

Dec. 25, 1962

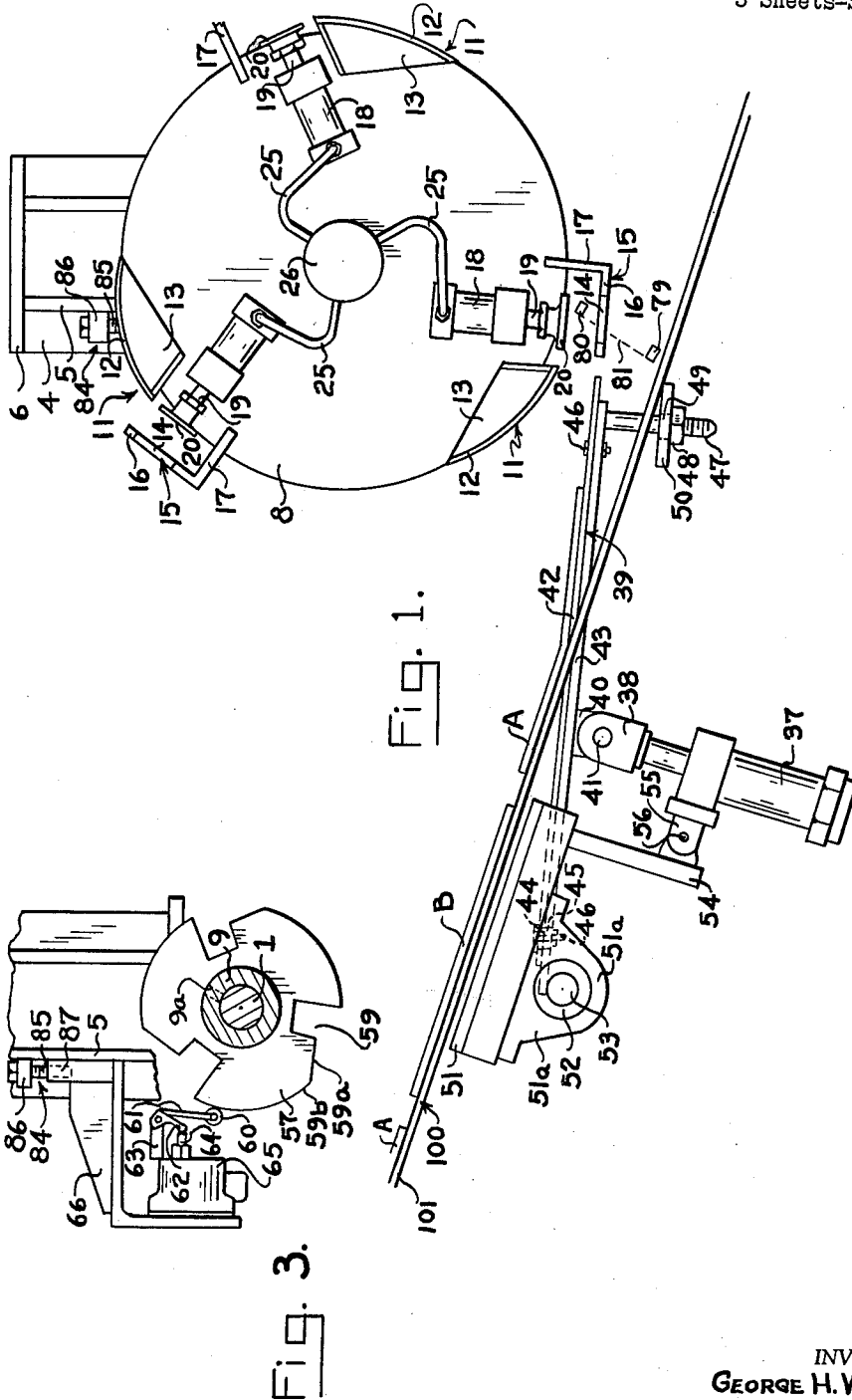
G. H. WILLIAMSON

3,070,211

SHINGLE FLIPPER

Filed Aug. 17, 1959

3 Sheets-Sheet 1



INVENTOR.
GEORGE H. WILLIAMSON

BY

John A. McRae
ATTORNEY

Dec. 25, 1962

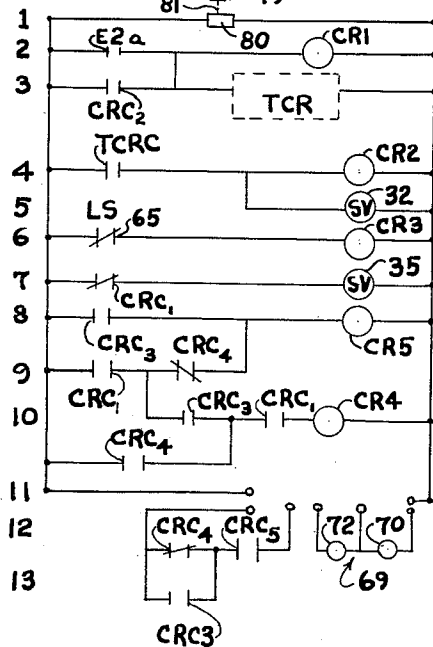
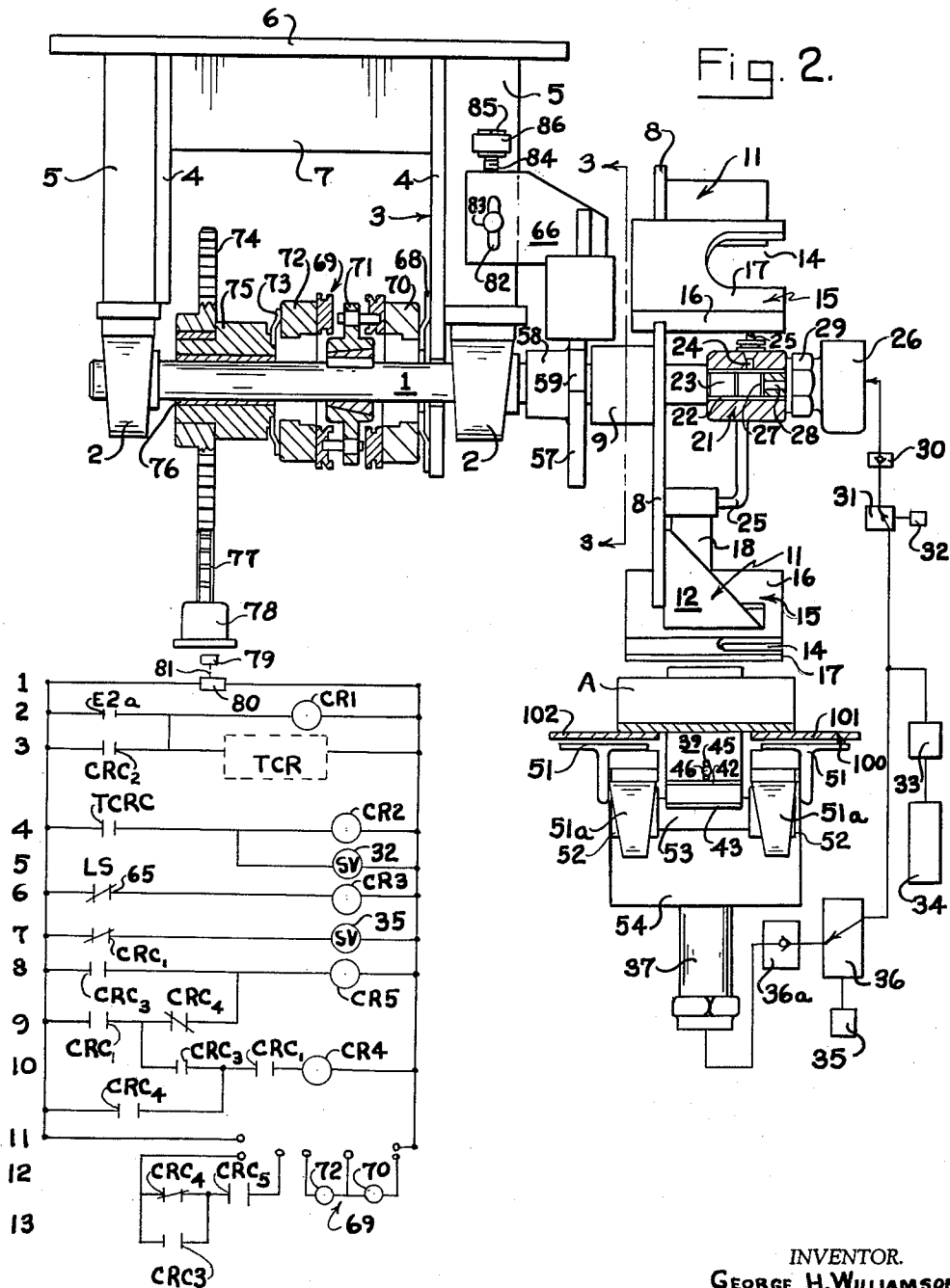
G. H. WILLIAMSON

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SHINGLE FLIPPER

Filed Aug. 17, 1959

3 Sheets-Sheet 2



INVENTOR.
GEORGE H. WILLIAMSON

BY

John A. McKinney
ATTORNEY

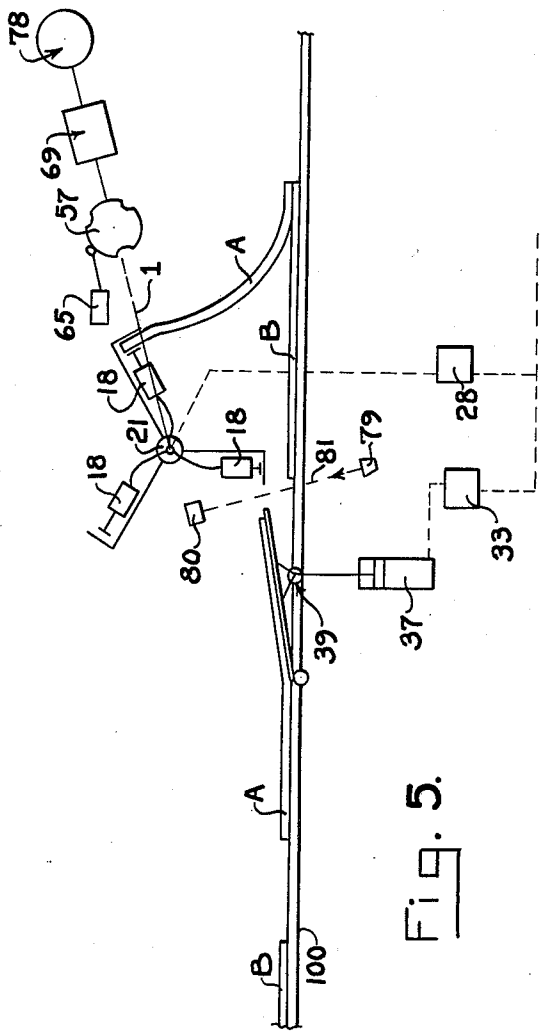
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G. H. WILLIAMSON
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3 Sheets-Sheet 3



INVENTOR.
GEORGE H. WILLIAMSON

BY

John A. McKinley

ATTORNEY

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3,070,211

SHINGLE FLIPPER

George H. Williamson, Somerville, N.J., assignor to
Johns-Manville Corporation, New York, N.Y., a cor-
poration of New York

Filed Aug. 17, 1959, Ser. No. 834,158

10 Claims. (Cl. 198—35)

This invention relates to mechanism for reversing flexible sheets of material; in particular, it relates to mechanism for automatically reversing alternate flexible asphalt shingles, and the like, conveyed on a conveyor belt system so that such reversed shingles can be paired, face-to-face or back-to-back, with alternate shingles not reversed on the conveyor system.

