

Oct. 29, 1957

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2,811,130

AUTOMATIC COATING SPRAY UNIT FOR FLOCKING MACHINES

Filed June 15, 1953

4 Sheets-Sheet 1

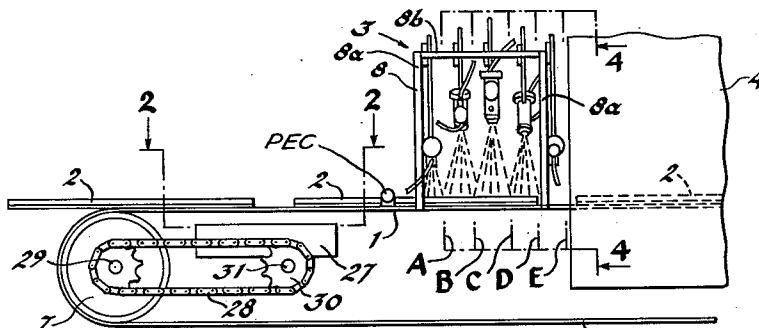


Fig. 1

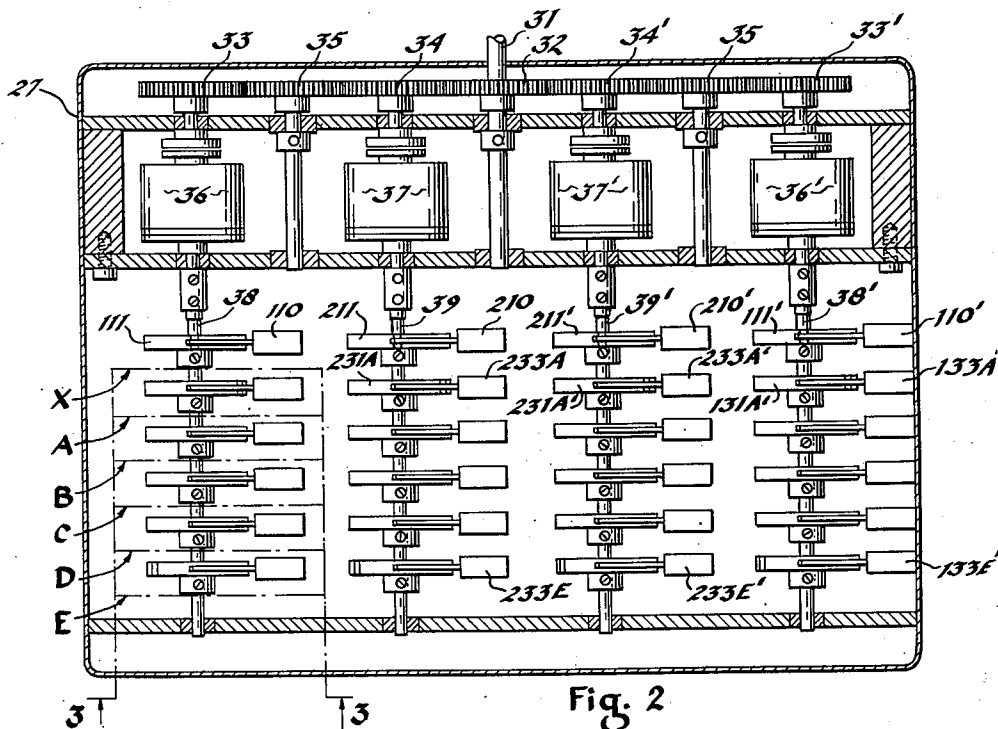
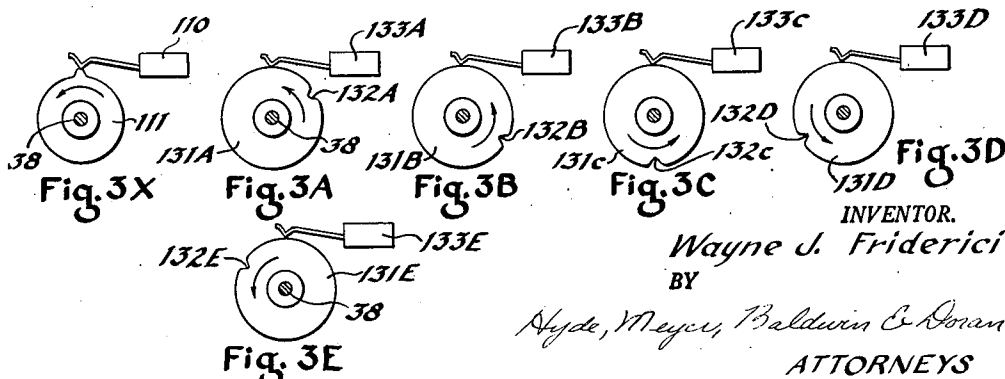


