June 13, 1967 J. W. A. OFF ETAL 3,325,163

WORKPIECE ASSEMBLING DEVICES FOR SEWING MACHINES AND THE LIKE

Filed July 9, 1965 4 Sheets-Sheet 1

FIG. 1

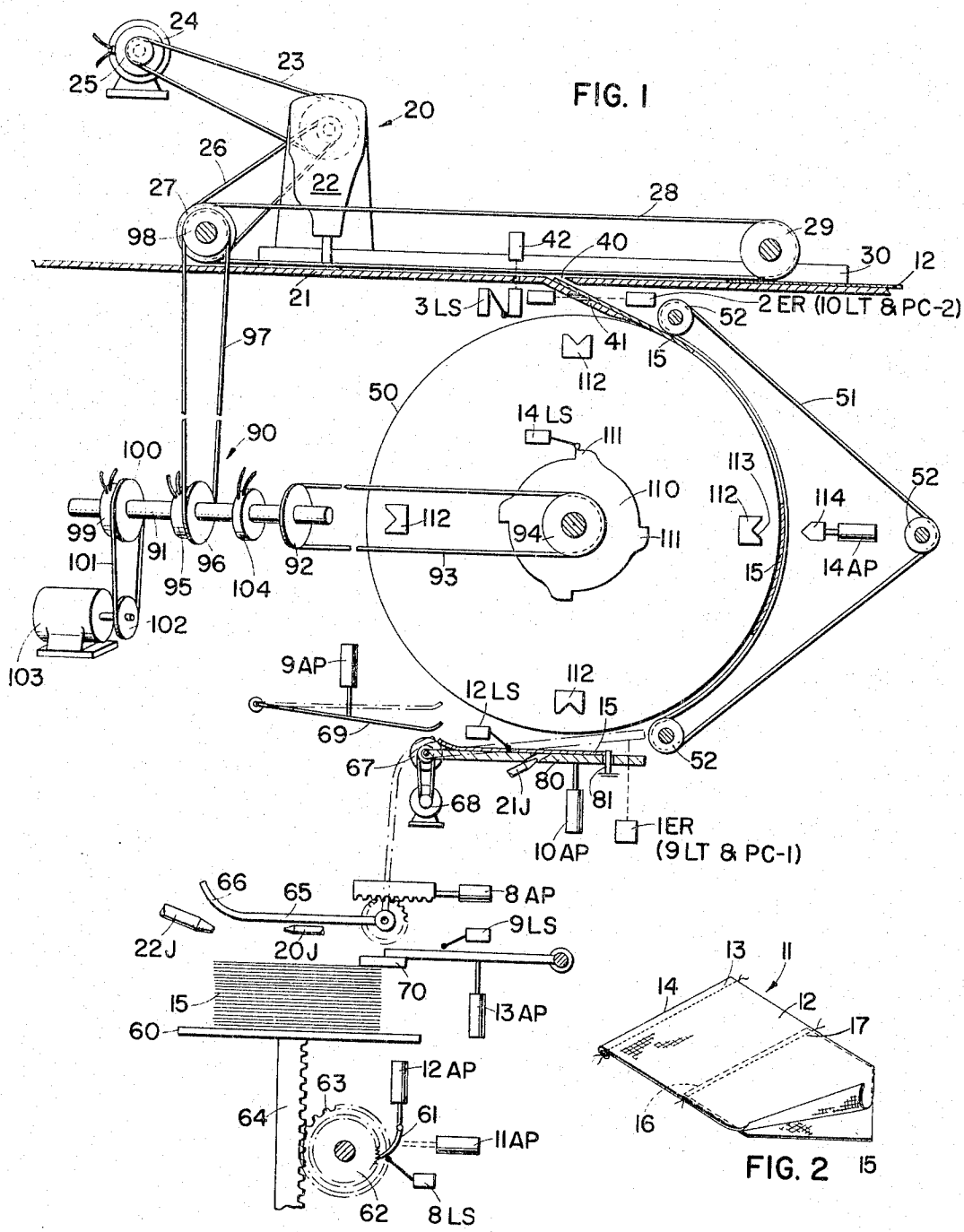

FIG. 2

WITNESS
Heidi Schleehauf

INVENTORS
JOSEPH W. A. OFF
JOHN A. RAUDONIS Jr.
BY Marshall J. Breen
