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Benner et al.

[11] **3,924,565**

[45] **Dec. 9, 1975**

[54] **SPRAYING APPARATUS**

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[52] **U.S. Cl.** **118/323;** 118/7; 118/324

[51] **Int. Cl.²** **B05B 3/00**

[58] **Field of Search** 118/7, 313, 316, 323, 324; 427/424

[56] **References Cited**

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2,925,801	2/1960	Bivens et al.	118/323 X
2,926,101	2/1960	Schaefer	118/323
3,195,501	7/1965	Barkhau	118/323
3,262,419	7/1966	Knight	118/323
3,509,852	5/1970	Wells	118/323
3,516,849	6/1970	Shank, Jr. et al.	118/323

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Assistant Examiner—Steven Hawkins
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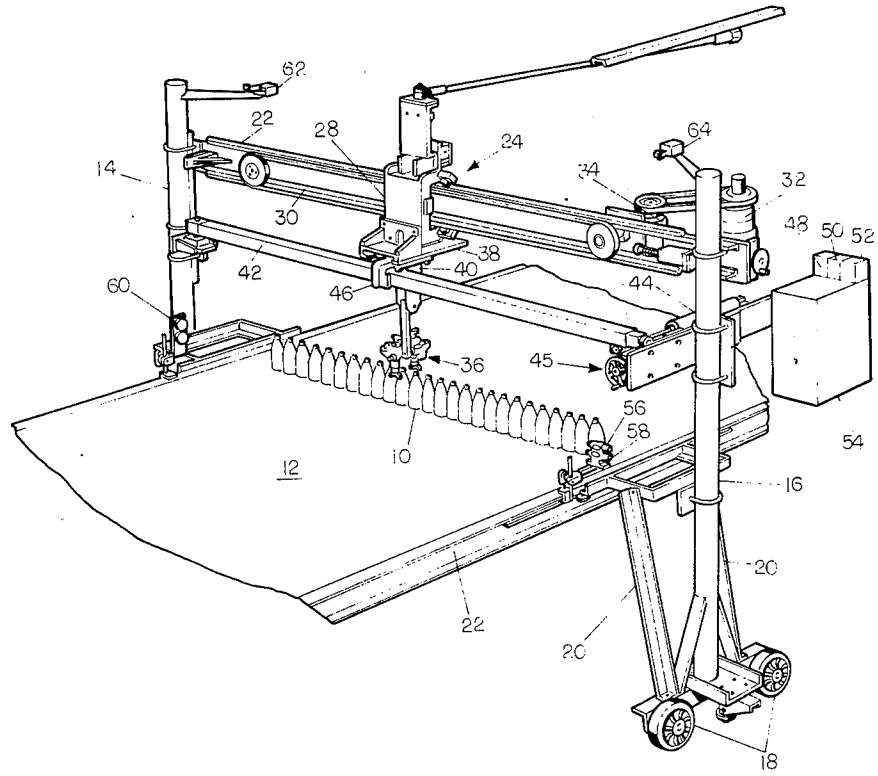
[57] **ABSTRACT**

A mechanism for spraying between the rows of a plurality of rows of moving objects. A conventional traversing spray unit is mounted for linear, transverse motion across a conveyor. The conveyor may be a part of a glass container annealing lehr on which rows of glass containers are carried. A control rail is pivotally connected on one side of the lehr under the spray unit. The other end of the control rail is attached to a reciprocating motor on the opposite side of the lehr. A sliding shoe connects the control rail to a slide plate carried by a movable carriage of the spray unit. The slide plate in turn carries a downwardly directed spray gun. When the reciprocating motor is actuated, the ccontrol rail pivots about its mounting, and moves the slide plate and spray gun. When the carriage moves across the lehr, the slide plate and spray gun will follow a diagonal path dictated by the control rail position. An electrical control system directs cycling of the carriage movement so that the diagonal path followed by the spray gun lies between adjacent, moving rows of glass containers.