Fig. 2



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4 Sheets-Sheet 2

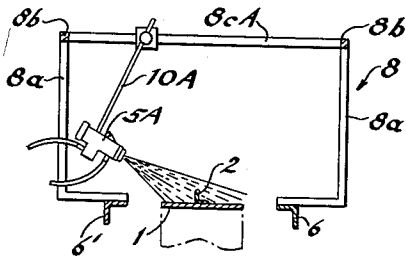


Fig. 4A

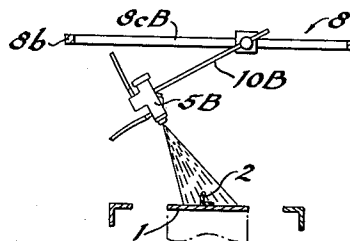


Fig. 4B

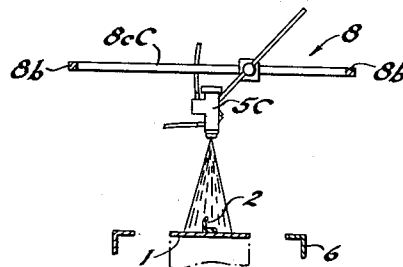


Fig. 4C

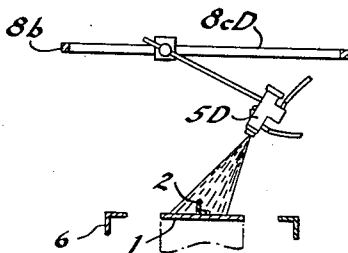


Fig. 4D

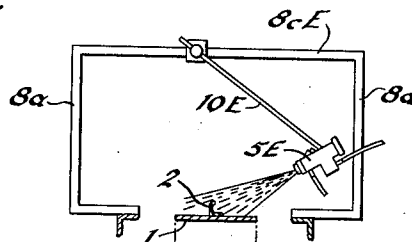


Fig. 4E

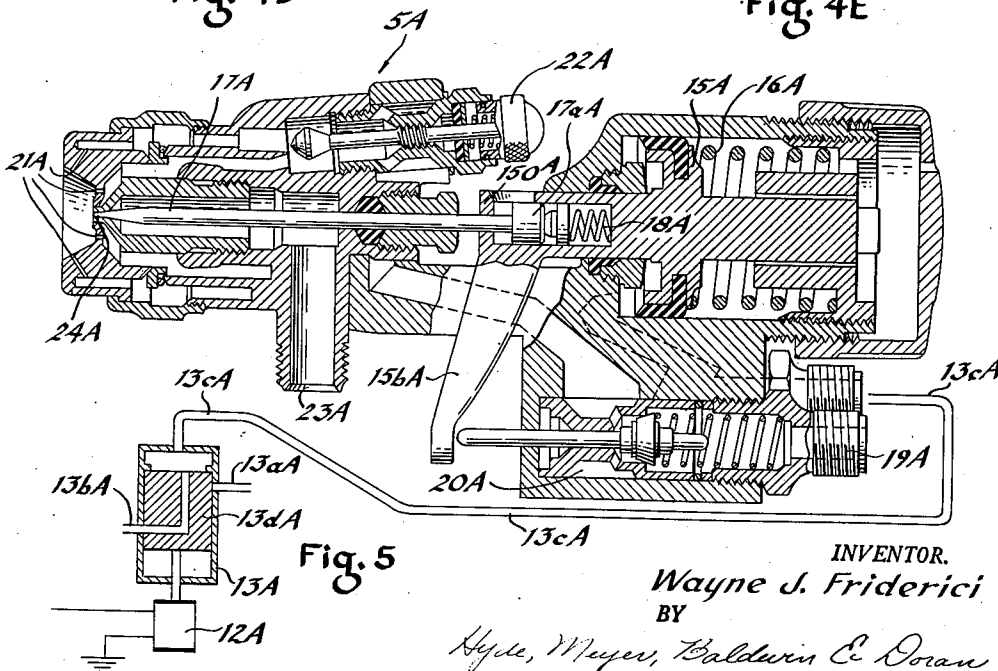


Fig. 5

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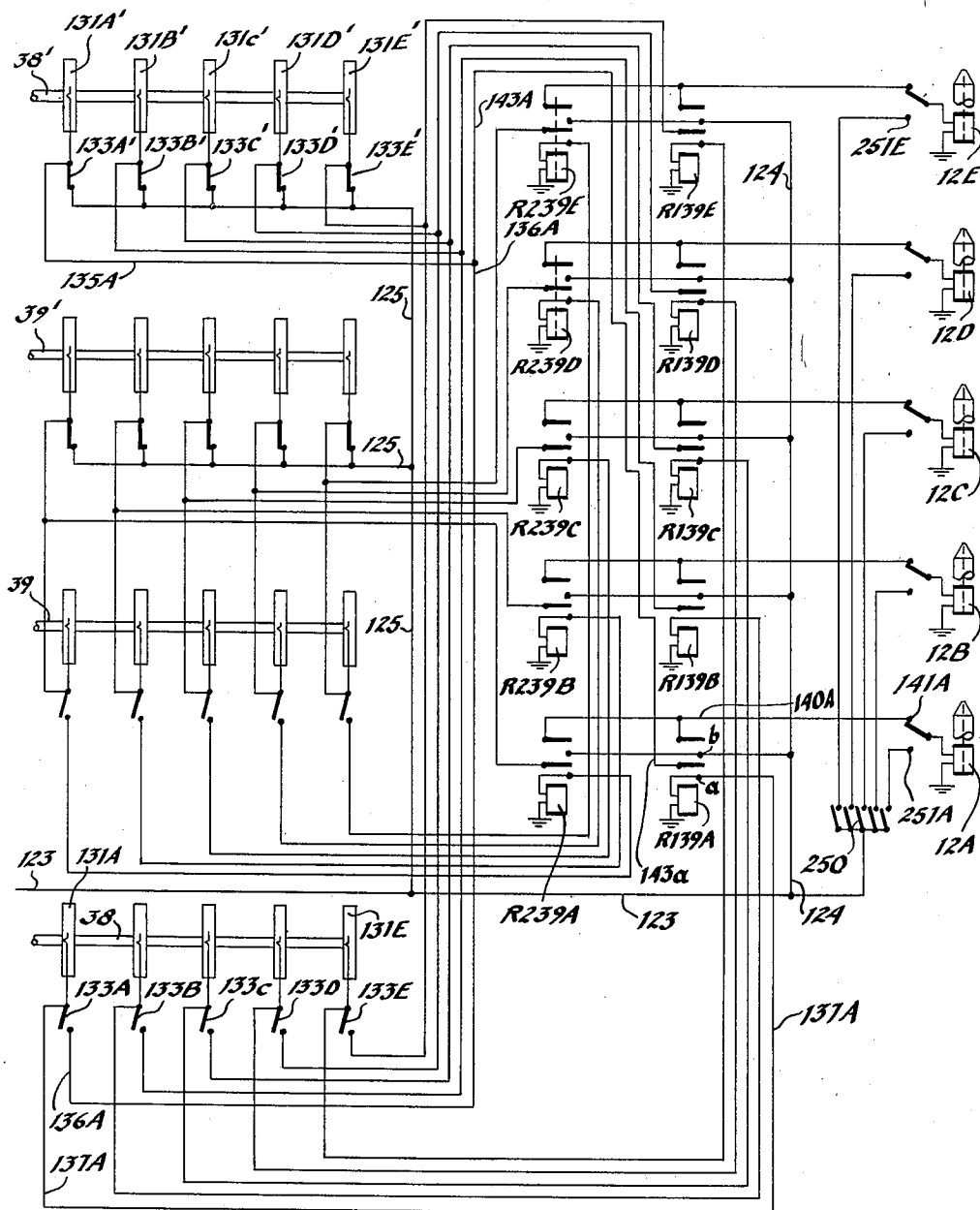


Fig. 7b

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AUTOMATIC COATING SPRAY UNIT FOR FLOCKING MACHINES

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Application June 15, 1953, Serial No. 361,726

19 Claims. (Cl. 118—2)

This invention relates to improvements in timing means and more particularly to the timing means in an apparatus for processing articles.

One of the objects of the present invention is to provide an apparatus for processing articles moving along a predetermined path at a plurality of stations along this path with control means for controlling the processing of each article at each station.

Another object of the present invention is to provide an apparatus for processing characterized by its automatic operation, its operating efficiency and its structural simplicity.

Other features of this invention reside in the arrangement and design of the parts for carrying out their appropriate functions.

Other objects and advantages of this invention will be apparent from the accompanying drawings and description and the essential features will be set forth in the appended claims.

In the drawings,

Fig. 1 is a side elevational view of the apparatus of the present invention used in a flocking machine;

Fig. 2 is a horizontal sectional view taken along line 2—2 of Fig. 1 through a control box housing a portion of the starting and stopping circuits and the nozzle control circuits;

Figs. 3A, 3B, 3C, 3D, 3E, and 3X are vertical sectional views through the control box along the respective similarly designated section lines in Fig. 2 showing the cam positions before counterclockwise rotation is begun;

Figs. 4A, 4B, 4C, 4D, and 4E are vertical sectional views taken respectively along the correspondingly numbered section lines in Fig. 1 with each of the Figs. 4A to 4E portraying one of the processing or spraying stations in the spray unit in the flocking machine of Fig. 1;

Fig. 5 is a longitudinal sectional view of a spray nozzle with the parts therein in the shut off or non-spraying position;

Fig. 6 is a vertical transverse view, partially in section and looking toward the left in Fig. 1, of the photoelectric cell and its protective hood.

Fig. 7a is the left half of the electrical diagram of this apparatus including the common master control circuit on the left and including starting and stopping control circuits on the right; while

Fig. 7b is the right half of the electrical diagram with common connections on the left to be interconnected with those on the right in Fig. 7a and with Fig. 7b having the individual nozzle control circuits with the switch contact positions corresponding to the switch actuator cam positions in Figs. 3A to 3E inclusive before rotation of the cam shaft in Figs. 3A to 3E has begun.

Before the apparatus for processing articles here illustrated is specifically described, it is to be understood that the invention here involved is not limited to structural details or arrangement of parts here shown since the apparatus embodying the present invention may take

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various forms. It also is to be understood that the phraseology or terminology herein employed is for purposes of description and not of limitation since the scope of the present invention is denoted by the appended claims.

Those familiar with this art will recognize that this invention may be applied in many ways, but it has been chosen to illustrate the same in connection with a flocking machine.