One of the developments in the field of asphalt shingles is an adhesive stripe superimposed upon either the face or the backside of a shingle, which stripe is utilized to seal overlapping shingles adhesively to each other when such shingles are laid on a roof deck to form a roof covering. Such shingles known in the trade as "self-sealing shingles." Since the adhesive stripe is an integral part of the shingle and is superimposed over one of the surfaces thereof, various problems are encountered after packaging of such shingles into a bundle, as the stripe has a tendency to adhere to an overlying or underlying shingle in the bundle. Consequently, the packaging arrangement must be modified to avoid objectionable adherence between shingles while they are packaged. One of the common ways to meet this problem is to package the shingles in pairs, either back-to-back or face-to-face depending upon which side has the adhesive stripe superimposed thereon, so that the adhesive stripes of such mating shingles mate with each other. While this type of mating does not avoid sticking between pairs of shingles, it protects the adhesive against contamination by foreign substances and utilizes the sticking characteristics of the adhesive in such a way as to produce a non-detrimental effect upon the shingles. Thus, upon removal of the shingles from the package, each pair of thusly mated shingles is smartly separated so that the intermediate layer of adhesive is split, thereby leaving approximately half of the total adhesive on one shingle and leaving the other portion of the total adhesive on the other shingle, or in essence, leaving each shingle with an amount of adhesive approximately equivalent to that amount originally added to it during manufacture.

Numerous other arrangements may be utilized to avoid the sticking problem produced as a result of adding the adhesive stripe to the shingles. Thus, for example, the shingles may be paired in the manner noted heretofore, but with a non-adhering strip of material sandwiched between the mating adhesive layers. This invention relates to those shingles which utilize some form of reversing arrangement for shingles in order to effect pairing of shingles, either back-to-back or face-to-face.

Heretofore, the shingles were paired either automatically or manually. With manual pairing of shingles, the disadvantages are, more or less, obvious, i.e., manual labor is required, persons must be trained to perform this operation, the possibility of injury to personnel is ever present, etc. Of the automatic mechanism known to perform this pairing function, most of the mechanisms are relatively expensive and quite complicated. Consequently, the initial installation expense is quite high, and the degree of maintenance required to maintain the machinery in operating condition is also quite high.

It is an object of this invention, therefore, to provide

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a mechanism for reversing or pairing asphalt shingles, and the like, which is relatively simple in construction and consequently does not require a large investment for initial installation.

5 An additional object of this invention is a mechanism for reversing asphalt shingles and the like, which mechanism can be inserted in existing shingle fabricating installations without extensive modification of such installations for accommodation thereof.

10 A still further object of this invention is a novel reversing mechanism used to reverse or pair asphalt shingles, and the like, which mechanism requires very little maintenance when such mechanism is used in continuous operation.

15 A still further object of this invention is to provide a novel mechanism for automatically reversing asphalt shingles and the like.

In brief, the invention comprises a rotatable shaft mounted transversely of the asphalt shingle conveyor system; on the shaft are mounted a plurality of individually operated clamping or grabbing mechanisms, which mechanisms are mounted to a plate or to radiating arms emanating from the shaft. The individual clamping mechanisms are equally spaced angularly about the shaft and are located relative to the shaft and to the shingle conveyor system so that, in the idle position, one of the clamping mechanisms is in a position to receive an asphalt shingle. Deflecting mechanism is utilized, which is operated by an electric eye mechanism to deflect an appropriate shingle conveyed on the conveyor system into the clamping mechanism in receiving positions; in addition, at periodic intervals the shaft is rotated, rotating thereabout the individual clamping mechanisms, one of which has the deflected shingle clasped thereto, through a predetermined angle. A subsequent shingle is allowed to by-pass the reversing mechanism, and after a predetermined distance of travel of this latter shingle on the conveyor, the clasped shingle is released and likewise reversed so that it falls back upon the conveyor to mate with the by-passing shingle. The paired shingles are subsequently conveyed to a further processing station in the shingle fabrication line, as, for example, a bundling and packaging station, while the reversing mechanism repeats the cycle on a new pair of sequential, oncoming shingles.

45 These and other objects will be readily apparent from the preceding brief description, and the following more detailed description and the attached drawings wherein:

FIG. 1 is a view, in side elevation, of the reversing mechanism and the shingle conveyor system;

50 FIG. 2 is a view, in front elevation, of the reversing mechanism with some of the parts thereof shown in cross section for purposes of clarification;

FIG. 3 is a cross sectional view taken along section lines 3—3 of FIG. 2 and showing with more clarity the cam mechanism utilized herein;

FIG. 4 is a diagrammatic view of the electrical control system used in conjunction with the reversing mechanism shown in FIGS. 1 and 2; and

60 FIG. 5 is a simplified diagrammatic representation or a flow diagram of the reversing unit, with parts exploded away from the central shaft for clarity, and the conveyor system.

Referring to the diagrammatic representation of FIG. 5, a conveyor system 100 conveys a plurality of spaced shingles in a continuous stream thereupon. The reversing mechanism comprises a central shaft 1 having a plurality of arms radiating therefrom and to which arms are mounted a plurality of individually operated claspers or

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grabbers, each comprising, in part, a fluid type motor 18. Also situated on the shaft is a cam mechanism 57 having associated therewith a limit switch 65. The shaft is rotated by drive motor 78; clutch-brake mechanism 69 is operated at properly timed intervals either to provide drive from the driver 78 to the shaft 1 or to cut out the drive and to brake the shaft. Underlying the conveyor system is a deflecting mechanism 39 operated by fluid servo motor 37. The motors 18 and 37 are controlled respectively by servo valves 28 and 33, which in turn are connected to a pressurized source of fluid supply. An electric eye having a light source 79 and a photo tube 80 electronically controls the operation of the deflecting mechanism, the actuation of the motors 18, and the sequential rotation of the shaft and its related mechanism. The shingles conveyed on the conveyor system are designated as A shingle and B shingle; in pairing, the face side of A shingle is reversed and mated with the face side of B shingle.