12 Claims, 3 Drawing Figures



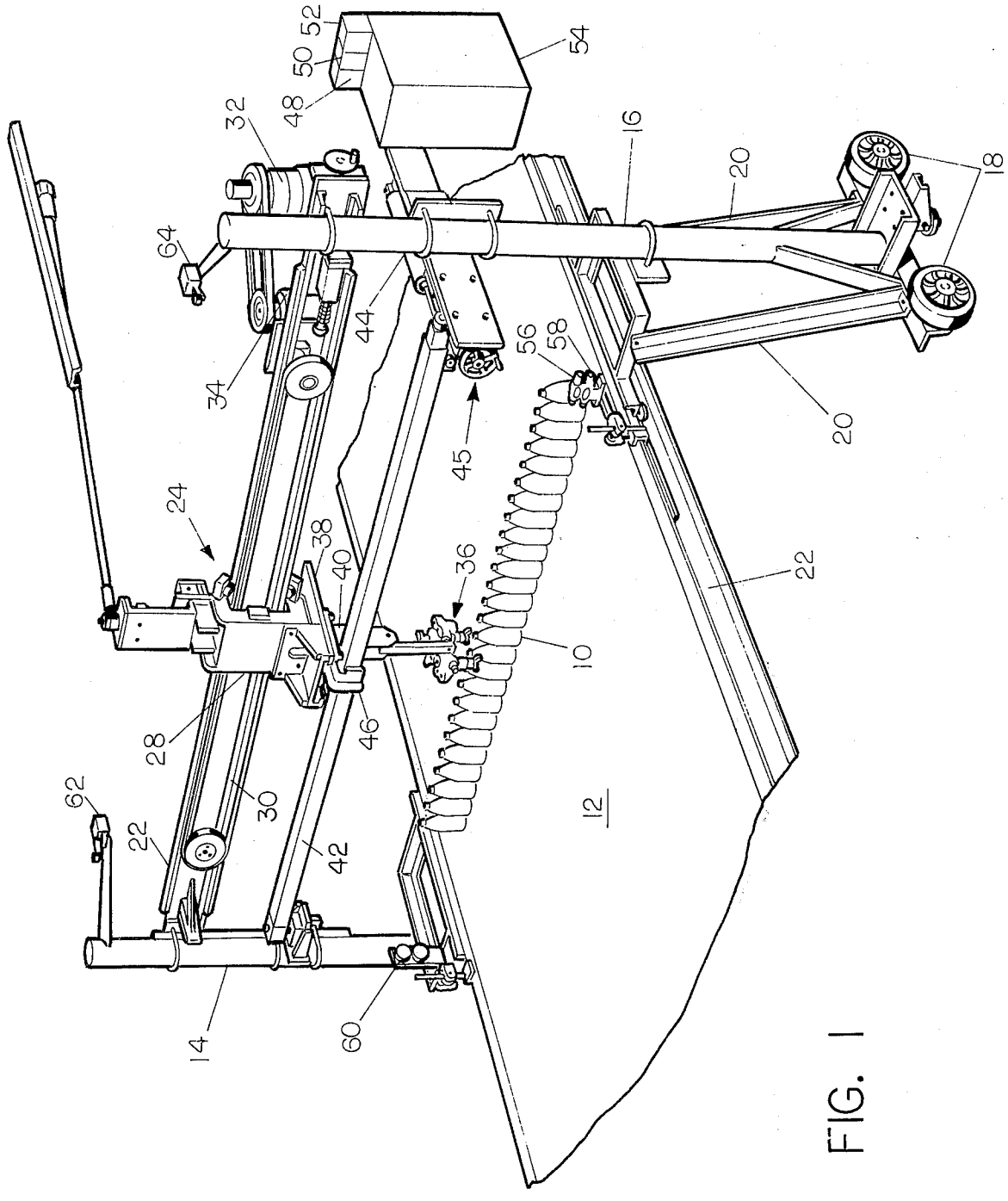

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FIG. 1

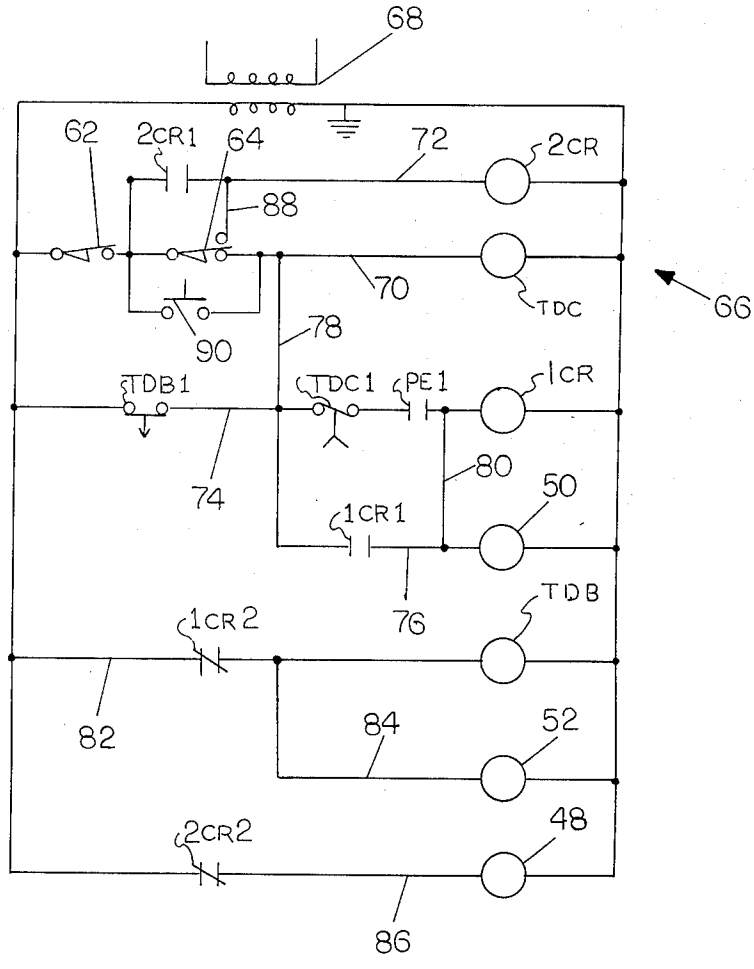
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FIG. 2