ATTORNEY

June 13, 1967 J. W. A. OFF ETAL 3,325,163

WORKPIECE ASSEMBLING DEVICES FOR SEWING MACHINES AND THE LIKE

Filed July 9, 1965

4 Sheets-Sheet 2

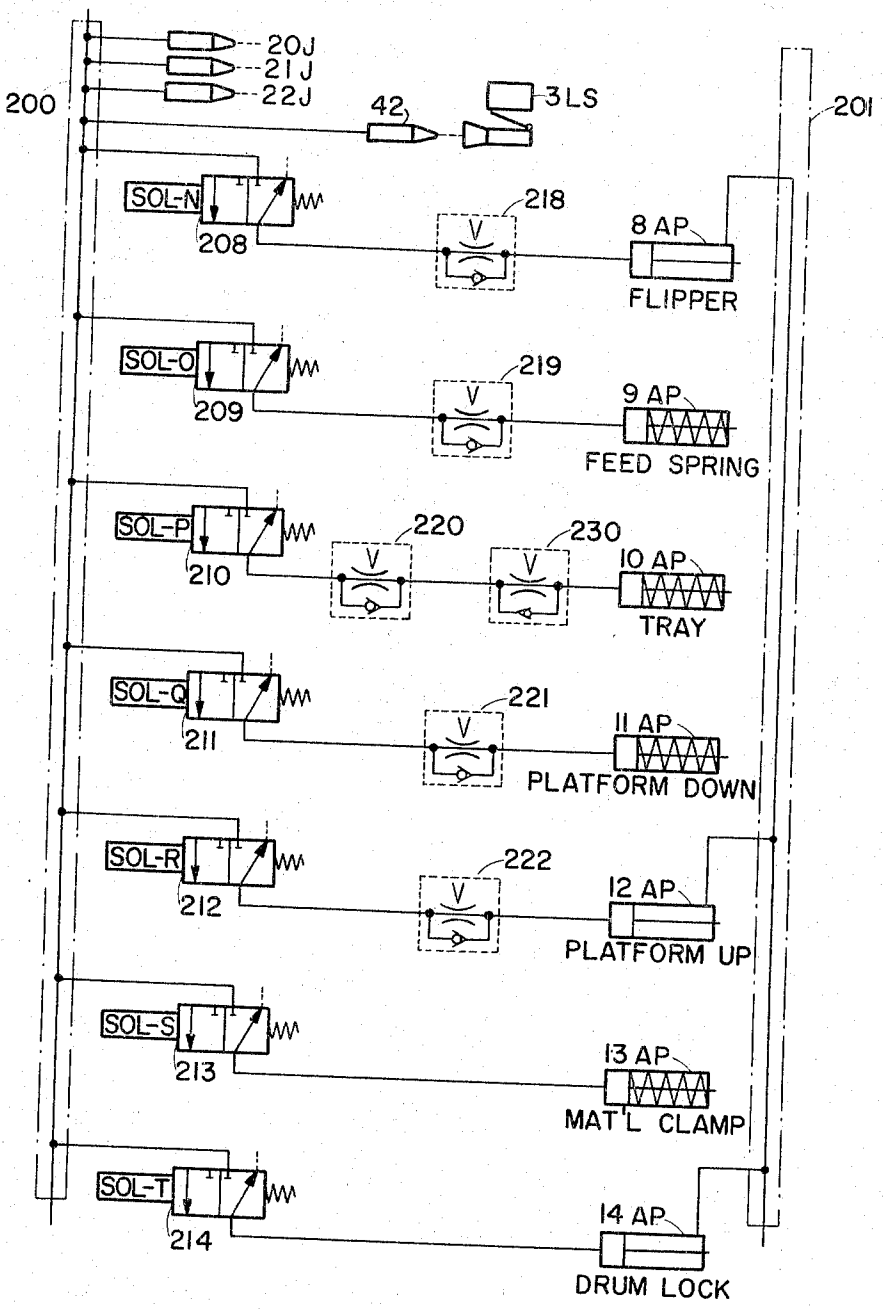

FIG. 3

WITNESS
Heidi Schleehauf

INVENTORS
JOSEPH W. A. OFF
JOHN A. RAUDONIS Jr.