In operation, the shingles are conveyed in a continuous stream on the conveyor system 100. The deflecting mechanism 39 has been left in a deflecting position by the previous cycle, and it is therefore in a position to deflect A shingle into an adjacent individual clasp unit. When the forward edge of A shingle passes the electric eye beam, i.e., when it breaks the beam, the sequence of operation for the reversing mechanism is commenced. Shingle A is clasped by adjacent clasp motor 18 and its related mechanism, the motors being actuated by valve 28 activated by the severance of the light beam. In addition, the shaft is rotated to a new predetermined angular position, as determined by cam 57 and limit switch 65, through operation of the clutch of the clutch-brake 69, which couples shaft 1 to the motor 78. After a predetermined angular travel, switch 65 is operated by cam 57 to place the brake of the clutch-brake 69 into operation, thereby cutting off the drive to shaft 1 from motor 78 and halting the shaft's rotation. The forward end of held A shingle is maintained in a fixed position relative to the shaft 1, while the rear end is driven forward by the conveyor 100 until a point is reached wherein the held shingle is capable of being reversed or flipped over upon subsequent release of the shingle. The beam, broken by the forward edge of A shingle, also operates the electric circuit to valve 33, which exhausts motor 37 thereby lowering the deflector 39. The latter maintains this position when the beam is once again made continuous by the passing of the trailing edge of A shingle. As a result, B shingle is allowed to by-pass the reversing mechanism, undeflected. Through an appropriate time delay mechanism actuated by the initial severance of the beam of the electric eye, the held forward edge of A shingle is released by deactivation of motors 18, so that its rear edge, and now its forward edge, mates with the forward edge of B shingle and it gently drops thereupon and mates face-to-face therewith. A and B shingles continue their travel on the conveyor 100 thusly mated. The moment the beam is continuous after the passing of the trailing edge of B shingle, valve 33 is operated to permit motor 37 to be energized, thereby placing deflector 39 into its deflecting position. The entire reversing mechanism is thus in a position to repeat the cycle upon each subsequent pair of A and B shingles, except that an angularly adjacent clasp unit is in position to grab the subsequent A shingle upon deflection thereof by the deflecting mechanism 39.

Referring now to the more detailed and the working embodiment of the invention (FIGS. 1 and 2), a conveyor 100 conveys superposed shingles thereon, which conveyor comprises, in part, a pair of laterally spaced, parallel belts 101, 102. The shingles are transported thereon in a continuous stream and are spaced approximately 12" to 18" apart. Superposed over the belts 101, 102 is a main shaft 1 mounted in ball bearing pillow blocks 2 to lie approximately transverse to the longitudinal axis of the conveyor system. The blocks 2 are sus-

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ended from a frame 3 comprising a pair of spaced depending legs 4 braced by legs 5 attached thereto. The legs 4, 5 depend from an upper support plate 6, mounted in any convenient manner to a base support (not shown), and the legs 4 are further braced by across brace 7 secured to the legs 4 and to the upper plate 6.

A flat, circular plate or disc 8, which is equivalent to the radiating arms of the diagrammatic version of the reversing unit illustrated in FIG. 5, is mounted transversely of the shaft 1 and is concentric therewith; the mounting comprises a hub 9 welded to the disc 8 and keyed to the main shaft 1 by any form of standard key. Equiangularly spaced adjacent the periphery of the disc 8 are a plurality of guides 11, each of which comprises a guide segment 12 mounted to the disc 8 by an L bracket 13. Adjacent each guide and also mounted to the disc adjacent the outer periphery thereof is a stop or shingle-end retainer 15 comprising a pair of legs 16, 17, at right angles to each other, the latter of which is welded to the disc 8; a cut-out 14 is made in leg 16 so that the photoelectric unit may be placed adjacent the nadir of the reversing unit without having its beam impeded by leg 16 when the reversing unit is in idle position. Fluid motors 18 are mounted to the disc 8 approximately between guides 11 and retainers 15. Plunger 19 of each motor has a plunger plate 20 attached thereto, and which, in conjunction with leg 16 of adjacent retainer 15, comprises the retaining, clasp, or grabbing mechanism for a shingle. The fluid motors 18 are actuated by compressed air; however, it is to be understood that other types of fluid motors and fluid systems may be utilized or substituted therefor.

Each motor 18 is connected to a fluid manifold 21 by connecting tubes 25; the motors are connected thereby to a common source of fluid pressure supply. The manifold 21 has a bore 22 centrally located thereof, which is inserted over extension 23 of shaft 1 and securely fastened thereto. Outlet ports 24 radiate from the bore 22, to which ports are interconnected the tubes 25. A rotating seal 26 has its extension 27 lying within bore 22 so that its air passage 28 is in communication with the bore, and the seal is anchored to the manifold 21 by a lock nut 29. A pressurized air supply 34 is coupled to the rotor seal via a pressure reducer 33, valve 31, and a quick exhaust valve 30. Valve 31 is operated by a solenoid 32, the electrical connections to which are herein-after described.