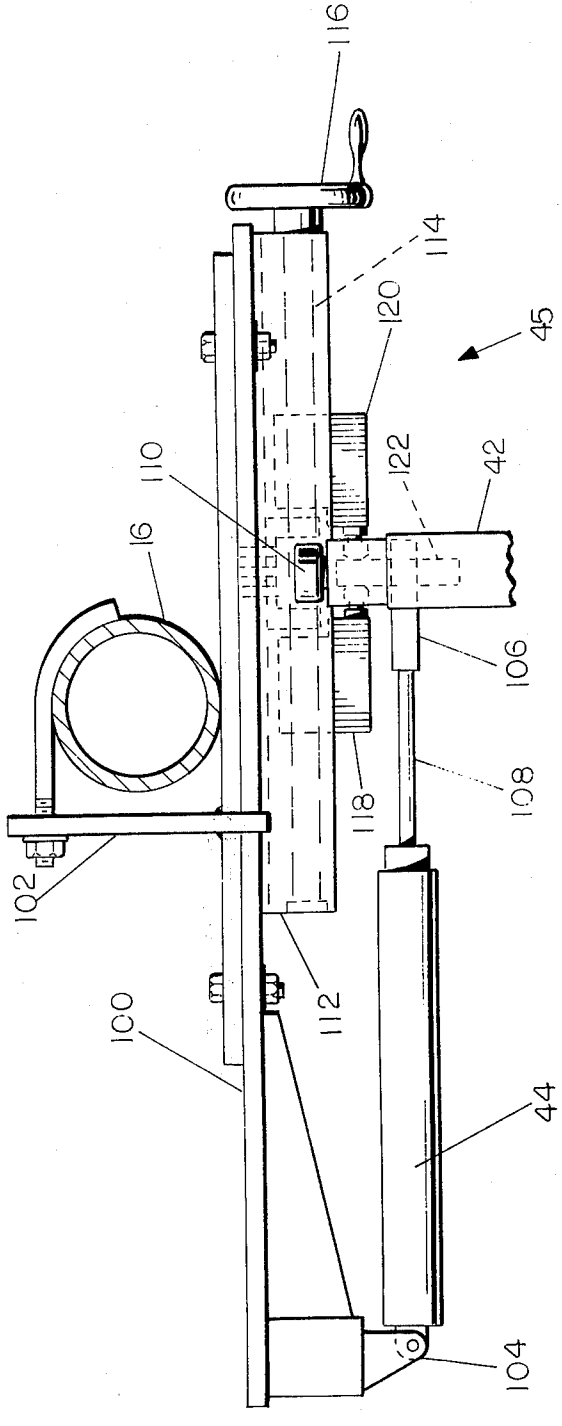

FIG. 3

SPRAYING APPARATUS

BACKGROUND OF THE INVENTION

This invention generally relates to spraying apparatus. More specifically, this invention relates to an apparatus for spraying between the rows of a plurality of moving objects. Particularly, this invention relates to an apparatus wherein a spray gun is directed in a diagonal path of travel across a moving conveyor by a pivotally mounted control rail.

It is frequently desirable to "track" a moving object while spraying a coating onto the object. In the case of glass containers, a spray of a lubricating material is placed on the exterior of the containers as they exit from the annealing lehr on a conveyor. The containers are arrayed in rows and columns at this time. It is desirable to avoid spraying into the open finish portion of the containers, since this would coat the interior of the container with the lubricating material. While this material is harmless to human beings, the interior coating can cause appearance problems when the container is filled. Since the containers are moving, a linear path of travel between the rows with a spray gun is not feasible, based on commercial operating speeds of the lehr, the distance across the lehr, and the speed of available spraying equipment. The prior art suggests several techniques for "tracking" the row of moving containers as seen in the following U.S. Pat. Nos.: 3,509,852 and 3,516,849. Other examples of prior art spray devices may be seen in U.S. Pat. Nos. 3,262,419 and 1,835,402. However, the prior art devices have proven bulky and expensive, or slow in response, and have not been widely used. We have invented a relatively simple, low-cost spray device which will move a spray gun across a lehr mat between rows of glass containers on a diagonal path, the diagonal path compensating for the forward progress of the glass containers. A simple pivoted rail moves only the spray gun itself. The major drive components do not pivot and can follow a conventional linear path, thus reducing the complexity of the device while increasing the response time due to the smaller moving mass.