BY
Marshall J. Breen
ATTORNEY

June 13, 1967 J. W. A. OFF ETAL 3,325,163

WORKPIECE ASSEMBLING DEVICES FOR SEWING MACHINES AND THE LIKE

Filed July 9, 1965 4 Sheets-Sheet 3

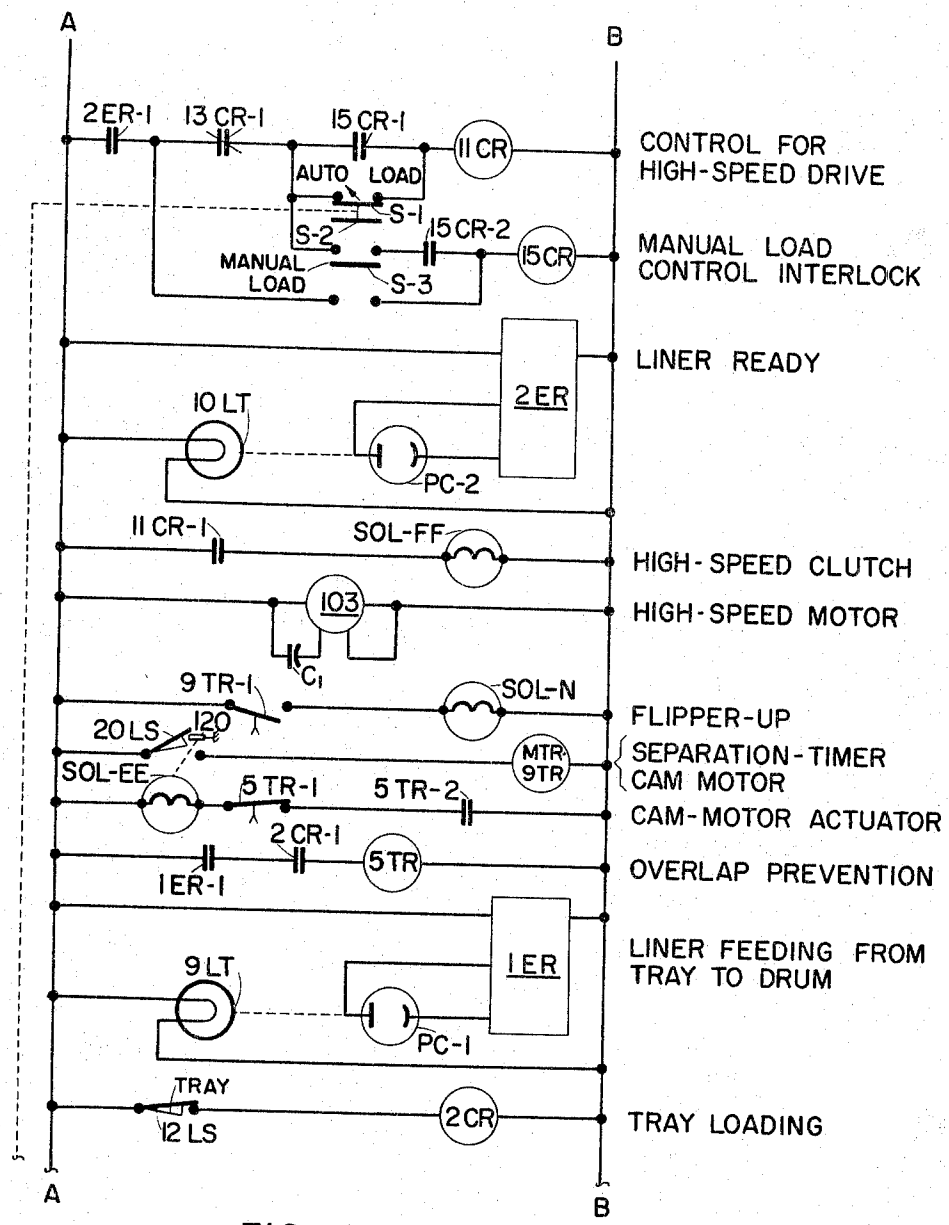

FIG. 4

WITNESS

Heidi Schlechauf

INVENTORS
JOSEPH W.A. OFF
BY JOHN A. RAUDONIS Jr.

Marshall J. Breen
ATTORNEY

June 13, 1967 J. W. A. OFF ETAL 3,325,163

WORKPIECE ASSEMBLING DEVICES FOR SEWING MACHINES AND THE LIKE

Filed July 9, 1965 4 Sheets-Sheet 4

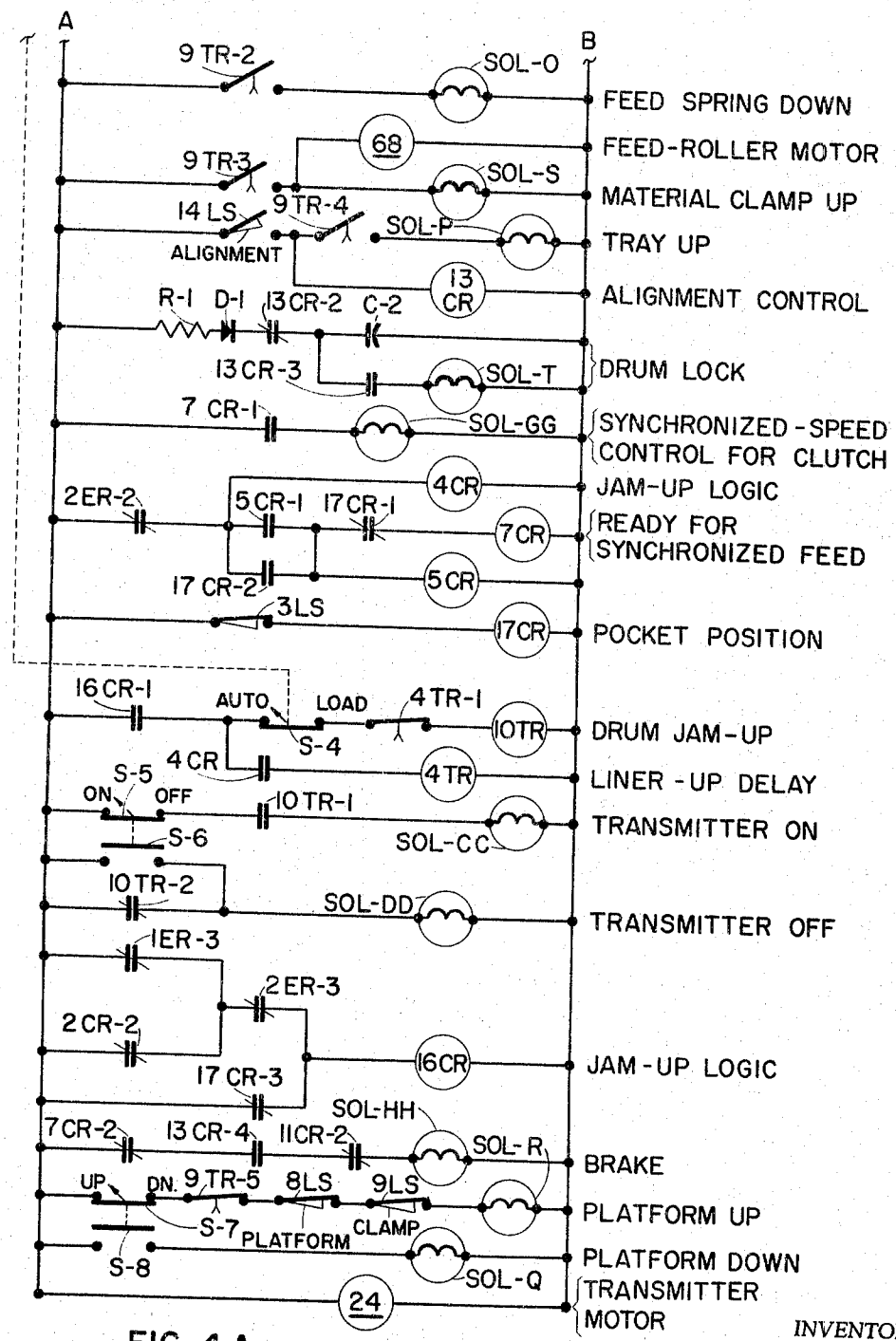

FIG. 4 A

INVENTORS
JOSEPH W. A. OFF
JOHN A. RAUDONIS Jr.