A deflector motor 37 lying subjacent the conveyor system 100 is likewise coupled to the pressurized supply 34 via an operating valve 36 and a quick exhaust valve 36a. Electrical solenoid 35, coupled to valve 36, operates the latter at properly timed intervals, and the electrical connections to which are likewise given in greater detail hereinafter. The motor 37 actuates a deflector 39 and is coupled therewith by a motor plunger 38 connected to a depending deflector plate boss 40 by a connecting pin 41. The deflector 39 comprises a pair of plates 42, 43 secured to each other by fasteners 46. Ports 44 and 45 in the upper plate 42 and the lower plate 43, respectively, are elongated thereby allowing adjustment, i.e., lengthening or shortening, of the deflector prior to securing by fasteners 46. A limiting rod 47 depends from the outer extremity of lower plate 43 and has secured thereto a nut 48. Stop 50 is secured in any convenient fashion to a base support (not shown) and has a port 49 therein through which the limiting rod 47 passes. Consequently, the upward and downward travel of the deflector plate 39 is limited by the nut 48 striking the stop 50 and by the lowermost surface of the lower plate 43 striking the stop 50, respectively.

A supporting bracket 51, secured in any convenient manner to an existing base support (not shown), has a pair of depending ears 51a extending therefrom. The latter support therebetween rocking shaft 53, mounted at the ends thereof in bearings 52. A terminal of the

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deflector 39 is welded to the shaft 53; consequently, the shaft acts as a fulcrum point for the deflector 39. The motor 37 is supported from a depending bracket extension 54 via a motor extension 55 and a connecting pin 56. At properly timed intervals, motor 37 is actuated to elevate the central portion of the deflector 39 whereupon the latter pivots around shaft 53 and is limited in its upward movement by nut 48 engaging stop 50. Upon deactivation of the motor 37, the deflector, by a spring return (not shown), recedes the plunger 38 and the downward movement is arrested by the lowermost surface of the deflector 43 striking stop 50.

A cam 57 (FIGS. 2 and 3) is mounted on the shaft 1 adjacent the disc 8 by a cam hub 58, being securely anchored to the shaft 1 by a conventional set screw 9a. The outer periphery of the plate-like cam 57 is properly contoured by a plurality of depressions 59, dwell lands 59b and intermediate cam surface 59a; the contour of the cam controls the movement of associated cam roller 60. The latter is coupled to a limiting microswitch 65 via a cam roller arm 61, arm support 63 and switch actuator 62. The actuator 62 is coupled to the arm 61 so that it follows the movement thereof, during which it operates the switch plunger 64 either to activate or deactivate the switch 65. The entire switch mechanism is mounted on an adjustable bracket 66 mounted on a frame leg 5. Adjustability of the bracket frame 66 is obtained by having the latter secured to the base frame 5 via elongated slots 82 and fastener 83. An adjuster 84, superposed over the frame 66, comprises a bolt 85, threadedly engaged with a lug 86 and screwed into an internal thread 87 in the frame 66. If adjustment or repositioning of roller 60 is required, fastener 83 is loosened and bolt 85 is rotated in the proper direction either to elevate or lower the frame 66 the desired amount. The fastener 83 is, of course, subsequently retightened to maintain this adjustment. To obtain a repositioning of the cam 57 relative to the roller 60, the set screw 9a, securing the cam to the shaft, is loosened and the cam rotated to the proper position; after which the set screw is retightened to lock the cam in its new position relative to roller 60.

Fitted between pillow boxes 2 on the main shaft 1 are a clutch-brake mechanism 69 and a sprocket wheel 74. The clutch-brake 69, in essence, comprises a brake segment 70 secured to frame 4 by a mounting ring 68, a free wheeling center hub 71 keyed to the main shaft 1 for rotation therewith, and a clutch segment 72 imparting drive from the sprocket to the hub 71 when properly activated. The clutch-brake mechanism is electrically operated, and the diagrammatic electrical connections are given in further detail hereinafter in the discussion of the operation of the reversing unit.

The sprocket 74 has a sprocket hub 75 attached thereto and which hub interconnects the sprocket and the clutch side of the clutch-brake 69 via a mounting ring 73. The hub is provided with a bearing 76, and the sprocket wheel 74 is connected to a drive motor 78 via a sprocket chain 77. The motor provides a continual drive to the sprocket and thereby also provides a continual drive to the clutch side 72 of the clutch-brake 69. Upon proper electrical contact being made, the hub 71 provides either a drive to the shaft 1 by being coupled with the clutch side 72 or provides a brake for the shaft 1 by being coupled to the brake side 70.

The control system is initiated by an electric eye mechanism comprising a light source 79 and a photo tube 80 (FIG. 1) connected to the electrical control circuit of FIG. 4. Cutouts 14 are made in the leg 16 of retainer 15 so that the beam 81 may be properly located relative to the reversing mechanism, and in order to facilitate instantaneous control or instantaneous operation of the electrical circuit.

The electrical control circuit (FIG. 4) is comprised of the usual standard contacts operated by control relays.

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The lines in the circuit have been enumerated to facilitate tracing of the electrical connections and to facilitate the further description thereof. The electric eye mechanism 79, 80, by its beam 81 (line 1) controls normally open contact E_{2a} (line 2); the latter controls the energizing of control relay CR₁ and the commencement of operation of a time delay unit TCR (line 3). Time delay relay contact TCRC (line 4) is controlled by the delay unit, and the contact controls the energizing and de-energizing of control relay CR₂ (line 4) and solenoid 32 (line 5), the latter of which controls the valve 31 which, in turn, controls the operation of fluid motors 18. Relays CR₁ (line 2) and CR₂ (line 4) control the opening and closing of normally closed contact CRC₁ (line 7), normally open contact CRC₁ (line 9), normally open contact CRC₁ (line 10) and normally open contact CRC₂ (line 3). Contact CRC₁ (line 7) controls solenoid 35 (line 7), which in turn operates the valve 36 in the pressure line leading to gate or deflector motor 37. Limit switch 65 (line 6), normally closed, controls the operation of relay CR₃ (line 6), which in turn operates normally open contact CRC₃ (line 8), normally open contact CRC₃ (line 10), and normally open contact CRC₃ (line 13). Relays CR₅ (line 8) and CR₄ (line 10) control their associated normally open contact CRC₅ (line 12) and normally closed contact CRC₄ (line 9), normally open contact CRC₄ (line 10), and normally closed contact CRC₄ (line 12), respectively. The clutch-brake 69 (line 12) is controlled through the operation of contacts CRC₄, CRC₅ (line 12) and contact CRC₃ (line 13). The timed sequential operation of the various relays, contacts, etc., of the control circuit is given hereinafter in the detailed description of the working embodiment of the reversing unit, which is as follows.