SUMMARY OF THE INVENTION

Our invention is an improvement in an apparatus for spraying objects arrayed in rows and columns that are continuously moved by a conveying means. In the apparatus, a traversing spray unit is mounted on support columns that are positioned on opposite sides of the conveying means and extends transversely across the conveying means. The traversing spray unit includes a movable carriage that is moved by a drive means in a linear path back and forth transversely across the conveying means. Our improvement comprises the following combination: A control rail which is positioned to extend transversely across the conveying means. A means for pivotally mounting one end of the control rail, in a location below the traversing spray unit, is located adjacent one of the support columns. A reciprocating motor means is mounted adjacent the other one of the support columns. The reciprocating motor can pivot the control rail about its pivot mounting through a means for connecting the free end of the control rail to the motor means. A slide plate is carried by the movable carriage and is slideably mounted thereon for longitudinal movement relative to the conveying means. A sliding shoe is engaged on the control rail and is also connected to the slide plate. The slide plate carries at least one downwardly directed spray means.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a perspective view of the apparatus of the present invention;

FIG. **2** is a schematic circuit diagram of the electrical control system for the present invention; and

FIG. **3** is a top, plan view of the stroke adjusting mechanism for the rail control motor of the present invention.

DETAILED DESCRIPTION OF THE DRAWINGS

In FIG. **1**, the apparatus of the present invention is seen in its operational environment. A plurality of rows of glass containers **10** are continuously moved past the apparatus of the present invention on a lehr mat or conveyor belt **12.** The lehr mat **12** is used to transport the glass containers **10** through an annealing lehr, and the apparatus of the present invention is situated at the exit of the annealing lehr. Two main support columns **14** and **16** are positioned on opposite sides of the lehr mat **12.** The support columns **14** and **16** may be mounted on wheels **18** to allow transport of this apparatus from one lehr to another if desired and to allow positioning of the apparatus in the desired lehr zone. Bracing members **20** are used to connect the main columns **14** and **16** to a side rail **22** which supports the lehr mat **12.** The two main support columns **14** and **16** are tied together at their upper ends by a transversely extending beam **22** which extends completely across the lehr mat **12.** Mounted on the transverse beam **22** is a moving traversing spray unit **24.** The traversing spray unit **24,** and the other elements described up to this point, are well known in the art. An example of this general type of apparatus may be seen in U.S. Pat. No. 2,925,801. This general type of apparatus is sold by the DeVilbiss Corporation of Toledo, Ohio and is designated as a Model YDB Transverse Spray. The traversing spray unit **24** is of the type which has a movable carriage **28** which moves from one side of the lehr mat **12** to the other in a continuous pattern under the driving influence of a chain **30.** The chain **30** is driven in a conventional fashion by an air-operated clutch/brake unit **32** which in turn is driven by an electric motor **34.** In the prior art, this general apparatus has been used in a repetitive manner to traverse back and forth across the lehr mat **12,** spraying a lubricating material onto the glass containers **10** as they pass under a plurality of spray guns **36** carried directly on the carriage **28.** However, this has proven less than satisfactory because of the difficulties involved in obtaining a uniform and even coat on the glass containers **10** and in preventing the material sprayed from entering the mouths of the glass containers **10.** The apparatus of the present invention is designed to obviate these problems of the prior art by forcing the spray guns **36** to follow a path of travel between the rows of glass containers **10** and to do so at a rate of speed and in a pattern which will prevent interference of the glass containers **10** with the passage of the spray guns **36.** Note that in FIG. **1,** both air and liquid lines or hoses have been omitted for the spray guns **36** in the interest of clarity. Also, air lines for solenoid valves have been omitted for the same reason.