BY Marshall J. Breen
ATTORNEY

WITNESS
Heidi Schleehauf

United States Patent Office 3,325,163 Patented June 13, 1967

3,325,163

WORKPIECE ASSEMBLING DEVICES FOR SEWING MACHINES AND THE LIKE

Joseph W. A. Off, Succasunna, and John A. Raudonis, Jr., Elizabeth, N.J., assignors to The Singer Company, New York, N.Y., a corporation of New Jersey

Filed July 9, 1965, Ser. No. 470,826
4 Claims. (Cl. 270—59)

This invention relates to fabric manipulating apparatus, and more particularly, to a novel device for automatically bringing together in predetermined orientation a plurality of panels of fabric or the like for operation upon as a unit in a succeeding operation.

It is an object of this invention to provide a fabric manipulating apparatus which may be applied readily to any operating unit, such as a sewing unit, for automatically presenting thereto composite multiple workpieces with the plies in predetermined relative arrangement.

In the preferred embodiment illustrated in the accompanying drawings, the fabric manipulating apparatus of this invention is arranged to deliver a ply of lining fabric squarely beneath and in predetermined spaced relation to one edge of each one of a series of main fabric panels destined to become trouser pockets, as the main fabric panels are transported toward a sewing unit.

The fabric manipulating apparatus of this invention may advantageously be arranged completely beneath the work supporting platform of the sewing unit to deliver the lining plies upwardly beneath the pocket panels, in which case the apparatus of this invention will not detract from accessibility to the sewing unit. It will be understood however, that the apparatus of this invention may also be adapted to orient fabric plies above as well as below fabric panels and several devices of this invention may be employed concurrently to orient a multiplicity of fabric plies.

It is an object of this invention to provide in a fabric manipulating apparatus of the above character, novel and advantageous means capable of separating fabric plies from a stack, carrying the separated fabric plies into oriented relation wtih a main fabric panel, and advancing the oriented fabric ply in synchronism with the main fabric panel toward an operating unit such as a sewing machine.

A further object of this invention is to provide a fabric manipulating apparatus of the above character which carries fabric plies at high speed into oriented position relatively to each one of a series of main fabric panels and advances the oriented fabric plies at a slower speed in synchronism with that of the main fabric panels toward an operating unit such as a sewing machine.

In accordance with one aspect of this invention first and second material conveyors are provided for feeding separate material plies into superposition. A drive unit is employed to drive the second conveyor at a first speed and a second speed in response to operation of a selective control. The drive unit is adapted to be arrested at a predetermined position of the second conveyor. A sensing unit is provided for sensing presence of a ply at a predetermined position on the first conveyor and is operative to select operation of the driving unit at the one speed. Another sensing unit is provided for sensing presence of a ply at a selected position on the second conveyor and is operative to select operation of the driving unit at the other speed during concurrent operation of the one sensing unit to select operation of the driving unit at the one speed.

In the accompanying drawings:

FIG. 1 represents a diagrammatic elevational view of a fabric orienting apparatus embodying this invention,

FIG. 2 is a perspective view of a garment sub-assembly of which the fabric plies have been oriented by the apparatus of FIG. 1,

FIG. 3 is a pneumatic circuit diagram illustrating the pneumatic devices used in the apparatus of FIG. 1 and FIGS. 4 and 4*a* comprise an electrical wiring diagram for the control instrumentalities of the apparatus illustrated in FIG. 1.

Referring to the drawings, FIG. 2 illustrates a finished garment sub-assembly **11** after the fabric plies have been oriented by the apparatus of this invention and the plies have been stitched together by a sewing unit. The garment sub-assembly, which in this instance is a lined trouser pocket, comprises a main fabric panel **12**, formed with a stitched hem **13** along the top edge **14**, and a pocket liner fabric ply **15** oriented squarely beneath the main fabric panel with a top edge **16** parallel to the top edge **14** of the main fabric panel. The fabric plies will be secured together by a line of stitches **17** in the above oriented relationship. A schematic elevational view of the fabric manipulating apparatus of this invention for orienting the garment sub-assembly **11** and delivering the oriented fabric plies to a sewing unit **20** is illustrated in FIG. 1.

The sewing unit **20** comprises a work support **21** on which a sewing machine **22** is carried. The sewing machine **22** is driven by a belt **23** from electric motor **24** by way of a transmitter **25** which may be of the clutch brake variety adapted to be controlled electrically. A belt **26** driven by the sewing machine engages a work feeding pulley **27** rotatably carried above the support **21**. A feed belt **28** entrained on the pulley **27** and on an idler pulley **29** carried above the support **21** at the opposite side of the sewing machine serves to advance main fabric panels **12** on the support **21** toward the sewing machine. An edge guide **30** may be provided parallel to the feed belt **28** for maintaining the top edge **14** of the main fabric panels **12** in alignment with the direction of feed.

The support **21** of the sewing unit is formed in front of the sewing machine with a slot **40** upwardly through which the lining plies **15** are directed by the apparatus of this invention, preferably along an inclined ramp **41** leading to the slot. A sensing device such as an air prove **42** located between the slot **40** and the sewing machine serves to detect the leading edge of each successive main fabric panel **12** that is fed toward the sewing machine by the feed belt **28** so as to signal operation of the fabric manipulating apparatus of this invention to initiate synchronous feed of a liner ply **15** therewith. The air probe may comprise a tube conducting air from a source of pressure downwardly against the support **21** and an aligned air receiving tube set into the support and leading to a pressure sensitive switch 3LS.

Also controlling the operation of the fabric manipulating apparatus is a sensing device 2ER arranged in the ramp **41**. The sensing device 2ER may include a light source 10LT at one side of the ramp and a photoelectric cell PC #2 at the other side arranged to sense the presence or absence of a liner ply **15** on the ramp.

The liner plies **15** are carried on to the ramp **41** on the periphery of a rotatable drum **50** against which a belt **51** is constrained by idler rollers **52**. As illustrated in FIG. 1, the ramp **41** extends into close proximity with the top of the drum **50** so that liner plies **15** carried upwardly between the belt **51** and the drum will be deflected up the ramp.