The shingles are conveyed on the conveyor belt system 100 face up, for example, and, as denoted in the prior brief description of the reversing unit, the shingles are designated as A and B, in continual sequence. The objective of the reversing unit is to reverse A shingle and to deposit it upon B shingle so that it is properly aligned therewith, especially as to the stripes of adhesive; the shingles, thusly mated, face-to-face, continue as unit to the next processing station.

Shingle A approaches the deflecting mechanism 39. Referring to FIG. 4, contact E_{2a} (line 2) is controlled by the electric eye beam 81; when the beam is continuous, contact E_{2a} is normally open. Lines 2, 3, 4, 8, 9, 10, 11, and 12 in the control circuit have contacts therein normally open so that the relays CR₁, CR₂, CR₄ and CR₅ are de-energized, the time relay unit TCR is de-energized, solenoid 32 is de-energized, and clutch-brake 69 has its brake 70 operative to freeze the shaft. Limit switch 65 (line 6), at commencement of the reversing cycle, has its contacts open, since the roller 60, at rest position, bears against a dwell land 59b and is about to enter a depression 59; consequently, relay CR₃ (line 6) in the electrical circuit is likewise de-energized. The gate or deflector solenoid 35 (line 7) has its adjacent contact CRC₁ normally closed so that the solenoid 35 is energized. Compressed air from supply 34 passes through pressure regulator 33 through valve 36, operated by solenoid 35 to be in an open position, through quick exhaust valve 36a and into fluid motor 37 thereby activating the motor to extend its plunger 38. With such an extension of the plunger, deflector 39 is raised to a deflecting position pivoting about shaft 53 and being limited in its upward travel by nut 48 engaging stop 50. As A shingle approaches the reversing mechanism, its forward end is consequently elevated from the conveyor system, rides upon the deflector 39, and is subsequently guided, if necessary, by guide plate 12 into retainer 15; whereupon, it strikes leg 17 and is momentarily halted. The forward edge of the shingle, in passing by cut-out 14, also cuts the beam 81. In the control circuit, contact E_{2a} is thereby closed and relay CR₁ is energized (line 2). A

jumper between control lines 2 and 3 provides current for the time delay unit TCR, which commences to operate and which instantaneously closes contact TCRC (line 4); subsequently, after the proper timed interval, it opens the same. With the closing of this contact, relay CR₂ is energized, thereby closing normally open contact CRC₂ (line 3), but since the time delay unit TCR and relay CR₁ have previously been energized, no new action occurs. In addition, upon the closing of contact TCRC, solenoid 32 is energized thereby operating valve 31 (FIG. 2) to pass pressurized fluid from the supply 34 into the rotor seal 26, manifold 21, and motors 18. All the motors are operated in unison so that all the plungers 19 are extended, but only the lowermost plunger illustrated in FIG. 1 is working while the other two units remain idle. The lowermost motor 18 of FIG. 1 has its plunger 19 extended to a position whereby plate 20 is tightly engaged against A shingle thereby holding the forward extremity of the shingle between itself and retainer 15. Control relay CR₁ opens control relay contact CRC₁ (line 7), thereby deactivating solenoid 35; as a result, the pressurized air in motor 37 exhausts to air through quick exhaust valve 36a. Valve 36, having its solenoid deactivated, cuts off the pressurized supply to motor 37. The control relay CR₁ also closes control relay contact CRC₁ (line 9), thereby energizing control relay CR₅ (line 8) since control relay contact CRC₄ (line 9) is normally closed. Control relay contact CRC₁ (line 10) is also closed but since contacts CRC₃ (line 10) and CRC₄ (line 10) are normally open, relay CR₄ is not energized. With relay CR₅ (line 8) being energized through contacts CRC₁ and CRC₄ (line 9), contact CRC₅ (line 12), normally open, is closed, and since adjacent contact CRC₄ (line 12) is normally closed, current is provided to the clutch-brake 69 to operate the clutch 72 and deactivate the brake 70, thereby commencing rotation of the main shaft 1, disc 8, the attached motors 18, and the end of the shingle held between plate 20 and leg 16 of retainer 15. With rotation of main shaft 1, cam 57 is likewise rotated therewith, and the cam roller 60 enters an adjacent depression 59 and allows the limit switch 65 to close; a moment later it rides out of the depression and bears against surface 59b and dwell land 59a to reopen the switch 65. With entrance of roller 60 into a depression, actuator 62 operates to close the contacts of limit switch 65. With this closure, relay CR₃ (line 6) is energized thereby closing contacts CRC₃ (line 8), CRC₃ (line 10), and CRC₃ (line 13). Contact CRC₃ (line 8) being closed, an additional energizing circuit is provided for relay CR₅, which previously has been energized. With the closing of contact CRC₃ (line 10), a circuit is completed to relay CR₄ (line 10) through contacts CRC₁ (line 9), CRC₃ and CRC₁ (line 10). With the closing of contact CRC₃ (line 13), an additional energizing circuit is provided for the clutch-brake mechanism 69 and the clutch 72 is continued to be energized continuing rotation of the main shaft 1.