Fig. 1 is a side elevational view of this flocking machine having an endless conveyor belt 1 driven by a conveyor drive pulley 7 for moving articles 2 in procession along a path through the flocking machine. The articles 2 first pass through a glue or adhesive spray unit 3 having a plurality of spraying stations along the belt 1 so that all or any predetermined portion of the article to be flocked is covered with glue or adhesive. Then, each article is passed in succession into the flocking machine 4 which can be of any conventional type, such as that flocking machine disclosed in my copending U. S. patent application No. 361,791 filed on June 15, 1953, and entitled, "Apparatus for Preventing Flock Build-up on a Flocking Machine Electrode."

This invention is specifically directed toward the glue spray unit 3 and the controls therefor. However, it should be understood that the articles passing there-through can be processed in other manners or sprayed with other materials instead of glue at each of these stations.

Glue spray unit 3 is provided with a plurality of nozzles 5A, 5B, 5C, 5D, and 5E with one nozzle at each station, as shown in the views of the five processing stations in Figs. 4A to 4E inclusive. Views at or reference numerals on corresponding parts at each station are identical except for the suffix A, B, C, D, or E corresponding to the station involved. The flocking machine has two parallel frame members 6, 6 straddling the endless conveyor belt 1 and article 2 thereon in Figs. 4A to 4E inclusive. A glue nozzles support unit 8 is provided comprising four vertical bars 8a with each having a bent in lower end secured to one of said frame members 6. A pair of the bars 8a are located on each side of conveyor belt 1 and each pair is joined together at upper ends by one of the two parallel longitudinal bars 8b while cross bars 8cA, 8cB, 8cC, 8cD and 8cE, equal in number to said stations with one located at each station, are each secured at opposite ends to the longitudinal bars 8b, 8b so as to bridge across the path of conveyor travel and serve along with supporting bars 8a and 8b as a plurality of supports with one for each glue nozzle. At each station, a glue spray nozzle is secured at the bottom of a support rod with said support rod secured to one of said cross bars; this construction at the first station in Fig. 4A comprises nozzle 5A, support rod 10A and cross bar 8cA. Adjustable and pivotal clamps are secured at each station between the support rod thereat and its cross bar and between said support rod and its glue nozzle so that each nozzle can be directed within the glue spray unit 3 toward the path of travel of article 2, as shown in Figs. 4A, 4B, 4C, 4D and 4E.

Since it is important to get the adhesive or glue over the entire surface of the article 2 and into the crevices therein for satisfactory flocking, each spray nozzle is directed approximately laterally toward the path of travel of article 2 but at an angle different from the other nozzles for completely covering the article 2 with the glue spray, as shown by the different spray angles at the different spray processing stations in Figs. 4A to 4E inclusive. As the article 2 passes through the flocking machine on the conveyor belt 1, each nozzle is actuated at the proper time for spraying each article so that it is completely covered with glue, and the spray from one nozzle does not inter-

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fere with the effectiveness of the spray from any of the other nozzles. Each glue nozzle sprays only while an article 2 is passing through its spray stream but sprays continually during the passing of the entire length of each article, as will be brought out in more detail hereinafter.

Since all of the glue spray nozzles are identical, only the glue spray nozzle 5A at the first station will be described, and this nozzle is shown in more detail in the longitudinal sectional view Fig. 5 where it is shown in its shut off or non-spraying position. This nozzle includes a control therefor in the form of an operating air valve 13A in the air flow line from a high pressure air source through air line 13aA, valve 13A and air line 13cA to the principal part of the nozzle. The valve 13A in Fig. 5 is in its normal or off position so that no spraying occurs since valve plunger 13dA blocks air flow between lines 13aA and 13cA. The plunger 13dA is spring biased upwardly against a stop in the valve housing since valve operating solenoid coil 12A is deenergized. Air line 13cA is connected to exhaust port 13bA by the passageway in plunger 13dA for exhaust of the air line 13cA and the spray control cylinder (as described hereinafter) connected therewith. Energizing of solenoid coil 12A pulls plunger 13dA downwardly to connect air lines 13aA and 13cA for actuating the spray nozzle while covering exhaust port 13bA.

The nozzle will spray when solenoid coil 12A is energized so that high pressure actuating air will flow thereto through air line 13cA. This actuating air moves the piston 15A to the right in the spray control cylinder against the bias of spring 16A to correspondingly move coupling 15aA and valve actuating arm 15bA formed integral with said piston. This movement to the right first causes arm 15bA to open spring loaded, normally closed, atomizing air valve 20A to admit low pressure atomizing air through air inlet port 19A from an air pressure source. Opening valve 20A causes atomizing air to emerge from the plurality of atomizing air outlet ports 21A around the spray orifice 24A to draw glue therefrom and spray it to the left as soon as needle 17A is withdrawn from orifice 24A but needle 17A remains seated in orifice 24A until further movement of piston 15A to the right occurs. Control valve 22A regulates the percentage of air emerging from each ring of outlet ports 21A. The movement to the right next causes coupling 15aA to engage and pull to the right plunger 17aA secured to needle 17A to withdraw the needle 17A from the spray orifice 24A so that glue will be sucked in from its source through glue inlet port 23A and sprayed outwardly to the left through spray orifice 24A by the atomizing action of the air emerging from ports 21A.

When the coupling 15aA is not pulling plunger 17aA to the right, spring 18A will normally force needle 17A to the left with sufficient force to pierce any glue seal formed across spray orifice 24A when the spray is cut off and to seat it therein to cut off glue flow. It should be noted that the lost motion in coupling 15aA and plunger 17aA causes atomizing air to emerge from ports 21A during a period prior to the withdrawal of needle 17A from spray orifice 24A, during the entire period of withdrawal, and during a period after the reinsertion of needle 17A into the orifice 24A.

When solenoid 12A is deenergized the parts assume the Fig. 5 position with actuating air flow from line 13aA cut off, air line 13cA and exhaust port 13bA connected, spring 16A pushing piston 15A of the spray control cylinder to the left so that the cylinder portion to the left of piston 15A is exhausted through exhaust port 13bA, coupling 15aA no longer pulling needle 17A to the right so that spring 18A forces needle 17A to the left into spray orifice 24A, and arm 15bA moving to the Fig. 5 position after needle 17A is seated in orifice 24A so that atomizing air valve 20A closes.

A control box 27 is shown in Figs. 1 and 2 for synchronizing the spraying of the successive articles 2 pass-

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ing through the machine with the travel of these articles past the glue nozzles at the different processing stations. The sprocket chain 28 in Fig. 1 drivingly connects a sprocket wheel 29 secured to and positively driven by the conveyor drive pulley 7 with a sprocket wheel 30 secured to and driving a shaft 31 extending into the control box 27 in Fig. 2. This shaft 31 has a gear 32 secured thereto for driving gears 33, 33', 34, and 34', either directly or through idler gears 35, 35'. Each gear is secured to a shaft that is suitably journaled in the walls of control box 27. Gears 33, 33', 34 and 34' are drivingly connected with the driving member in respective electromagnetic actuated clutches 36, 36', 37 and 37' with the clutches respectively having their driven members connected to shafts 38, 38', 39 and 39'. These shafts contain the cams for controlling the starting and stopping of the spray of each glue nozzle by energizing or de-energizing through a nozzle control circuit the appropriate glue nozzle solenoid coil, such as solenoid coil 12A, as will be brought out in more detail hereinafter.

The automatic operation of the apparatus will first be described in general. The apparatus has two control means for controlling the spray of the successive articles 2 passing through the glue spray unit 3 with the first control means controlling the spraying of the alternate or odd-numbered (first, third, fifth, etc.) articles passing from left to right in Fig. 1, while the second control means controls the spraying of the even-numbered (second, fourth, etc.) articles.