For introducing liner plies **15** one-by-one at the bottom of the drum **50** between the drum periphery and the belt **51**, an air operated separator for stacked textile pieces may be employed similar to that illustrated and described in detail in the copending United States patent application of O. B. Reid, No. 213,433, filed July 30, 1962, now

abandoned, to which reference may be had. Briefly this air operated separator includes a platform **60** adapted to support a stack of liner plies **15**. The platform **60** is vertically shiftable being indexable upwardly by an air piston **12AP** and asscciated limit switches **8LS** and **9LS** which operate a pawl **61** cooperating with a ratchet wheel **62** fast on a gear **63** meshing with a rack **64** carried beneath the platform. The platform **60** may be freed for downward movement by an air piston **11AP** which separates the pawl **61** from the ratchet wheel **62**.

Above the stack of liner plies is disposed a flipper **65** which includes an air foil **66** along which a jet of air is directed by an air nozzle **20J**. The flipper **65** is pivotally mounted and adapted to be turned by operation of an air piston **8AP** from a position in which the air foil **66** overlies the stack of liner plies to a position in which the air foil overlies a feed roller **67** driven by a motor **68**. The air jet from air nozzle **20J** causes one edge of the topmost liner ply from the stack to adhere to the air foil **66** when the flipper is turned onto the stack. When the flipper is elevated, the air foil will carry the one edge of the topmost liner ply **15** onto the feed roller **67**. A feed spring **69** pivoted above the feed roller is shiftable into and out of opposition to the feed roller **67** by an air piston **9AP**. After the feed spring **69** has been lowered into opposition with the feed roller **67** to grip the elevated edge of the topmost liner ply **15**, a pivoted material clamp member **70** which is normally urged downwardly against the stack is released by operation of an air piston **13AP**. A jet of air from a nozzle **22J** directed against the top of the stack serves to prevent any but the topmost liner ply from being released when the material clamp member **70** is elevated. A limit switch **9LS** senses the travel of the material clamp member **70** and signals for upward indexing of the platform **60** when required in order to maintain the level of the top of the stack within prescribed limits.

The feed roller **67** propels the elevated liner plies onto a pivoted tray **80** against a fixed stop **81**. A jet of air from a nozzle **21J** directed along the tray assists in propelling the liner. A limit switch **12LS** senses movement of the liner plies **15** onto the tray **80** and permits pivotal movement of the tray in response to operation of an air piston **10AP** bringing the liner ply **15** in the tray against the bottom of the drum **50**.

A sensing device **1ER** detects presence of a liner ply passing onto the drum from the tray **80** and serves to control the operation of the fabric manipulating apparatus. The sensing device **1ER** may comprises a reflective photosensitive unit including a light source **9LT** and a photocell PC **#1**.

The above described separator for the stacked liner plies differs from that disclosed in the referenced United States patent application No. 213,433 in certain details of construction i.e., the material clamp member **70** is shifted relatively to the stack upon each withdrawal of a liner ply and also the tray **80** is pivotally mounted. The major difference, however, resides in the manner in which the separator is combined with the drum **50** and organized with control circuitry, as will be hereinafter described so as to operate automatically in the orientation of the separated liner plies **15** with the main fabric panel **12**.

Indicated generally at **90** is a transmission unit for driving the drum **50**. The transmission unit includes a shaft **91** carrying a pulley **92** connected by means of a belt **93** to a pulley **94** on the drum. Connectible to the shaft **91** by way of an electromagnetic clutch unit **95** is a pulley **96** driven by a belt **97** from a pulley **98** on the sewing machine driven feed pulley **27**. Connectible to the shaft **91** by way of an electromagnetic clutch unit **99** is a pulley **100** driven by a belt **101** from a pulley **102** on a high speed motor **103**. Preferably the drive from the sewing machine is arranged to provide a drum peripheral speed in synchronism with that of the feed belt **28**, while the drive from the high speed motor **103** turns the drum **50** at an appreciably higher rate of speed. An electrically operated friction brake unit **104** is provided on the shaft **91** to stop the drum **50** when required.

The drum **50** is adapted to be turned, i.e. indexed, in 90° increments during operation of the device and to this end a cam **110** is carried by the drum and provided with four cam lobes **111** adapted to be sensed by a limit switch **14LS** for controlling the drum motion. For accurately locating or aligning the drum after each quarter turn, four blocks **112** equally spaced about the drum are each formed with a locating notch **113** adapted to be entered by a pointed camming element **114** carried by an air piston **14AP**. Since the fixed stop **81** provides for accurate location of each liner ply **15** when each liner ply is first brought into contact with drum **50**, and since the drum is moved into alignment in accurate quarter turn increments, each liner ply **15** will be presented on the ramp **41** in an accurately predetermined position so that when feed of the liner ply is initiated by a signal from the air probe **42** a very accurate orientation of liner and main fabric plies is attained.

As shown in FIG. 3 which illustrates a preferred pneumatic diagram for the fluid pressure operated devices of the apparatus of FIG. 1, fluid pressure for operating the pneumatic devices is delivered from a primary manifold **200** in which the pressure is preferably maintained at approximately 70 p.s.i. Certain of the pneumatic devices as illustrated in FIG. 3 exhaust directly to the atmosphere and in the case of an air piston are returned by mechanical spring pressure. Others of the air pistons are double acting and are returned by air pressure from an auxiliary manifold **201** in which the pressure is preferably maintained lower than in the primary manifold for instance at approximately 30 p.s.i.

Referring to FIG. 3, the air jets **20J**, **21J**, and **22J** as well as the air probe **42** are connected directly to the manifold **200**.