When relay CR₄ (line 10) is energized, normally closed contact CRC₄ (line 9) is opened, and relay CR₅ (line 8) is controlled by the opening or closing of contact CRC₃ (line 8), which, at the moment, is closed; as a result, relay CR₅ continues to be energized. Contact CRC₄ (line 10) is closed so that relay CR₄ (line 10) is self-energized in conjunction with the opening or closing of contact CRC₁ (line 10). Contact CRC₄ (line 12) is likewise opened so that control to the clutch is continued through the additional closed circuit including the contacts CRC₅ (line 12) and CRC₃ (line 13).

During continued rotation of the main shaft 1, roller 60 rides out from the depression 59 and bears against surfaces 59b; at which time, the limit switch 65 is again reopened de-energizing relay CR₃. Contact CRC₃ (line 8) is opened, and relay CR₅ is de-energized since the other energizing line (line 9) has an open contact CRC₄ therein. Contact CRC₃ (line 10) is opened; however, since

relay CR₄ is self-energized and is controlled by contact CRC₁ (line 10), this relay is maintained energized. Contact CRC₃ (line 13) is opened at approximately the same time that contact CRC₅ (line 12) is opened, so that energizing line 13 and energizing line 12 are both open circuits, thereby cutting off the current to the clutch 72 of the clutch-brake 69; as a result, the current switches from the clutch 72 to the brake 70. Since the mechanical action of the brake is not as instantaneous as the electric impulse action of the control circuit, the main shaft 1 continues to rotate slightly before the shaft comes to a complete stop. In this interval roller 60 rides upon dwell land 59b and finally stops on a land 59b adjacent a depression 59.

The disc 8, driven conjointly with the main shaft 1, likewise halts after approximately 120° angular rotation, whereupon each working motor 18 is 120° from its original position and the forward end of A shingle is still being held between a plate 20 and a leg 16 of a retainer 15. Meanwhile, the trailing edge of A shingle is continued to be conveyed forwardly by the conveyor belt system 100, and the shingle commences to reverse itself. When the trailing edge of A shingle passes the electric eye unit 79, 80, the beam 81 is recontinued and contact E_{2a} (line 2) is reopened. However, since relay CR₁ (line 2) is additionally energized through contact CRC₂ (line 3), the opening of the contact E_{2a} does not produce any further change in the electrical control circuit. A moment later, beam 81 is again broken, this time by the forward edge of B shingle, and contact E_{2a} (line 2) is reclosed. Since relay CR₁ was not affected by opening of contact E_{2a}, deflector solenoid 35 (line 7) remained de-energized as contact CRC₁ (line 7) remained open; therefore, motor 37 continues to be inactive and deflector 35 remains in the non-deflecting or down position. B shingle continues to be driven forward, non-deflected, by the conveyor belt system 100.

The time delay unit TCR is adjusted to time out momentarily prior to the time that the trailing edge of B shingle passes the electric eye. When the time delay unit times out, contact TCRC (line 4) is opened and relay CR₂ (line 4) and solenoid 32 are de-energized. Solenoid 32 being de-energized, valve 31 cuts off the pressurized supply to the seal 26, and the pressurized air in the fluid motors 18, manifold 21, and seal 26 exhausts through the quick exhaust valve 30. The plungers 19 of the motors 18 are retracted by a spring return in each motor, and the shingle held by the working motor 18 is thereby released. At this time, A shingle has completely reversed itself and its forward edge, previously the trailing edge, mates approximately with the forward edge of B shingle and gradually falls thereupon to mate therewith. Since the conveyor belt system continues to drive both shingles forward, a gradual face-to-face mating occurs. Moreover, the shingles, after mating, remain longitudinally aligned; consequently, the adhesive stripes remain in alignment, and, since the shingles are mated, the stripes are superposed over each other. In production, it is, of course, quite difficult to time the release of A shingle so that A and B shingles mate with their forward edges in exact alignment. Consequently, the time of release (controlled by the time delay unit) is adjusted so that the forward edge of A shingle trails by a short distance the forward edge of B shingle after mating. After the paired shingles are halted, in order to be packaged, for example, A shingle is capable of sliding slightly on B shingle to bring the forward edges in a more precise alignment. If this pairing arrangement were not followed, and the release of A shingle were to be timed for exact alignment of the forward edges, a certain percentage of the paired shingles would be paired in a manner wherein A shingle's forward edge would lead B shingle's forward edge. After being halted, B shingle would not be able to slide very readily since the weight of A shingle would bear down upon it. In such a situa-

tion, constant manual realignment of the forward edges would be required, and which would, in a sense, defeat the automatic pairing operation.

As a result of the de-energizing of relay CR₂ (line 4), contact CRC₂ (line 3) is opened; relay CR₁ is thus placed under control of the electric de-energized eye circuit. When the trailing edge of B shingle passes the beam 81, the latter is once again continuous and contact E_{2a} (line 2) is opened, de-energizing relay CR₁. Contact CRC₁ (line 7) is again closed, and deflector solenoid 35 is re-energized, placing valve 36 in a position to allow pressurized air from supply 34 to fluid motor 37. The latter is activated to elevate deflector 39 into a deflecting position; the next on-coming A shingle necessarily will be deflected into the reversing mechanism. Contact CRC₁ (line 10) is opened, and contact CRC₁ (line 9) is likewise opened. The circuit to relay CR₄ (line 10) is opened thereby, and the relay is de-energized. Contacts CRC₄ (line 9) and CRC₄ (line 10) revert to their normally closed and open position respectively, placing these sub-circuits in condition for the next cycle. Open contact CRC₄ (line 12) is reclosed; however, since contact CRC₅ (line 12) was previously opened, clutch-brake 69 is maintained in its braked position. The entire electrical circuit is in condition for another cycle, commenced by the breaking of beam 81 by the next on-coming shingle deflected by the deflector 39.