To this end, a support plate **38** is attached to the carriage **28** and travels with the carriage **28** in a fixed linear path of travel back and forth across the lehr mate **12.** A slide plate **40** is slideably attached to the support

plate **38** and may be freely moved back and forth. The spray guns **36** are actually attached to the slide plate **40** so that movement of the slide plate **40** will also move the spray guns **36.** A control rail **42** is pivotally connected at one end to the main support column **14.** The opposite end of the control rail **42** is controlled by a fluid motor or rail air cylinder **44.** The end of the control rail **42** that is controlled by the air cylinder **44** is free to slide, under the control of the air cylinder **44.** Thus, as the operating rod of the air cylinder **44** is extended or retracted the end of the control rail **42** will move in response to the air cylinder **44.** The net result of this arrangement is that when the air cylinder **44** has its operating rod completely retracted the path of movement of the spray guns **36** will be on a diagonal line across the lehr mat **12** from the pivot point of the control rail **42** to the position dictated by the air cylinder **44.** Conversely, when air cylinder **44** has its control rod fully extended, the path of travel of the spray guns **36** will likewise be a diagonal across the lehr mat **12** but in a different position from that followed when the air cylinder **44** has its control rod completely retracted. The general path of travel of the spray guns **36** may thus be seen to be a triangular pattern with the apex of the triangle lying at the pivot point of the control rail **42** on the main support column **14.** Note that a sliding shoe **46** is engaged over the control rail **42** and is connected to the slide plate **40.** Thus, movement of the control rail **42** by the air cylinder **44** will be transmitted to the slide plate **40** thus allowing free movement of the spray guns **36** which are also attached to the slide plate **40.** This type of movement allows the spray guns **36** to be positioned very precisely so that they may always be spraying between the rows of glass containers **10,** thus allowing uniform coating of the glass containers **10** and avoiding spraying into the open mouths of the glass containers **10.** This is accomplished by moving on the diagonal pattern across the lehr mat **12.** It is necessary to move in such a diagonal pattern because the widths of the lehr mats **12** now in use make it impractical to move the spray guns **36** fast enough in a linear path to avoid interference with the moving rows of glass containers **10.** Moving on a diagonal path allows the spray guns **36** to, in effect, track the movement of the glass containers **10** as they progress forward on the lehr mat **12.** The air cylinder **44** may have its stroke adjusted by an adjusting means **45,** which is shown in detail in FIG. **3.**

Air for controlling the cycling of the air cylinder **44** is furnished from a four-way solenoid valve **48.** The solenoid valve **48** itself is connected to a source of compressed air which is not shown. A solenoid valve **50** furnishes air to operate the clutch portion of the clutch/brake unit **32.** A solenoid valve **52** furnishes air to operate the brake portion of the clutch/brake unit **32.** The valves **48, 50** and **52** have their cycling in sequence controlled from a control unit which is housed in a main control cabinet **54.** It should be clear that because of the path of travel followed by the spray guns **36** in this invention it is necessary to control the times at which the clutch of the clutch/brake unit **32** is engaged to allow traversing of the spray unit **24.** This particular function is controlled through the control circuits and is directed by a light source **56** and photo-electric cell **58** which are mounted adjacent the main support column **16.** Across the lehr mat **12** are positioned reflector units **60** which reflect the light from the light source **56** back to the photo-cell **58.** The controls may be set to function such that when a row of glass containers **10** blocks transmission of the light beam across the lehr mat **12** and back to the photo-cell **58,** a spray cycle is initiated. Conversely, of course, the circuit could be wired such that the traversing is initiated when the photo-cell **58** sees or is in alignment with light reflected by the reflector units **60.** The position of the moving carriage **28** is sensed by two limit switches that are mounted in the path of travel of the carriage **28.** One limit switch **62** signals when the carriage **28** has reached the side of the lehr mat adjacent the main support column **14.** The other limit switch **64** signals when the carriage **28** has reached the side of the lehr mat **12** adjacent to the main support column **16.**