Of the air pistons used with this apparatus, air pistons **9AP** for the feed spring **69**, **10AP** for the tray **80**, **11AP** for releasing the platform **60**, and **13AP** fo rthe material clamp **70** are single acting air pistons returned by mechanical springs. The remaining are pistons **8AP** for turning the flipper, **12AP** for raising the platform and **14AP** for the drum lock are preferably double acting air pistons being connected at one side to the auxiliary manifold **201** for air return.

Each of the air pistons **8AP** to **14AP** is supplied air from the primary manifold **200** by way of a solenoid operated air valve **208** and **214** respectively. Valves **208** to **214** are operated by solenoids SOL–N to SOL–T respectively.

In the case of air pistons **8AP** to **12AP** inclusive; flow of air from the manifold **200** to each air piston may be regulated by an adjustable check valve **218** to **222** respectively, the check valves **218** to **222** providing for unimpeded return flow of air from the air pistons to the atmosphere. These adjustable check valves provide for regulation of the rate at which the air pistons will operate under the influence of the air from the primary manifold.

In the line between the manifold **200** and the air piston **10AP** for elevating the tray **80** is also included an adjustable check valve **230** for regulating the rate at which the return flow of air from the air piston **10AP** flows to the atmosphere so that the rate of both the rise and fall of the tray **80** may be regulated.

The operation of the fabric manipulating apparatus may be controlled by an electrical circuit of the kind illustrated by the schematic diagram shown on FIGS. 4 and 4A. Each circuit of the electrical system is shown connected across conventional power lines A and B. In this circuit power is assumed to be off for all relays and solenoids in the positions shown, and air probe **42** is assumed to be on.

Prior to automatic operation of the fabric manipulating apparatus, the separator platform **60** must be loaded, the drum **50** must be loaded with two liner plies **15**, and a third liner ply should be supplied to the tray **80**.

To that end power is applied to lines A and B and the Auto-Load switches S–**1**, S–**2**, and S–**4** are pushed to the Load position, and the Manual load switch S–**3** is depressed momentarily to actuate a manual load control interlock relay **15**CR which is powered by normally-open contacts **2**ER–**1** which will be closed because no liner ply **15** is blocking the path between lamp **10**LT and photocell PC–**2**. Thus normally-open interlocked contacts **15**CR–**1** and **15**CR–**2** will be closed by manual load control interlock relay **15**CR and as alignment cutoff contacts **13**CR–**1** of the then inactive alignment-control relay **13**CR will be closed because alignment limit switch **14**LS will be open, power will flow to high-speed, control relay **11**CR which operates high-speed-clutch solenoid FF controlling the high-speed clutch **99** by means of normally-open, clutch contacts **11**CR–**1**. Contacts **13**CR–**1** will remain closed except when alignment-control relay **13**CR is operated by alignment switch **14**LS when one of the alignment cams **111** is driven to drum-alignment position, at which times the brake unit **104**, and drum-lock air piston **14**AP will be operated by brake solenoid SOL–HH and drum-lock solenoid SOL–T, respectively. Brake solenoid SOL–HH is operated by the closing of alignment-contacts **13**CR–**4** and high-speed contacts **11**CR–**2** and the normally-closed contacts **7**CR–**2** of synchronized-feed relay **7**CR which will remain closed until the drum **50** is fully loaded and ready to pass a liner ply **15** from ramp **41** onto work support **21**.

At the end of each 90° turn of the drum following the high speed portion of the cycle, the drum must be accurately aligned, thus the drum-lock solenoid T is actuated for a moment by closing of alignment-contacts **13**CR–**3** and opening of alignment-contacts **13**CR–**2** in a conventional pulsing circuit including resistor R–**1**, diode D–**1**, and capacitor C–**2**. In addition, switch S–**4** removes power from transmitter, time-delay relay **10**TR which opens contacts **10**TR–**1** and closes contacts **10**TR–**2** to remove power from the transmitter-on solenoid SOL–CC and applies power to transmitter-off solenoid SOL–DD to turn the transmitter **25** off.

At the same time, the flipper air cylinder **8**AP will be operated by flipper solenoid SOL–N by closure of cam-timer-flipper contacts **9**TR–**1** of cam-timer relay **9**TR driven by separation-cam-timer motor MTR–**9**TR which is operated by detented limit switch **20**LS from which the detent **120** is removed by cam-motor-actuator solenoid SOL–EE when cam-motor-overlay-prevention contacts **5**TR–**1** and **5**TR–**2** are closed during the time delay of liner-overlap-prevention relay **5**TR which closes contacts **5**TR–**2** immediately on actuation and opens contacts **5**TR–**1** after a short delay permitting motor MTR–**9**TR to hold switch **20**LS closed for the remainder of the cam-motor timing cycle.

Overlap relay **5**TR will operate when contacts **1**ER–**1** are closed by tray-to-drum sensing relay ER–**1** when the beam to cell PC–**1** from light **9**–LT is not blocked and contacts **2**CR–**1** are closed because tray-loading control relay **2**CR is actuated by tray-loading limit switch **12**LS which is closed when no liner ply **15** is on tray **80**.

Then cam timer **9**TR will operate in succession the feed spring **69** via air cylinder **9**AP driven by solenoid SOL–O via timer contacts **9**TR–**2**, and the feed roller motor **68** and material-clamp air cylinder **13**AP driven by solenoid SOL–S via timer contacts **9**TR–**3**. When the drum **50** is to be stopped by closure of alignment switch **14**LS, switch **14**LS, and contacts **9**TR–**4** permit the tray **80** to be raised by air cylinder **10**AP driven by solenoid SOL–P, and the alignment relay **13**CR operates to provide alignment as described above.