As the first article 2 is carried toward the right in Fig. 1 by the conveyor belt 1, its leading edge intercepts a light beam directed at the photoelectric cell PEC, located adjacent the path of article travel and on the article approach side of the glue spray unit 3, in the common master control circuit which in turn energizes the electromagnetic starting clutch 36 in Figs. 2 and 7a in the proper starting circuit for starting the rotation of shaft 38 in Fig. 2 with the cams thereon, as shown in Figs. 3A to 3E, for synchronously driving them with the conveyor belt 1 carrying the first article 2. These cams provide proper time delay in the nozzle control circuits so that each nozzle starts spraying when the leading edge of the first article is in position to intercept its spray stream. It should be noted that the actuating notches in the cams in Figs. 3A to 3E are out of phase with each other to provide the proper time delay for starting the spray of the nozzle at each station at the proper instant since each nozzle is a different distance to the right of photoelectric cell PEC in Fig. 1. As the trailing edge of the first article 2 goes by the photoelectric cell PEC, the light beam again hits the photoelectric cell PEC of the common master control circuit to energize the stopping electromagnetic clutch 36' in the stopping circuit of the first control means. This clutch then drives the shaft 38' in Fig. 2 with corresponding cams for actuating the nozzle control circuits with a proper time delay so that each nozzle in turn stops spraying when the trailing edge of the first article 2 intercepts its spray stream.

The second control means operates in a similar manner to energize the starting clutch 37 and the stopping clutch 37' in Fig. 2. The second control means is necessary since the spraying of the first article is not completed before the leading edge of the second article intercepts the light path of the photoelectric cell PEC. It will be noted as the description proceeds that the first and second control means operate independently of each other, and also clutches 36, 36', 37 and 37' operate independently of each other so that each spray nozzle sprays the full length of each article passing by.

In other words, the control to be described in more detail hereinafter includes four different kinds of time delay means for starting or stopping spraying of each nozzle at the proper instant. Each time delay means includes the common master control circuit with the photoelectric cell PEC; a starting or a stopping circuit

with clutch 36, 36', 37 or 37'; and the nozzle control circuits actuated by the cams of the particular starting or stopping circuit that are driven by the last mentioned clutch.

The electrical circuits will now be described in more detail. The common master control circuit covers the left half of Fig. 7a, the starting and stopping circuits cover the right half of Fig. 7a, and the nozzle control circuits are shown in Fig. 7b.

All of the circuits obtain their power through power lines L1 and L2 shown at the lower left in Fig. 7a connected to a 115 volt A. C. power source or any other suitable power source including a D. C. source after appropriate changes have been made. A main switch 43 must be closed before the circuit can be energized.

Common master control circuit

The master control circuit in the left half of Fig. 7a will be first described. This master control circuit causes the energization of the starting circuits with clutches 36 and 37 in Fig. 2 and at the right end of Fig. 7a as well as stopping circuits with clutches 36' and 37'. Alternating light and dark conditions on the photoelectric cell PEC will cause energization in the following sequence: starting clutches 36, stopping clutch 36', starting clutch 37, and stopping clutch 37'.

In the master control circuit, power is provided to a photoelectric cell unit PE at the upper left in Fig. 7a by a circuit formed through line L1, closed switch 43, line 45, photoelectric cell unit PE, line 46 and line L2. The photoelectric cell unit PE includes the photoelectric cell PEC and a relay actuated by the cell shown as relay PER with the circuit therebetween of any conventionally designed photoelectric cell circuit that is provided within the unit PE.

Power is provided to a time delay unit to prevent actuation of the remainder of the common master control circuit, the starting and stopping circuits, and the nozzle control circuits until the circuit in the photoelectric cell unit PE is properly heated up. This time delay is generally approximately one minute. The specific timed delay unit in the present disclosure has a circuit formed by line L1, closed switch 43, line 48, line 49, relay coil R50, line 55, and line L2. Relay coil R50 and its normally open relay contacts R50c, R50d and R50e have a dashpot R50T or equivalent mechanical time delay unit connected therewith. Then, the normally open relay contacts R50c, R50d and R50e will remain open until after relay coil R50 has been energized for a time period equal to the desired time delay so that relay contacts R50c and R50d will not close to supply power to the balance of the common master control circuit and relay contact R50e will not close to supply power to the individual nozzle control circuits in Fig. 7b (as will be brought out in more detail hereinafter) until after the photoelectric cell unit PE is properly heated up by the elapse of the time delay period.

The glue sprayed by nozzles 5A, 5B, 5C, 5D and 5E may prevent proper operation of photoelectric cell PEC if proper precautions are not taken since a coating of glue either on the light source or on the lens system of the photoelectric cell PEC will prevent adequate light transmission. Fig. 6 discloses a protecting cylindrical hood 61 secured to the photoelectric cell PEC and projecting forwardly to the right from its light receiving lens system. An air line 63 from an air or gas pressure source is secured thereto so that air rushing in the direction of the arrows through hood 61 away from the photoelectric cell PEC will prevent the glue vapor from entering hood 61 and from coating the lens system. A similar hood and air line may be used on the light source, if desired.

The photoelectric cell PEC in Figs. 1 and 7a detects or is responsive to the presence or absence of an article 2 at this sensing station. Before an article 2, being

carried toward the right in Fig. 1, reaches the photoelectric cell PEC, the light beam strikes the cell creating what will hereinafter be referred to a "light" condition. As the leading edge of the article cuts the light beam, the light striking the photoelectric cell is cut off to create what will hereinafter be termed a "dark" condition. The trailing edge of the article, as it passes the photoelectric cell, will permit the light to strike the cell to again create the "light" condition. The photoelectric unit PE includes not only the photoelectric cell but also the photoelectric cell relay PER that is normally de-energized when the "dark" condition exists so that relay contact PERb is normally closed. When the "light" condition exists, the relay coil PER is energized to close the relay contact.

It should be understood, however, that other means for sensing the absence or presence of an article could be used. For example, a mechanical finger in the path of travel could open and close the circuit switch instead of the photoelectric cell.

D. C. power instead of A. C. is supplied to the balance of the main control circuit and to the starting and stopping circuits from the A. C. source connected to lines L1 and L2. The voltage of the A. C. source is step-down to the proper voltage for the control circuits by a circuit formed by line L1, closed switch 43, line 65, a primary winding of the stepped down transformer 66, line 67, and line L2. The A. C. current is changed to D. C. by a circuit formed from the secondary of the step-down A. C. transformer 66 to a rectifier 68. The rectifier 68 provides D. C. current at the proper control voltage from on one side the ground and line 69 to on the other side the power line 70 from which the balance of the main control circuit and the starting and stopping circuits will receive their D. C. power. Of course, it should be readily apparent that if a source of D. C. current is available at the proper voltage, the step-down transformer and rectifier would not be necessary.

Before the operation of the common master control circuit is described in detail, two components of this circuit will be described first. There are provided time delay relay coils R76 and R83 with each having its coil core equipped with a copper slug or surrounding ring or other equivalent structure so that a .05 second time delay takes place between the energization of the time delay relay coil R76 or R83 and the opening of the normally closed respective relay contact R76a or R83a.

The common master control circuit also includes two flip flop or impulse relays with their coils shown at FR79 and FR80. Each impulse relay has four contacts, for example the impulse relay coil FR79 has relay contacts FR79a, FR79b, FR79c, and FR79d, connected by the dotted line in Fig. 7a. Each successive energization of the impulse relay coil FR79 moves the contact closing member to alternate positions so that a pair of contacts is energized in each position. Hence, for example, the first energization of the impulse relay coil FR79 will close the relay contacts FR79b and FR79d, the second energization will close relay contacts FR79a and FR79c, the third energization will again close relay contact FR79b and FR79d, etc. Closing relay contact FR80d energizes the starting circuit and the electromagnetic clutch 36 therein, closing relay contact FR79c energizes the stopping circuit and the clutch 36' therein of the first control means while closing relay contacts FR80c and FR79d energize for starting and stopping in corresponding manner the clutches 37 and 37' respectively of the second control means.