It is seen, from the above description, that the motors 18 are operated simultaneously even though only one of the motors is working at a particular time to retain a shingle between itself and leg 16 of retainer 15. This provides for simplicity of the complete unit and reduces considerably the maintenance problem. On the other hand, it is within the scope and intent of this invention to provide for individual fluid pressure circuits to the fluid motors 18, so that only the working motor is energized while the other two motors remain truly idle. However, as noted, this necessitates a more complex fluid distributing mechanism which would be more susceptible to operating difficulties, especially when relatively high shingle conveyor speeds are utilized.

While the invention has been described in rather full detail, it will be understood that these details need not be strictly adhered to and that various changes and modifications may suggest themselves to one skilled in the art, all falling within the scope of the invention as defined by the subjoined claims.

What I claim is:

1. A mechanism for reversing flexible articles having a leading and a trailing edge conveyed on a conveyor system, comprising, a plate mounted for rotation adjacent the conveyor system, a plurality of article grabbing means mounted on the mounting plate, said plate and article grabbing means being mounted relative to the conveyor system so as ordinarily to permit the articles to pass thereby, means to deflect the leading edge of predetermined articles into one of the article grabbing means, means to activate the grabbing means upon a predetermined degree of entry of the leading edge of the articles into one of the grabbing means, and means to rotate the plate and attached grabbing means for a predetermined degree of rotational travel while the trailing edge of said articles continues to be conveyed by said conveyor system.

2. Mechanism for reversing flexible shingles of predetermined length, and the like, conveyed in a continuous stream on a conveyor system, comprising, a rotatable shaft, a plurality of clasp ing means mounted to the shaft at predetermined points thereabout, said shaft and clasp ing means being superimposed above the continuous stream of shingles being conveyed, means to rotate the shaft and clasp ing means through predetermined arcs of travel, means to activate the clasp ing means to grasp the leading edge of a shingle at the beginning of said predetermined arc, and means to deactivate the clasp ing means at the end of said predetermined arc, the location

of the end of said arc being spaced from said conveyor system a distance less than the length of said shingles.

3. Mechanism as recited in claim 2 wherein the latter means activate all the clasp ing means simultaneously.

4. Apparatus for pairing flexible asphalt shingles, and the like, conveyed in a continuous stream on a conveyor system, comprising, a plurality of clasp ing means mounted for rotation about a central axis, said axis being approximately perpendicular to the longitudinal direction of the continuous stream, means to deflect the leading edge of a selected shingle into one of the clasp ing means, means to activate and to deactivate all of the clasp ing means simultaneously, and means to rotate the clasp ing means through a predetermined arc while the trailing edge of said shingle remains in contact with and is moved by said conveyor system.

5. Apparatus for pairing flexible shingles, and the like, conveyed on a conveyor system, comprising, a mounting plate mounted for rotation adjacent the conveyor system, a plurality of individually operated clasp ing means equi-angularly secured to said plate, means to deflect the leading edge of alternate shingles into said clasp ing means, means to actuate said clasp ing means to grip said leading edges, and means to rotate the plate and attached clasp ing means at periodic intervals for predetermined distances to place the individual clasp ing means sequentially into a shingle receiving position and a shingle release position, said latter position being spaced from said conveyor system a distance less than the length of a shingle.

6. Apparatus for pairing flexible shingles, and the like, conveyed on a conveyor system, comprising, a plate mounted for rotation adjacent the conveyor system, clasp ing means attached to said plate, means to deflect the leading edge of predetermined shingles into the clasp ing means, means to activate the clasp ing means upon entry of the leading edge of a shingle into the clasp ing means, means to rotate said leading edge through a predetermined angular travel of the clasp ing means while the trailing edge of said shingle remains in contact with and is moved by said conveyor system, and means to release the said leading edge after rotation thereof.

7. The apparatus of claim 7 wherein the clasp ing means includes therein a fluid pressure actuated motor.

8. Apparatus for pairing flexible asphalt shingles, or the like, conveyed on a conveyor system, comprising, a rotatable shaft mounted for rotation adjacent the conveyor system, a plurality of fluid motors secured to said shaft for rotation therewith, a shingle retainer bar secured adjacent each of the fluid motors, means to deflect alternate shingles into a position between an adjacent motor and its associated retainer bar, means to activate the said adjacent motor thereby having the deflected shingle held fast between the motor and the adjacent retainer bar, means to rotate the shaft and shingle retaining motor through a predetermined angular increment, and means to deactivate the said adjacent motor to release the held shingle upon rotation of the motor through said angular increment thereby releasing the shingle to mate with a non-deflected subjacent shingle conveyed by the conveyor system.

9. Apparatus as recited in claim 8 wherein the means to activate the motor includes means to activate simultaneously the idle fluid motors thereby having all the motors activated simultaneously.

10. Apparatus for pairing flexible asphalt shingles, and the like, conveyed in a continuous stream on a conveyor system, comprising, a plurality of clasp ing means mounted for rotation about a central axis, means to deflect a shingle into one of the clasp ing means, means to activate all of the clasp ing means simultaneously whereby one of clasp ing means contains a portion of the deflected shingle, means to rotate the clasp ing means through a predetermined arc thereby reversing the retained shingle, means to allow the immediately following shingle to bypass the clasp ing means, means to release the retained,

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reversed shingle so that it mates with the by-passing shingle, and means to time the release of the retained, reversed shingle so that its forward edge, after reversal, trails the forward edge of the by-passing shingle after mating of the shingles.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,070,211

December 25, 1962

George H. Williamson

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 3, line 58, for "single" read -- shingle --;
column 4, line 5, for "across" read -- a cross --; column 6,
line 28, for "respectievly" read -- respectively --; line 37,
for "singles" read -- shingles --; line 50, for "relay" read
-- delay --; column 10, line 42, for the claim reference
numeral "7" read -- 6 --.

Signed and sealed this 3rd day of December 1963.

(SEAL)

Attest:

ERNEST W. SWIDER

Attesting Officer

EDWIN L. REYNOLDS

Acting Commissioner of Patents