At that point, the tray **80** will be filled and the tray switch **12**LS will open, removing power from tray-loading

control relay **2**CR, thence overlap relay **5**TR, thence cam-motor solenoid SOL–EE to prevent repetition of the cam-motor cycle while a liner ply **15** in on the tray i.e., to prevent overlap of liner plies. Then the whole mechanism will stop.

Manual load push button switch S–**3** must be depressed to start the cycle again because alignment-contacts **13**CR–**1** will be held open by the corresponding alignment cam **111**, alignment switch **14**LS, and alignment relay **13**CR since the drum is in the first aligned position with the brake on. The high-speed relay **11**CR will operate to remove the brake by opening normally-closed contacts **11**CR–**2** and as before, the drum will be advanced at high speed by another 90° increment by closure of contacts **11**CR–**1**, and operation of solenoid SOL–FF and motor **103** to draw the liner ply then on the elevated tray **80** up to the intermediate position. At the same time another liner ply will be supplied to the tray **80** as soon as tray-loading switch **12**LS closes when the first liner ply leaves the tray to actuate tray-loading relay **2**CR, and the trailing edge of the first liner ply passes the beam from **9**LT to PC–**1** turning on unit **1**ER, respectively closing tray-loading contacts **2**CR–**1** and tray-to-drum contacts **1**ER–**1** respectively, thence powering overlap relay **5**TR, cam-timer actuator SOL–EE, and the cam motor MTR–**9**TR, as before.

When the drum **50** is in the second aligned position, with the tray **80** refilled and raised, and the first liner ply half-way up drum **50** (in intermediate position) the manual-load switch S–**3** must be repressed to draw the first liner ply to the top of the drum **50** and onto ramp **41**, breaking the beam from light source **10**LT to PC–**2**, and thereby removing power from the liner-ready sensor **2**ER and returning the contacts **2**ER–**1**, **2**ER–**2** and **2**ER–**3** controlled thereby to their normal positions. Concurrently, the second liner ply is drawn into the intermediate position and a third liner ply will be fed to tray **80**, as was the second liner ply. Then the tray will be raised with the drum aligned in a third position.

The fabric handling apparatus is now ready for automatic operation. Thus the Auto-Load switches S–**1**, S–**2**, S–**4** are returned to their normal, Auto, positions. The apparatus is now ready for synchronized feed of a liner ply under a main fabric panel **12** (hereinafter referred to as a pocket) as soon as a pocket is fed into position under air probe **42**. Air probe **42** will hold air probe switch **3**LS closed in the absence of a pocket under probe **42** thereby operating pocket-position relay **17**CR. Before synchronized-speed drive can commence, synchronized-feed relay **7**CR must be actuated to close contacts **7**CR–**1** to operate synchronized-speed, clutch-control solenoid SOL–GG.

Synchronized-feed relay **7**CR can operate only it, first of all liner-ready contacts **2**ER–**2** close while pocket-not-ready contacts **17**CR–**2** remain closed, i.e. **3**LS is closed, showing that a pocket is not yet in position, thereby powering interlock relay **5**CR which closes bypass contacts **5**CR–**1** around pocket-not ready contacts **17**CR–**2**. Interlock relay **5**CR assures that synchronized feed will not be commenced unless a liner ply **15** arrives at PC–**2** before a pocket **12** arrives under probe **42**. Then secondly, when the pocket arrives in "ready" position **3**LS opens as probe **42** is blocked and pocket position relay **17**CR will be deactivated closing pocket ready contacts **17**CR–**1**, powering synchronized-feed relay **7**CR which operates the synchronized speed clutch solenoid SOL–GG, via contacts **7**CR–**1** and releases the brake via contacts **7**CR–**2**.

Before the transmitter **25** can be turned on by solenoid SOL–CC, switch S–**5** must be closed, switch S–**6** open, and jam-up contacts **10**TR–**1** must be closed (**10**TR–**2** open) by jam-up relay **10**TR which will operate if Auto-Load switch S–**4** is closed, and contacts **16**CR–**1** are closed (which will occur only when power is supplied to jam-up logic relay **16**CR), and if excessive delay relay

4TR has not been operated for a long time by contacts 4CR–1 of liner-ready relay 4CR. Contacts 4CR–1 close when liner-ready contacts 2ER–2 close. In other words the excessive-delay contacts 4TR–1 open when the machine holds a liner ply in position too long, indicating a failure of the fabric handling apparatus.

Logic relay 16CR will not operate to close contacts 16CR–1 if either of the following events occur:

(1) a pocket 12 is not in position (contacts 17CR–3 controlled by relay 17CR controlled by switch 3LS are open) and no liner ply 15 is ready (contacts 2ER–3 are open).

(2) a pocket is not in position (contacts 17CR–3 are open) and a liner is ready (contacts 2ER–3 closed) but no liner ply is being fed from the tray (contacts 1ER–3 are open) and no liner ply is present on the tray (contacts 2CR–2 are opened by power to relay 2CR from closed tray switch 12LS). Otherwise jam-up relay 16CR will operate indicating faultless separation and feeding onto the drum. Several failures may occur. For example, it may be that the supply of pockets has been exhausted, delayed, or that a pocket is jammed in belt 28.

Synchronized feed is prevented once the liner ply passes from control of drum 50 and the path of photocell PC–2, by SOL–GG via 7CR–1 via 7CR because opening of contacts 2ER–2.

Excessive delay relay 4TR will hold the machine off, if the apparatus is unable to correct the condition of delay of delivery of a pocket within a selected period of time, because for instance, the separator is unable to deliver a liner ply to the tray when it is empty, jammed, etc.

The transmitter-delay relay 10TR will stop the transmitter if excessive time is required for a liner ply to be positioned on the tray 80 or passed on from it or for a liner ply to arrive in ready position opposite photocell PC–2.