Although the leading and trailing edges of each article are described herein as the photoelectric cell actuating portions, it should be clearly understood that the beginning and end of any other predetermined portion on each article may be used as well.

Before the first article 2 intercepts the light beam to

the photoelectric cell PEC, the impulse relay contacts FR79d and FR80c are normally closed, as shown in Fig. 7a. The photoelectric cell PEC in "light" condition with the photoelectric cell relay contact PERa closed. As the leading edge of the first article 2 breaks the light beam to the photoelectric cell PEC, the photoelectric cell PEC is changed to a "dark" condition to provide the initial response for actuating the control circuits. When the "dark" condition occurs, the photoelectric cell relay coil PER is de-energized so that normally closed relay contact PERb closes, as shown in Fig. 7a, to form a circuit from power line 70 through line 74, closed relay contact PERb, line 75, normally closed relay contact R76a, line 77, previously closed relay contact R50c, line 78, closed relay contact FR79b, line 86, closed relay contact FR80a, impulse or flip flop relay coil FR80 to the ground and back to the power line 70. The impulse relay coil FR80 then moves its contact closing structure so that relay contacts FR80b and FR80d are closed instead of relay contacts FR80a and FR80c. After the .05 second time delay has elapsed, the time delay relay coil R76 opens the normally closed contact R76a to break the circuit previously formed since only an electrical impulse was necessary to actuate the impulse relay coil FR80. Now, the starting circuit with the electromagnetic clutch 36 is energized since the contact FR80d has been closed and consequently the energized clutch 36 makes the shaft 38 be driven synchronously with the article conveyor belt 1 so that the cams in Figs. 3A to 3E will provide the proper time delay for starting the spraying of each nozzle, as will be brought out in more detail hereinafter.

As the trailing edge of the first article 2 goes past the light beam directed at the photoelectric cell PEC, the beam is no longer interrupted and the photoelectric cell assumes the "light" condition with the consequent energization of photoelectric cell relay coil PER to close the relay contact PERa. A circuit then is formed from the control power line 70, line 74, closed relay contact PERa, line 82, normally closed relay contact R83a, line 84, previously closed relay contact R50d, line 85, impulse relay coil FR79 to the ground return. Then, the flip flop or impulse relay causes contacts FR79a and FR79c to close with the consequent energization of the stopping circuit and electromagnetic clutch 36' in Figs. 2 and 7a so that the shafts 38' will be driven synchronously with the conveyor belt 1 so that its cams will stop the nozzles at each of the stations with the proper time delay to assure that the first article is sprayed by each nozzle throughout its full length. The time delay action and purpose of time delay relay coils R83 and R76 is the same.

Although only the first control means for controlling the spraying of the alternate articles (first, third, fifth, etc.) by energization of the starting clutch 36 and the stopping clutch 36' have been described with reference to the closing of relay contacts FR80d and FR79c, similar action takes place in the second control means for controlling the spraying of the even numbered articles (second, fourth, etc.) with the closing of relay contacts FR80c and FR79d controlling respectively the starting circuit with clutch 37 and the stopping circuit with clutch 37' of the second control means. The action is basically the same except that line 87 is used in the energizing circuit of flip flop relay coil FR80 with the second control means while line 86 is used with the first control means.

An examination of this common master control circuit will reveal that the following operational sequence of closing relay contacts will occur in each operating cycle with two articles moving past the photoelectric cell PEC: relay contact FR80d, relay contact FR79c, relay contact FR80c, and relay contact FR79d. These closing actions respectively correspond with the passage of the leading edge of the first article, the trailing edge of the first article, the leading edge of the second article, and the trailing

edge of the second article moving past the photoelectric cell PEC.

If for any reason, one of these contacts should be out of phase, for example, if it is closed when it should be open, the flip flop or impulse relay coils FR79 and FR80 will automatically reestablish this sequence of operation after only a small number of electrical impulses have been imparted to either or both flip flop or impulse relays by closing one or both of the photoelectric relay coil contacts PERa and PERb alternately in the normal manner.

Starting and stopping circuits

It should be mentioned before explaining the starting and stopping circuits and the individual nozzle control circuits that the switch actuating cams in Figs. 3A to 3X are in their idle or starting positions before counterclockwise rotation is begun and these positions correspond to the cam actuated switch contact positions shown in Figs. 7a and 7b.

Each of the four starting or stopping circuits in the right half of Fig. 7a is the same so only one circuit will be described, that is, the starting circuit of the first control means with the starting electromagnetic clutch 36. This circuit is the lower one of the four shown in the right half of Figs. 7a. After the leading edge of the first article has intercepted the light beam to photoelectric cell PEC to consequently close the impulse or flip flop relay contact FR80d, this starting circuit is energized by a circuit including control power line 70, line 100, line 101, closed impulse relay contact FR80d, line 102, line 112, normally closed relay contact R103a, line 105, line 106, relay coil R107, and the ground return. Energization of relay coil R107 closes the associated normally open relay contacts R107a and R107b so that the clutch 36 is engaged by a circuit including power line 70, closed relay contact R107b, line 109, clutch engaging coil C110 to the ground return so that the clutch 36 is engaged to drivingly connect gear 33 in Fig. 2 with shaft 38.

Sustaining means is provided for causing continued counterclockwise rotation of shaft 38 in Fig. 3X until one full operation has been completed and the nozzles at all five stations in Figs. 4A to 4E have started spraying even though the relay contact FR80d no longer exists. This assures that the first article will be processed or sprayed under the control of its control means (the first control means) independently of the other control means for the immediately following article (the second control means). A maintaining circuit for keeping the clutch 36 engaged includes control power line 70, closed relay contact R107a, line 112, normally closed relay contact R103a, line 105, line 106, relay coil R107, and the ground return. Before shaft 38 in Fig. 2 starts to rotate counterclockwise in Fig. 3X, the lobe on the control cam 111 in Fig. 3X is engaged with the lever on a microswitch having a contact 110 so that contact 110 in Fig. 7a is open. However, the switch contact 110 closes after two to three degrees of counterclockwise rotation by cam 111 to form a parallel maintaining circuit through line 113, closed switch 110, and line 114 in parallel with the closed relay contact 103a. The control for de-energizing the clutch coil C110 after one full counterclockwise revolution of shaft 38 is now given to closed switch 110 which will be opened by the lobe on cam 111 after one revolution. This control is given switch 110 by the opening of normally closed relay contact R103a soon after the switch 110 is closed by the rotation of shaft 38. The original closing of impulse or flip flop relay contact FR80d also formed a circuit from power control line 70, line 100, line 101, closed impulse relay contact FR80d, line 102, line 116, resistance 117, through the parallel circuits of capacitance 118 and relay coil R103 to the common line 119 and the ground return. This R-C delay circuit is adjusted for sufficient time delay so that the relay coil R103 is energized to open the normally closed

relay contact R103a after switch 110 is closed by sufficient rotation of shaft 38. After impulse relay contact FR80d is opened, this circuit receives its power from power lines 70, maintaining circuit closed relay contact R107a, through line 116.

Although this specific sustaining means is disclosed herein, any other circuit and mechanical structure for performing this function can be used.

A similar flow of current takes place in the appropriate stopping circuit when stopping clutch 36' of the first control means is engaged as well as when either the starting or stopping clutches 37 or 37' of the second control means is engaged. These starting and stopping circuits as well as the individual nozzle control circuits to be described later have corresponding parts designated respectively, whenever possible by primed 100 series reference numerals, unprimed 200 series, and primed 200 series with the same basic reference numeral in each.

