on either side of the machine, successively from the loading end, nearest the conveyor belt 12 to the last set of breaking jaws 63 nearest the stop member 285. Approximately 42 sets of breaking jaws are thus activated in each section 30 and 31.

The foregoing movements of the machine create a breaking action that is certain and efficient. The glass lenses which have been prescored are easily broken from the surrounding glass strip member with accuracy and without chipping or harm to any portions of the preselected area. This ease and certainty of forming of the glass lenses is due primarily to two actions of the machine. The first action as has been described above is the successive breaking action of the jaw members with a squeezing or pinching action.

The second important factor is that the suction cups exert a slight downward pressure on the scored lenses when in their lowermost position. There is a certain amount of overtravel to the piston 205 which allows the suction cups 111 to rest on the lenses. Further movement of the piston 205 and cross bar 120 causes the slide detent 119 and tube 114 to move relative to the threaded ferrule 116. In effect the U-shaped portion 115 of the ferrule is moved downwardly while the slide detent remains stationary and locates itself at the top of the U-shaped opening 115. In this position the weight of the slide detent, tube 114, tube 113, rubber hose 112 and suction cups 111 rest upon the lens area of the glass member and apply a slight downward pressure. After the breaking jaws 63 have been actuated this slight downward pressure, due to the force of gravity, causes the lenses to drop slightly preferably approximately one quarter of an inch. The downward movement of the lenses clears each lens from the glass strip member as it is broken. Thus, as each lens is broken it tends to drop slightly and in effect is no longer part of the glass strip member.

After the cam 77 has actuated all of the breaking jaws it returns along the upper portion of the chain and activates the lever of microswitch 81. Microswitch 81 turns off the motor 76 and thus the breaking jaws are deactivated. At this point the timer on the air cylinder 123 actuates the piston 205 to move upwardly to its original position locating the suction units 110 on a plane slightly above the plane of the top surface of the conveyor belt 251. The upward movement of the guide shaft 124 is terminated when it abuts and actuates a microswitch 255 having an adjustable actuating arm.

The microswitch 255 in turn actuates air cylinder 150 which causes piston 273 to more horizontally toward the conveyor belt 251. The piston 273 slides the entire holding and transfer means over to a position directly above conveyor belt 251. At this point brace bar 128 trips a control member of the microswitch 254 which activates a cut off switch to release the suction applied to the suction cups 111 and the completed glass lenses are deposited upon the conveyor belt 251. The lenses may be further transferred to a second conveyor belt 280 and carried away from the machine to a suitable area. A timer on the air cylinder 150 then returns the piston 273 to its position as shown in FIG. 1. As the right end sliding block 126 returns to its resting position it activates a lever of microswitch 257 which in turn activates the air cylinders 56, 57, 58 and 55 to move plates 50 and 51 toward each other and clear any broken glass 60 that may be jammed between the lower breaking members. Release of the lever of microswitch 257 allows the plates 50 and 51 to return to their original position as shown in FIG. 2. Alternatively a spring means 700 attached to the machine frame at one end and to the plate 50 at a second end may be employed to return the plate 50 to its original position. The return of the suction units to their original resting position ends the cycle of the machine.

Throughout the specification and drawings elements have been simplified in order to clearly define applicants' invention. For example in FIG. 5 only certain ones of the breaking means and suction units have been shown for purposes of simplicity. Further, only portions of the frame structure of the machine have been shown in order to simplify the drawings. However it will be understood that one skilled in the art may easily employ conventional frame structures. Conventional electrical circuitry and air suction attachments may be employed to interconnect the various switches and actuating means in the present invention.

The novel and improved machine of this invention provides a means for carrying out a unique and advantageous method of breaking prescored areas of glass from a glass member. Preferably the method of this invention comprises positioning a glass member with its outer edges resting upon a series of parallel substantially planarly aligned lower breaking jaws, successively bringing mating upper breaking jaws together thereby squeezing edges of the glass member while simultaneously applying a slight downward pressure to the prescored areas of the glass member. The specific pressure required varies with the thickness of the glass. Preferably the pressure is sufficiently high to impart downward movement to each scored area as it is separated from the glass member by the breaking action.

While the specific preferred embodiments of this invention have been described and illustrated many variations of the invention are possible. For example, there has been described a device having twelve suction cups and 42 breaking jaw sets. However, it is possible to vary the number of suction cups and breaking jaws depending upon the size and number of the areas to be broken and the size of the glass members employed. It should further be understood the terms such as upward, downward, rearward, etc., are relative terms and are not intended to limit the invention. Various automatic feeding means may be employed, or alternatively, hand feeding may be employed.

All such variations and modifications are intended to be covered by the present invention which is to be limited only by the scope of the following claims interpreted in the light of the prior art.