FIG. **2** illustrates a ladder-type circuit diagram **66** for the electrical control system of the present invention. The ladder circuit **66** receives its power from a transformer **68** as is conventional practice. The configuration of the components in FIG. **2,** is that assumed when a complete cycle has been completed and the traversing spray unit **24** is in a so-called home position adjacent to the air cylinder **44.** In the description of the circuit **66,** the notation used will be that conventionally used in describing ladder diagrams. That is, a coil relay will be given a specific letter and number. Then, the contact pairs associated with that particular relay will be given the same letter and number as the coil and in addition will be given a unique identifying numeral. A conductor **70** connects the two legs of the ladder circuit **66.** Connected in series in the conductor **70** are the two limit switches **62** and **64** and a time-delay relay TDC (time-delay relay-clutch unit). A relay **2CR** and a contact pair **2CR1** are connected in series with one another in a conductor **72.** The conductor **72** is itself connected in parallel with the limit switch **64** and the relay TDC and in series with the limit switch **62.** A conductor **74** also extends between both legs of the circuit **66.** Connected in series in the conductor **74** are a contact pair TDB**1,** a contact pair TDC**1,** a contact pair PE**1,** and a relay **1CR.** A conductor **76** is connected in parallel with the contact pairs TDC**1,** PE**1,** and the relay **1CR.** A contact pair **1CR1** and the solenoid valve **50** for the clutch unit are connected in series in the conductor **76.** The contact pairs TDC**1,** PE**1** and **1CR1,** the relay **1CR,** and the solenoid valve **50** are also connected in series with the limit switches **62** and **64.** A cross-conductor **78** connects the conductors **70** and **74** at a point such that the relay TDC connected in the conductor **70** is in parallel with the contact pairs TDC**1,** PE**1,** and the relay **1CR.** Similarly, a cross-conductor **80** connects the conductor **74** and **76** such that the contact pairs TDC**1** and PE**1** are independently in parallel with the contact pair **1CR1** and the relay **1CR** is in parallel with the solenoid valve **50.** A conductor **82** independently connects the two legs of the circuit **66.** Connected in series in the conductor **82** are a contact pair **1CR2** and a time-delay relay TDB (time-delay relay-brake unit). A conductor **84** is connected in parallel with the relay TDB and in series with the contact pair **1CR2.** The solenoid valve **52** for the brake unit is connected in the conductor **84.** Finally, a conductor **86** completes the connection of the two legs of circuit **66.** A contact pair **2CR2** and the solenoid valve **48** which controls the movement of the rail **42** are connected in series in the conductor **86.**

As was noted, the configuration of the elements shown in FIG. **2** is that assumed when the entire mechanism is at rest at the home position. Both limit switches

62 and 64 are the normally closed type and are opened by the passage of the carriage 28 at the extreme ends of its movement. Thus, at this time, the limit switch 64 is definitely closed since the carriage is at the remote position from this limit switch. However, the limit switch 62 may be either opened or closed. It is possible for the carriage 28 to stop on the limit switch 62 and thus keep it open even after the apparatus has come to a halt. Nevertheless, note that a path for current still exists through the contact pair TDB1 to the relay 1CR, which is the main relay that sets the entire apparatus in motion. Note that at this time the contact pair 1CR2 is a normally closed pair and since the relay 1CR is off due to the contact pairs PE1 and 1CR1 being off, the contact pair 1CR2 is closed. This then means that the solenoid valve 52 is on and air is being furnished the brake unit to prevent movement of the carriage. The contact pair PE1 is controlled by the photocell 58. Assume for the purposes of this example that the photocell 58 is responsive to receipt of light to it to initiate the beginning of a cycle. Thus, when the photo-cell 58 can "see" between the rows of containers 10, the contact pair PE1 will close immediately. When this occurs, the relay 1CR will be activated. When this occurs, the contact pair 1CR1 will also close and the contact pair 1CR2 will open. When the contact pair 1CR2 opens, the solenoid valve 52 is turned off thus releasing the brake. In addition, the time-delay relay TDB begins to time. The relay TDB is of the type which will release its closed contact a pre-selected period of time after it has been de-energized. Therefore, the contact pair TDB1 does not open immediately. The contact pair PE1 will open after a relatively short period of time as the row of glass containers begins to move in front of it thus blocking the space which allowed it to receive a light signal. However, note that the contact pair 1CR1 remains sealed and may receive power to keep the relay 1CR energized either through the contact pair TDB1 or through the two limit switches 62 and 64. In case the limit switch 62 has been kept open by the position of the carriage 28 when it stopped on the last cycle, the timing out of the relay TDB will allow the contact pair TDB1 to remain closed long enough for the carriage 28 to clear the limit switch 62. After a short period of time, the carriage 28 has begun to move and the contact pair TDB1 will open. However, by this time, the limit switch 62 has been cleared and will be closed so that the current may continue to flow through the limit switches 62 and 64 to maintain the relay 1CR energized. Note that with the release of the brake solenoid valve 52 by the opening of the contact pair 1CR2, the solenoid valve 50 for the clutch is activated by closing of the contact pair 1CR1. The pairs 1CR2 and 1CR1 are non-overlapping to prevent simultaneous engagement of the clutch and the brake.