Nozzle control circuits

The nozzle control circuits receive their power for automatic operation for energizing the nozzle solenoid coils 12A, 12B, 12C, 12D and 12E at the right in Fig. 7b with each coil corresponding to the nozzle solenoid coil 12A in Fig. 5 from a circuit including power line L1 (Fig. 7a), previously closed switch 43, line 48, switch 121 (manually closed to start automatic operation of glue spray nozzles), line 122, previously closed relay contact R50e, line 123 extending from Fig. 7a to Fig. 7b, line 124 (Fig. 7b), and line 125 while power line L2 in Fig. 7a is connected by lines 55 and 56 with a return ground.

The nozzle control circuit associated with shaft 38 in Fig. 2 of the first spraying control means for the odd numbered articles operate on basically the same principle as the nozzle control circuits associated with shafts 38', 39' and 39 so that only the nozzle control circuits associated with shaft 38 will be described in detail for starting the spraying at each of the five nozzle stations while the nozzle control circuits associated with shaft 39 will be briefly described as to their stopping the spraying at the five stations. The spray nozzles 5A, 5B, 5C, 5D and 5E at the five spray or processing stations in Figs. 4A to 4E have their solenoids energized for commencing the spray operation by the closing of the respective microswitches 133A, 133B, 133C, 133D and 133E when the corresponding notches 132A, 132B, 132C, 132D and 132E in the respective operating cams 131A, 131B, 131C, 131D and 131E engage the respective switch arms to open the switch contacts in turn as shaft 38 is rotated counter-clockwise in the direction of the arrows in Figs. 3A to 3X inclusive. The proper time delays, corresponding to the distances between the photoelectric cell PEC in Fig. 1 and nozzle at each of the spraying stations, correspond respectively with the arcuate distances between each switch lever and its coacting cam notch for each glue nozzle in Figs. 3A to 3E inclusive since these drawing figures show the position of each of the five process station actuating cams with respect to its associated switch at the time the clutch 36 is engaged when the leading edge of first article 2 breaks the beam to the photoelectric cell PEC. The change in light condition on the photoelectric cell PEC provides the initial response for the subsequent operation of each nozzle in turn with the proper time delay.

Since the nozzle control circuit for each station controlled by the cam in Figs. 3A to 3E is the same, only one nozzle control circuit will be described. A control circuit exists from power line 125 in Fig. 7b, closed microswitch contact 133A', line 135A, line 136A, closed switch contact 133A when cam notch 132A engages the lever of switch 133A, line 137A, relay coil R139A through the ground return. Solenoid coil 12A is energized to open valve 13A to cause the other nozzle parts to assume the spraying position when the leading edge of the first article is about to register with the flow stream

path from nozzle 5A. It is energized by a control circuit formed from the power line 124, closed relay contact R139Ab, line 140A, closed switch contact 141A, nozzle solenoid coil 12A to the ground return. The relay coil R139A is kept energized by a maintaining circuit in parallel with the cam operated switch 133A' that includes line 135A, line 143A, closed relay contact R139Aa, relay coil R139A and the ground return.

This circuit is maintained and nozzle 5A continues to spray until clutch 36' is engaged when the trailing edge of the first article 2 no longer intercepts the light beam to the photoelectric cell PEC. Then, shaft 38' begins to rotate synchronously with the travel of the conveyor belt 1 to open the normally closed switch 133A' in Figs. 2 and 7b after the proper time delay corresponding to the arcuate length between the switch arm and cam notch in Fig. 3A. Opening switch 133A' opens the maintaining circuit and de-energizes the relay coil R139A to stop the glue spraying by the nozzle 5A as the trailing edge of the first article leaves the flow stream path of nozzle 5A. This circuit opening action de-energizes solenoid coil 14A to close valve 13A so that the nozzle parts assume the Fig. 5 position to stop the nozzle spraying with the piercing needle 17A moving to the left into the spraying orifice 24a to be sure no glue seal forms therein while the spray is cut off.

It should be apparent that nozzle 5B, 5C, 5D and 5E will each in turn start and stop after the proper time delay has elapsed after the leading edge and the trailing edge of the article in turn have passed the photoelectric cell PEC so that the glue nozzle at each station will continuously spray while the article is intercepting the spray stream but will not spray between the articles. The proper time delay is assured because the corresponding paired starting and stopping cams 131B and 131B', cams 131C and 131C', cams 131D and 131D', and cams 131E and 131E' have the same arcuate time delay distance between the starting points and the switch actuating notch.

The second control means for controlling the spraying of the even numbered articles 2 (second, fourth, etc.) has structure substantially identical with and operating in substantially the same manner as that described immediately heretofore for the first control means but with the 200 series of reference numerals being given, whenever possible, the corresponding elements of the second control means nozzle control circuits and actuating cams while the 100 reference numeral series was generally used for the first control means nozzle control circuits and actuating cams. The unprimed reference numerals generally appear in the starting circuits with their individual nozzle control circuits while the primed reference numerals generally appear in the stopping circuits with their individual nozzle control circuits. Further description does not appear to be necessary since the corresponding numbering of the parts makes the following of the remaining circuits readily understandable to anyone skilled in the art.

General operation

Hence, it can readily be seen that the present apparatus includes two control means for automatically controlling the spray of the successive article 2 passing through the glue spray unit 3 with the first control means including clutches 36 and 36' for controlling the spraying of the alternate or odd-numbered (first, third, fifth, etc.) articles passing from left to right in Fig. 1, while the second control means includes clutches 37 and 37' and controls the spraying of the even-numbered (second, fourth, etc.) articles.

As the first article 2 is carried toward the right in Fig. 1 by the conveyor belt 1, its leading edge intercepts the light beam directed at the photoelectric cell PEC in the common master control circuit at the left in Fig. 7a which in turn energizes the electromagnetic starting clutch 36 of the first control means in Figs. 2 and 7a in the proper starting circuit (lowest of the four similar circuits at

the right in Fig. 7a) for starting the rotation of shaft 38 in Figs. 2, 7a and 7b with the cams 111, 132A, 132B, etc. thereon, as shown in Figs. 3A to 3X, for synchronously driving them with the conveyor belt 1 carrying the first article 2. These cams provide proper time delay in the nozzle control circuits in Fig. 7b so that each of the nozzles 5A, 5B, etc. starts spraying when the leading edge of the first article is in position to intercept its spray stream. It should be noted that the actuating notches 132A, 132B, etc. in the cams 131A, 131B in Figs. 3A to 3E are out of phase with each other to provide the proper time delay for starting the spray of the nozzle at each station at the proper instant since each nozzle is a different distance to the right of photoelectric cell PEC in Fig. 1. As the trailing edge of the first article 2 goes by the photoelectric cell PEC, the light beam again hits the photoelectric cell PEC of the common master control circuit at the left in Fig. 7a to energize the stopping electromagnetic clutch 36' in the stopping circuit (uppermost circuit at the right in Fig. 7a) of the first control means. This clutch 36' then drives the shaft 38' in Figs. 2, 7a and 7b with corresponding cams 131A', 131B', etc. for actuating the nozzle control circuits in Fig. 7b with a proper time delay so that each nozzle 5A, 5B, etc. in turn stops spraying when the trailing edge of the first article 2 intercepts its spray stream.

The second control means operates in a similar manner to energize the starting clutch 37 and the stopping clutch 37' in Figs. 2 and 7a. The second control means is necessary since the spraying of the first article 2 is not completed before the leading edge of the immediately following second article 2 intercepts the light path of the photoelectric cell PEC. The first and second control means operate independently of each other, and also clutches 36, 36', 37 and 37' operate independently of each other so that each spray nozzle sprays the full length of each article passing by.

In other words, the control includes four different kinds of time delay means for starting or stopping the spraying of each nozzle at the proper instant. Each time delay means includes the common master control circuit at the left in Fig. 7a with the photoelectric cell PEC; a starting or a stopping circuit at the right in Fig. 7a with clutch 36, 36', 37 or 37'; and the nozzle control circuits in Fig. 7b actuated by the cams on the shaft driven by the last mentioned clutch in the particular starting or stopping circuit.