What is claimed is:

1. A machine for breaking a plurality of predetermined shaped glass articles from scored glass members, said machine comprising,

breaking means including sharp wedge shaped cutting teeth located adjacent the edges of said glass members and on opposite sides thereof; said cutting teeth extending only over the non scored waste areas of said glass member; means for actuating said cutting teeth to successively apply a cutting and wedging force to predetermined points along the edges of said glass members beginning adjacent one end thereof and progressing toward the other end thereof;

a retaining and removal means for holding scored glass articles prior to formation thereof from a glass member and for removing and transferring said glass articles after formation thereof from one section of the machine to a second section of the machine.

2. A machine in accordance with claim 1 and further comprising a positioning means for positioning said glass members in the machine.

3. A machine for breaking predetermined shaped glass articles from flat scored glass members,

said machine comprising,

a first lower row of longitudinally aligned sharp wedge shaped cutting jaws,

a second lower row of longitudinally aligned sharp wedge shaped cutting jaws extending substantially parallel and spaced from said first lower row,

a first upper row of longitudinally aligned sharp wedge shaped cutting jaws positioned above said first lower row and adapted to have selected ones of said upper jaws individually move towards selected ones of said first lower jaws,

a second upper row of longitudinally aligned sharp wedge shaped cutting jaws positioned above said second lower row and adapted to have selected ones of said upper jaws individually move towards selected ones of said second lower jaws,

means for sequentially activating said cutting jaws beginning with the jaws adjacent one end of said blank and progressing towards the other end thereof; whereby waste portions of said glass members are successively cut and wedged away from said glass articles and those waste portions which still remain as part of said glass member.

4. A machine in accordance with claim 3 and further comprising,

suction means for engaging scored glass areas of said glass member and applying light pressure thereto,

said suction means acting to lower those scored areas which have been broken away so as to provide space for succeeding portions of said glass member to be wedged and cut away from the remainder of said member and said scored areas.

5. The improvement of claim 3 wherein said suction means comprises a plurality of tubular members each having a portion thereof slideably mounted in one of a plurality of ferrules,

means on each of said ferrules for allowing movement of said tubular members in a first direction and limiting movement of said tubular members in a second direction.

6. In a machine for breaking predetermined shaped glass articles from a substantially rectangular scored flat glass blank, said machine comprising a retaining means for holding said articles before breaking from said glass blank, the improvement comprising:

a plurality of rows of substantially longitudinally aligned breaking jaws,

each of said jaws comprising a sharp wedge shaped cutting edge planarly aligned with a second sharp wedge shaped cutting edge of a second breaking jaw,

said planarly aligned sharp wedge shaped cutting edge being mounted at an acute angle to each other whereby when they are brought together they exert a cutting, wedging and pinching action therebetween.

7. The improvement of claim 6 and further including a means for activating said breaking jaws whereby successive glass portions of said glass member are engaged by said edges and broken therebetween by a pinching force.

8. A machine in accordance with claim 6 and further comprising a means for clearing broken glass portions from said breaking edges, said clearing means being slideably mounted on said first and second sections.

9. A method of breaking away scrap portions from a blank having a series of prescored areas;

said method comprising:

successively applying cutting and wedging forces to opposite sides of said blank adjacent each of the lateral edges thereof at predetermined increments along the length of the blank;

whereby the scrap portions of the blank are cut and wedged away from said prescored areas.

10. A method of breaking away scrap portions from a frangible blank having a series of prescored areas;

said method comprising:

successively applying cutting and wedging forces to opposite sides of said blank adjacent each of the lateral edges thereof at predetermined increments along the length of the blank;

applying a downward force on said prescored areas;

whereby waste portions of said blanks are successively cut and wedged away from the remainder of the blank and said prescored areas; and said prescored areas are lowered when they are broken away so as to provide space for succeeding portions of said blank to be cut and wedged away from said blank and said prescored areas.

11. Apparatus for breaking away scrap portions from a blank having a series of prescored areas;

said apparatus comprising:

first sharp wedge shaped breaking means located on one side of the blank adjacent one edge thereof and in cutting relationship thereto;

second sharp wedge shaped breaking means located on said one side of the blank adjacent the other edge thereof;

third sharp wedge shaped breaking means located on the other side of said blank adjacent said one edge thereof and in cutting relationship thereto;

fourth sharp wedge shaped breaking means located on said other side of said blank adjacent said other edge thereof and in cutting relationship thereto;

said breaking means all lying in a single plane located transversely with respect to the plane of said blank; and extending only over the waste portions of said blank; means for actuating said breaking means simultaneously with respect to each other;

whereby a portion of said blank is broken away along the scored edges thereof.

12. Apparatus for breaking away scrap portions from a frangible blank having a series of prescored areas;

said apparatus comprising:

sharp wedge shaped breaking members located on opposite sides of said blank;

said breaking members lying in a single plane disposed transversely of the plane of the blank;

means for actuating said breaking members with respect to each other;

whereby a portion of said blank is broken away along the edges of a scored area.

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