During the time the traversing spray unit 24 moves from the location adjacent the air cylinder 44 toward the pivotal mounting of the control rail 42, the solenoid valve 48 is maintained in its initial state by the normally closed contact pair 2CR2. The solenoid valve 48 may be a four-way valve which will furnish air to either the rod end or the blind end of the rail air cylinder 44. When the traversing spray unit 24 reaches the pivoted end of the control rail 42, the limit switch 64 will be tripped. When this occurs, power to the relay 1CR will be interrupted. Note that this must occur since the contact pair TDB1 opens shortly after the traversing spray unit 24 began to move. Thus the only path available for current to the coil 1CR is through the two limit switches 62 and 64. With power lost to the relay 1CR, the contact pair 1CR1 will open. In addition, the normally closed contact pair 1CR2 will close again thus activating the brake solenoid valve 52 and stopping the unit. Prior to this, the solenoid valve 50 which controls the clutch unit will have lost power through the opening of the contact pair 1CR1 and the clutch unit will have been released. Note that the limit switch 64 is a switch of the single pole double throw type. Thus, when it is actuated by the traversing spray unit 24, it not only interrupts power to the relay 1CR, but also makes contact with a conductor 88 which allows power to flow through the limit switch 62 and the limit switch 64 to the relay 2CR. The actuation of the relay 2CR closes the normally open contact pair 2CR1 and thus even though the limit switch 64 reverses itself and no longer makes contact with the conductor 88, the relay 2CR continues to be activated by power coming through the limit switch 62. Actuation of the relay 2CR opens the normally closed contact pair 2CR2 and thus switches the air flow controlled by the solenoid valve 48. This then moves the operating rod of the rail air cylinder 44 and shifts the control rail 42 to its new position for the return path of travel of the traversing spray unit 24. Immediately after the second limit switch 64 closes, the relay TDC is activated again. However, the contact pair TDC1 is of the type which delays its closing on the actuation of the relay TDC. Thus, the contact pair TDC is not closed until a short period of time after the relay TDC has received power again to avoid having the clutch and brake units on simultaneously. In addition, the relay TDC prevents an invalid start initiated by a glass container 10 which is out of position from its row. In this case, the contact pair PE1 will close, just as if a row of glass containers 10 were present. However, if the delay of the relay TDC is set at a time period corresponding to the interval between successive rows of glass containers 10, the contact pair TDC1 will still be open, and no traverse will occur. The entire system may now wait in this configuration until the photo-cell 58 generates a new signal which will control the closing of the contact pair PE1 to repeat the cycle thus causing the traversing spray unit 24 to move back along a new path until the limit switch 62 is reached which will again interrupt power to the relay 1CR thus resetting the entire system to the configuration shown in FIG. 2. Note that if it is desired to have the traversing spray unit 24 make two complete passes across the lehr mat 12 before it is stopped, a switch 90, which is connected in parallel around the limit switch 64, may be manually activated. The switch 90 is normally open and if left in this state the traversing spray unit 24 will move from one side of the lehr mat 12 to the other and stop, and will return only upon receipt of a signal from the photocell 58. However, with the switch 90 closed, the limit switch 64 is shorted out and will have no effect on stopping the traversing spray unit 24 when it reaches the pivot side of the control rail 42. Rather, the traversing spray unit will simply move back across the lehr mat 12 to the home position adjacent the rail air cylinder 44 where it will be stopped by the limit switch 62. It is important to note that even though the traversing spray unit is not stopped in what is called a two-pass mode, switch 64 will still be operated and because of the single pole double throw configuration will allow the relay 2CR to be activated at the pivot end of the control rail 42. This is important because the actuation of the relay

2CR controls the solenoid valve **48** which switches the air flow to the rail air cylinder **44.** This then will move the control rail **42** to its new position for the return trip of the traversing spray unit **24.**

It is possible to eliminate the time-delay relays TDC and TDB and their associated contact pairs TDB1 and TDC1. This condition would assume that the carriage **28** would not stop the switch **62** and the clutch/brake unit **32** would change from the clutch to brake mode and back with danger of simultaneous engagement of both components. Such a condition is quite practical and can be utilized without undue operational difficulty.

FIG. **3** shows the adjusting means **45** for the cylinder **44** partially removed from its operational environment. The entire mechanism is mounted on a plate **100** which is secured to the main column **16** by a clamp member **102.** The air cylinder **44** has its blind end connected to a clevis mount **104** secured to the plate **100.** A tie rod **106** is connected to the extensible operating member or operating rod **108** of the air cylinder **44.** The tie rod **106** in turn is connected to the control rail **42.** A cam follower **110** is attached to the end of the control rail **42** and rolls on a guide rail **112** attached to the plate **100.** A threaded shaft **114** is rotatably mounted under the guide rail **112.** A hand wheel **116** is attached to the shaft **114** and may rotate the shaft **114.** A pair of threaded stop blocks **118** and **120** are threadably engaged on the shaft **114.** One of the blocks **118** and **120** is right-hand threaded and the other is left-hand threaded. Thus, when the wheel **116** rotates the shaft **114,** the blocks **118** and **120** move toward or away from a fixed center line as a unit. A limit plate **122** is carried by the tie rod **106** and extends between the two stop blocks **118** and **120.** In FIG. **3,** the stop blocks **118** and **120** are in contact with the limit plate **122.** Thus, the rod **108** cannot move at all. In this case, with the control rail **42** centered, the spray guns **36** would follow a linear path across the lehr mat **12.** In operation, to fix a diagonal path of travel as previously explained, the stop blocks **118** and **120** would be moved to some intermediate position. Then, the rod **108** could move until the limit plate **122** struck one or the other of them. Adjusting the relative positions of the stop blocks **118** and **120** will change the angle of the diagonal path across the lehr mat **12.** This is desirable to compensate for variations in speed of the lehr mat **12** and spacing between row of glass containers **10.**