The spray nozzles 5A, 5B, 5C, 5D and 5E can be individually manually controlled as well as automatically controlled as described heretofore. In manual control, a switch 250 in Fig. 7b receives its power from power line L1, closed switch 43, line 48, closed switch 121, line 122, closed relay contact R50e, line 123 to the switch 250. The switch 250 is made up of five individually and independently operable switch elements. When its switch element on the right in Fig. 7b is closed, nozzle 5A is caused to spray by opening contact 141a to remove it from automatic control and by closing switch contact 251A in Fig. 7b to secure manual control for energizing the nozzle solenoid coil 12A through the ground return circuit to power line L2. The switch contact 251A can be closed manually when spraying is desired at the first station with nozzle 5A, and a similar manual closing of the corresponding switch element and contact will cause manual instead of automatic spraying by any of the other nozzles 5B, 5C, 5D, or 5E.

Although only two control means for controlling the spraying of the articles is disclosed (first control means for spraying the odd numbered articles and including clutch 36 and 36' and the second control for spraying even numbered articles and including clutches 37 and 37'), it should be readily apparent that a different number of control means may be required under some conditions and the electrical circuit therefor would be basically the same as the circuit disclosed in the present ap-

plication and would be well within the skill of anyone versed in the art to construct in view of the teaching of the present application. For example, if the articles 2 were spaced a sufficient distance apart, only one control means might be necessary. If the articles 2 were of shorter length so that the first one was still being sprayed by some of the nozzle stations when the leading edge of the third one was being detected by the photoelectric cell, three different control means would be desirable. With the three control means, each control means would control the spraying of every third article instead of every other article as in the present disclosure. Any other number of control means could be used if necessary.

Various changes in details and arrangement of parts can be made by one skilled in the art without departing from the spirit of this invention or the scope of the appended claims.

What I claim is:

1. In an apparatus for processing articles passing along a predetermined path, a processing station arranged along the path of travel, a first means initially responsive to the beginning of a predetermined portion of an article passing along said path on the approach side of the processing station and operatively effective for activating said processing station when the beginning of said predetermined portion on said last mentioned article registers with said station, and a second means initially responsive to the end of said predetermined portion of said article passing along said path on the approach side of said processing station and operatively effective for deactivating said processing station when the end of said predetermined portion of said last mentioned article registers with said station.

2. In an apparatus for processing articles passing along a predetermined path, a plurality of processing stations arranged along the path of travel, a first means initially responsive to the beginning of a predetermined portion of an article passing along said path on the approach side of all the processing stations and operatively effective for initially activating in turn each processing station when the beginning of said predetermined portion on said last mentioned article registers with each station in turn, and a second means initially responsive to the end of said predetermined portion of said last mentioned article passing along said path on the approach side of all said processing stations and operatively effective for deactivating in turn each processing station when the end of said predetermined portion of said last mentioned article registers with each station in turn.

3. In an apparatus for processing articles passing along a predetermined path, means for moving articles in succession along said path, a plurality of processing stations arranged along the path of travel, a first control means for controlling the processing of a first article and a second control means for controlling the processing of a second article following said first article, each control means comprising a first time delay means responsive on the approach side of the processing stations to the leading edge of an article passing along said path and subsequently operatively effective after a time delay for activating in turn each processing station when the leading edge of said last mentioned article registers with each station in turn, each control means comprising a second time delay means responsive on the approach side of the processing stations to the trailing edge of said last mentioned article passing along said path and subsequently operatively effective after a time delay for deactivating in turn each processing station when the trailing edge of said last mentioned article registers with each station in turn, each of said two first time delay means and said two second time delay means being operable independently of each other so that each article will be processed under the control of its control means independently of the other control means.

4. In an apparatus flocking machine for processing by flocking articles passing along a predetermined path, means for moving articles in succession along said path, a plurality of processing stations arranged along the path of travel, a first control means for controlling the processing of a first article and a second control means for controlling the processing of a second article following said first article, each control comprising a first time delay means operatively connected to said article moving means and responsive on the approach side of the processing stations to the beginning of a predetermined portion of an article passing along said path and subsequently operatively effective for activating in turn each processing station when the beginning of said predetermined portion on said last mentioned article registers with each station in turn, each control means comprising a second time delay means operatively connected to said article moving means and responsive on the approach side of the processing stations to the end of said predetermined portion of said last mentioned article passing along said path and subsequently operatively effective for deactivating in turn each processing station when the end of said predetermined portion of said last mentioned article registers with each station in turn, and sustaining means for causing continued operation of any of said time delay means when another of said time delay means is activated so that each article will be processed under the control of its control means independently of the other control means.

5. In an apparatus for processing articles passing along a predetermined path, means for moving articles in succession along said path, a plurality of processing stations with each having a spray nozzle arranged along the path of travel, a first control means for controlling the spray processing of a first article and a second control means for controlling the spray processing of a second article following said first article, each control means comprising a first time delay means operatively connected to said article moving means and initially responsive to the beginning of a predetermined portion of an article passing along said path and operatively effective for causing each nozzle in turn to spray when the beginning of said predetermined portion on said last mentioned article registers with each nozzle flow stream in turn, each control means comprising a second time delay means operatively connected to said article moving means and initially responsive to the end of said predetermined portion of said last mentioned article passing along said path and operatively effective for causing each nozzle in turn to stop spraying when the end of said predetermined portion of said last mentioned article registers with each nozzle flow stream in turn, and sustaining means for causing continued operation of any of said time delay means when another of said time delay means is activated so that each article will be processed or sprayed under the control of its control means independently of the other control means.

6. In a machine for applying glue prior to flocking on articles passing along a predetermined path, means for moving articles in succession along said path, a plurality of processing stations with each having a glue spray nozzle arranged along the path of travel, a first control means for controlling the glue spraying of a first article and a second control means for controlling the glue spraying of a second article following said first article, each control means comprising a first time delay means operatively connected to said article moving means and responsive on the approach side of the glue spray nozzles to the leading edge of an article passing along said path and subsequently operatively effective for causing each nozzle in turn to spray glue when the leading edge on said last mentioned article registers with each nozzle glue flow stream in turn, each control means comprising a second time delay means operatively connected to said article moving means and responsive on the approach side of the glue spray nozzles to the trailing edge of said last mentioned article passing

along said path and subsequently operatively effective for causing each nozzle in turn to stop spraying glue when the trailing edge of said last mentioned article registers with each flow stream in turn, and sustaining means for causing continued operation of any of said time delay means when another of said time delay means is activated so that each article will be processed or sprayed under the control of its control means independently of the other control means.

7. In a machine for applying glue prior to flock on articles passing along a predetermined path, a plurality of spraying stations arranged along the path of travel, a support unit at least partially encircling said path of travel, said support unit comprising a grid bridging across said path of travel with said grid forming one support bar at each station with said support bars spaced along the line of travel and all located on the same side of said path, said grid and support bars extending generally parallel to said path, and a spray glue nozzle fixed to each support bar and directed within the support unit toward said path of travel with said nozzles spaced apart along the path of travel, each spray nozzle being directed approximately laterally toward said path of travel but at an angle different from the other nozzle for covering said article with spray, all of said nozzles being located on the same side of said path.

8. The combination of claim 7 wherein all of said support bars are located equidistant from said path, and wherein said support unit includes two one-piece members with each secured to respective ends of said bars to form said grid.

9. In an apparatus for processing articles passing along a predetermined path, means for moving articles in succession along said path, a processing station arranged along the path of travel, a first control means and a second control means for controlling the processing respectively of first and second articles, each control means including a means responsive independently of the spacing between said articles and independently of any even multiple of said spacing and responsive a spaced distance ahead of said processing station to the beginning of a predetermined portion of its article passing along said path and operatively effective for initially activating said processing station when its article has traversed said distance and is in registration for processing therewith.

10. The combination of claim 9 wherein each of said control means includes a timing member normally stationary during article travel and means for synchronously driving said timing member with the travel of its article after article response so that articles of any length or spacing may be processed.

11. In a machine for applying glue prior to flock on articles passing along a predetermined path, a plurality of spraying stations arranged along the path of travel, a plurality of supports with one support at each station, a spray glue nozzle on each support directed toward said path of travel with said nozzles spaced apart along the path of travel, each nozzle having a spray orifice for directing a spray to intercept the path of article movement and having valve means for controlling the flow through said orifice, each nozzle also having piercing means for piercing any glue seal formed in the orifice when the flow is cut off, a first means initially responsive to the beginning of a predetermined portion of an article passing along said path and operatively effective on said valve means for each nozzle for causing each glue nozzle in turn to spray and operatively effective to withdraw the associated piercing means from each spray orifice in turn when the beginning of said predetermined portion on said last mentioned article registers with each nozzle flow stream in turn, and a second means initially responsive to the end of said predetermined portion of said last mentioned article passing along said path and operatively effective on said valve means for each nozzle for causing each glue nozzle in turn to stop spraying and operatively effective to extend the

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associated piercing means into each spray orifice in turn when the end of said predetermined portion of said last mentioned article registers with each nozzle flow stream in turn.

12. In an apparatus for processing articles passing along a predetermined path, means for moving articles in succession along said path, a plurality of processing stations arranged along the path of travel, a first control means for controlling the processing of a first article and a second control means for controlling the processing of a second article following said first article, each control means comprising a first time delay means responsive on the approach side of the processing stations to the leading edge of an article passing along said path and subsequently operatively effective for activating in turn each processing station when the leading edge of said last mentioned article registers with each station in turn, each control means comprising a second time delay means responsive on the approach side of the processing stations to the trailing edge of said last mentioned article passing along said path and subsequently operatively effective for deactivating in turn each processing station when the trailing edge of said last mentioned article registers with each station in turn, each of said two first time delay means and said two second time delay means being operable independently of each other so that each article will be processed under the control of its control means independently of the other control means, the sequence in the operation cycle being actuation of said first time delay means and then said second time delay means of said first control means and then actuation of said first time delay means and then said second time delay means of said second control means, and means for automatically re-establishing said sequence of operation if the operation of any of said time delay means gets out of phase.

13. In a machine for applying glue prior to flock on articles passing along a predetermined path, means for moving articles in succession along said path, a plurality of spraying stations arranged along the path of travel, a support unit at least partially encircling said path of travel, said support unit comprising a grid bridging across said path of travel with one support bar at each station, a spray glue nozzle fixed to each support bar and directed with the support unit approximately laterally toward said path of travel but at an angle different from the other nozzle for covering said article with spray, said nozzles spaced apart along the path of travel, each nozzle having a spray orifice for directing a spray to intercept the path of article movement and having valve means for cutting off or permitting the flow through said orifice, each nozzle also having piercing means for piercing any glue seal formed in the orifice when the flow is cut off, a first control means for controlling the spraying of a first article and a second control means for controlling the spraying of a second article following said first article, each control means comprising a first time delay means responsive on the approach side of the nozzles to the leading edge of an article passing along said path and subsequently operatively effective on said valve means for each nozzle for causing each nozzle in turn to spray and operatively effective to withdraw the associated piercing means from each spray orifice in turn when the leading edge on said last mentioned article registers with each nozzle flow stream in turn, each control means comprising a second time delay means responsive on the approach side of the nozzles to the trailing edge of said last mentioned article passing along said path and subsequently operatively effective on said valve means for each nozzle for causing each nozzle in turn to stop spraying and operatively effective to extend the associated piercing means into each spray orifice in turn when the trailing edge of said last mentioned article registers with each nozzle flow stream in turn, sustaining means for causing continued operation of any of said time delay means when another of said time delay means is activated

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so that each article will be processed or sprayed under the control of its control means independently of the other control means, the sequence in the operation cycle being actuation of said first time delay means and then said second time delay means of said first control means and then actuation of said first time delay means and then said second time delay means of said second control means, and means for automatically re-establishing said sequence of operation if the operation of any of said time delay means gets out of phase.

14. In an apparatus for processing articles passing along a predetermined path, a processing station arranged along the path of travel, a first control means responsive a spaced distance ahead of said processing station to a predetermined portion of an article and a second control means responsive a predetermined distance ahead of said processing station to a predetermined portion of an article different from said first mentioned portion for controlling the processing of said articles, each of said control means including a timing member and including a means responsive to one of said predetermined portions for setting one timing member in motion independently of the other timing member.

15. In an apparatus for processing articles passing along a predetermined path, a processing station arranged along the path of travel, a first control means responsive a spaced distance ahead of said processing station to a predetermined portion of an article and a second control means responsive a predetermined distance ahead of said processing station to a predetermined portion of an article different from said first mentioned portion for controlling the processing of said articles, said first and second control means including a separate timer for each of said control means and including means responsive to one of said aforementioned portions for changing the relative timing relationship between said timers.

16. In an apparatus for processing articles passing along a predetermined path, a plurality of processing stations arranged along the path of travel a spaced distance apart, and a means initially responsive a spaced distance ahead of the first encountered processing station to the beginning of a predetermined portion of an article passing along said path and operatively effective for initially activating in a predetermined sequence the processing stations for causing each to process the last mentioned article at an appropriate time after said article has traversed said distance, said means including a normally stationary timing member and means responsive to said article for setting said timing member in motion, whereby the apparatus may be used for processing articles of any length or spacing without requiring readjustment.

17. In an apparatus for processing articles passing along a predetermined path, a processing station arranged along the path of travel and operable between processing and non-processing positions, and a means initially responsive to spaced distance ahead of said processing station to a predetermined portion of an article passing along said path and operative for changing said processing station from one to the other of said positions when said last mentioned article is at said processing station for processing thereof, said means including a timing member normally stationary during article travel and means for synchronously driving said timing member with the travel of said article after article response, whereby the apparatus may be used for processing articles of any length or spacing without requiring readjustment.

18. In an apparatus for processing articles passing along a predetermined path, a plurality of processing stations arranged along the path of travel, and means initially responsive to the beginning of a predetermined portion of an article passing along said path and operatively effective for activating in turn each processing station when the beginning of said predetermined portion on said last mentioned article registers with each station in turn, said means including a normally stationary timing member

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and means for synchronously driving said timing member with the travel of said article after article response, whereby the apparatus may be used for processing articles of any length or spacing without requiring readjustment.

19. In a machine for apply glue prior to flock on articles passing along a predetermined path, a plurality of spraying stations arranged along the path of travel, a plurality of supports with one support at each station, a spray glue nozzle on each support, said nozzles spaced apart along the path of travel and being directed approximately laterally toward said path of travel but at an angle different from the other nozzle for covering said article with spray, each nozzle having a spray orifice for directing a spray to intercept the path of article movement and having valve means for controlling the flow through said orifice, and a means initially responsive to only the beginning of a predetermined portion of an article passing along said path before reaching the first spraying station and operatively effective on said valve means for causing each nozzle in turn to spray in a predetermined sequence at the appropriate time for applying glue to said last mentioned article, said means including a normally stationary timing member and means for synchronously driving said timing member with the travel of said article after article response, whereby the apparatus may be used for processing articles of any length or spacing without requiring readjustment.

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tionary timing member and means for synchronously driving said timing member with the travel of said article after article response, whereby the apparatus may be used for processing articles of any length or spacing without requiring readjustment.

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