We claim:

1. In an apparatus for spraying objects arrayed in rows and columns that are continuously moved by a conveying means wherein a traversing spray unit is mounted on support columns positioned on opposite sides of said conveying means and extends transversely across said conveying means, and wherein said traversing spray unit includes a movable carriage that is moved by a drive means in a linear path back and forth transversely across said conveying means, the improvement in said apparatus which comprises, in combination:

a control rail extending transversely across said conveying means;

means for pivotally mounting said control rail adjacent one of said support columns in a location below said traversing spray unit;

reciprocating motor means mounted adjacent the other one of said support columns;

means for connecting the free end of said control rail to said motor means, whereby said motor means can move said control rail about said means for pivotally mounting said control rail;

a slide plate, carried by said movable carriage and slideably mounted thereon for longitudinal movement relative to said conveying means;

a sliding shoe, engaged on said control rail and connected to said slide plate;

at least one downwardly directed spray means carried by said slide plate; and

circuit means for controlling the movement of said traversing spray unit.

2. The improvement of claim **1** wherein said reciprocating motor means comprises a fluid motor having an extensible operating member.

3. The improvement of claim **2** which further includes:

means for adjusting the length of the stroke of said extensible operating member.

4. The improvement of claim **3** wherein said means for adjusting the stroke of said extensible operating member comprises:

a threaded shaft, rotatably mounted adjacent said fluid motor;

a pair of stop blocks, threadably engaged on said threaded shaft, one of said stop blocks being right-hand threaded and the other of said stop blocks being left-hand threaded, whereby rotation of said threaded shaft will move said stop blocks as a unit toward or away from a fixed center line; and

a limit plate, connected to said extensible operating member, said limit plate following a path of travel between said stop blocks.

5. The improvement of claim **1** wherein said circuit means includes:

electrical control means, responsive to the passage of successive rows of said objects, for actuating said motor means and said drive means to thereby cause said control rail to move about its pivotal connection and force said spray means to follow a diagonal path across said conveying means between rows of said objects.

6. The improvement of claim **5,** wherein said electrical control means includes:

means positioned adjacent each of said support columns for detecting the presence of said movable carriage and de-activating said drive means in response to such presence.

7. The improvement of claim **6** wherein said electrical control means includes a main electrical supply and wherein said means for detecting the presence of said movable carriage comprises normally closed limit switches, one positioned adjacent each of said support columns, said limit switches being connected in series across said main electrical power supply.

8. The improvement of claim **7** wherein said drive means includes a clutch/brake unit, connected to power or brake said carriage, driven by an electrical motor, the clutch portion and the brake portion of said clutch/brake unit being individually controllable.

9. The improvement of claim **8** wherein said electrical control means further includes:

a first normally open contact pair, controlled by a means for sensing the gap between successive rows of said objects, connected in series with said limit switches;

a relay coil connected in series with said first normally open contact pair;

a second normally open contact pair, controlled by said relay coil, connected in parallel with said relay coil and said first normally open contact pair; and

electrically controlled means for actuating said clutch portion of said clutch/brake unit, connected in series with said second normally open contact pair and in parallel with said relay coil.

10. The improvement of claim **9** wherein said electrical control means further includes:

a first normally closed contact pair, controlled by said relay coil, connected across said main electrical power supply; and

electrically controlled means for actuating said brake portion of said clutch/brake unit, connected in series with said first normally closed contact pair.

11. The improvement of claim **10** wherein said electrical control means further includes:

a second relay coil, connected across said main electrical supply in series with one of said limit switches, and in parallel with the other one of said limit switches; and

a third normally open contact pair, connected in series with and controlled by said second relay coil, said second mentioned limit switch being of the double pole, double throw type having a normally closed terminal connected to said first mentioned limit switch and a normally open terminal connected in series with said second relay coil.

12. The improvement of claim **11** wherein said electrical control means further includes:

a second normally closed contact pair, controlled by said second relay coil, connected across said main electrical supply; and

electrically controlled means, connected in series with said second normally closed contact pair, for actuating said reciprocating motor means.

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