Synchronized speed operation will continue until the trailing edge of a liner ply passes by PC–2 thereby opening contacts 2ER–2 to remove power from relays 7CR, 4CR and 5CR, removing synchronized speed clutch via contacts 7CR–1 and solenoid SOL–GG. Contacts 2ER–1 operate high speed relay 11CR to cause operation of the high speed drive to the next drum position so that a liner ply will be ready just after the pocket moves past switch 3LS signalling for feeding another liner ply at synchronized speed. Alignment contacts 13CR–1 will open when 14LS signals that an alignment position has been reached thereby declutching the high speed drive, braking the drum and accurately positioning the drum into alignment by means of the drum lock as before.

As explained above, the platform must be periodically raised to the proper position to hold the depleting stack of liner plies thereon in contact with the clamp 70 and the flipper 65. Thus, the air cylinder 12AP will be driven by solenoid SOL–R as described above when the material clamp 70 is down far enough to indicate need for raising the platform (9LS closed) and the cam timer relay 9TR has reclosed 9TR–5 after a separation. The limit switch 8LS will be opened by detent 61 on each stroke to return pawl 61. Pawl 61 is reciprocated until limit switch 9LS opens when no further adjustment is necessary.

When it is desired to reload the platform, switches S–7 and S–8 are operated to actuate solenoid SOL–Q to withdraw the pawl 61 by means of air cylinder 11AP, thereby permitting rack 64 and ratchet 62 to move freely until platform 60 has fallen by gravity to its lower limit.

What is claimed herein is:

1. Apparatus for superposing separate material plies comprising a first and a second material conveying means having a point of confluence for providing superposition of said separate material plies by operation of said conveying means, means for sensing the presence of one of said separate material plies under the influence of said first conveying means in a first predetermined position relatively to said point of confluence, means for stopping said second conveying means with another of said separate material plies subject to the influence thereof, and with said other material ply disposed in a second predetermined position relatively to said point of confluence, driving means for operating said second conveying means at the same material advancing rate as said first conveying means relatively to said point of confluence, means effective in response to operation of said sensing means for actuating said drive means, means for detecting improper operation of at least said second conveying means, and providing an output in response thereto, and means for arresting operation of said apparatus in response to operation of said detecting means.

2. Apparatus for superposing separate material plies comprising a first and a second material conveying means having a point of confluence for providing superposition of said separate material plies by operation of said conveying means, driving means for operating said second conveying means at a first speed and a second speed in response to selective control, means for arresting said driving means at a predetermined position of said second conveyor, one sensing means for sensing a ply at a predetermined position on said first conveying means operative to select operation of said driving means at said first speed, another sensing means for sensing a ply at a predetermined position on said second conveying means operative to select operation of said driving means at said second speed.

3. Apparatus for superposing upper and lower material plies comprising an endless conveyor, a rotatable drum having an input and an output for material, said conveyor and said drum having a point of confluence, means for supplying separate lower plies of material to the input of said drum seriatim, one detection means for sensing presence of a lower ply at the output of said drum proximate to said point of confluence, another detection means for sensing presence of an upper ply proximate said point of confluence, fast drive means for driving said drum at high speed, slow drive means for driving said drum at slow speed, positioning means for accurately aligning said drum relatively to a predetermined position, a control system operative in response to said one detection means in the absence of a lower ply at said one detecting means to position said drum by actuation of said high speed drive, and responsive to said one detection means in the presence of a lower ply at said one detection means to operate said positioning means, and operate said means for supplying separate lower plies, and said control system operative in response to said one and said other detection means in the presence of a lower ply at said output and an upper ply at said other detection means to operate said slow drive means.

4. Apparatus for superposing upper and lower material plies comprising an endless conveyor, a rotatable drum, said conveyor and said drum having a point of confluence, said conveyor being positioned above a work support for cooperation therewith to provide advancement of material by said conveyor on said work support, said drum being positioned beneath said work support, an aperture in said work support and a ramp therein positioned to pass lower plies of material from said drum to said work support, means for supplying separate lower plies of material from a prearranged stack of said lower plies to said drum comprising a separator for delivering said lower plies in seriatim from said stack, a tray accommodating said lower plies from said separator, lifting means for elevating said tray against said drum periphery, first detection means for sensing presence of a lower ply on said tray, second detection means for sensing a lower ply passing from said tray to said drum, third detection means for sensing presence of a lower ply on said ramp, and fourth detection means for sensing an upper ply in

a predetermined position on said work support relative to said aperture, fast drive means for driving said drum at high speed, fifth detecting means for sensing a predetermined drum position, braking means for stopping said drum near said predetermined position, locking means for aligning said drum accurately in said predetermined position, and slow drive means for operating said drum in synchronism with said first conveyor to provide identical fabric advancing rates relatively to said point of confluence, means for retaining lower plies in contact with said drum periphery, means for actuaing said separator automatically in the absence of a lower ply on said tray in response to operation of said first and said second detection means, means for stopping said conveyor in the absence of a lower ply on said tray as indicated by said first and second detection means and in the absence of a lower ply on said ramp as indicated by said third detection means, said third detection means actuating said high speed drive in the absence of a lower ply on said ramp thereby operating said high speed drive until said

fifth detection means operates said braking means, said first detection means actuating said lifting means during the presence of a lower ply on said tray, said conveyor being actuated to transport an upper ply towards said aperture, said slow speed drive being actuated by said fourth detection means upon passage of the leading edge of said upper ply by said fourth detection means, means for shifting from said slow speed drive to said high speed drive operative in response to passage of the trailing edge of a lower ply beyond said third detection means.

References Cited

UNITED STATES PATENTS

2,883,929	4/1959	Eichenbaum et al.	101—132.5
3,083,009	3/1963	Barr et al.	270—58
3,112,680	12/1963	Hein et al.	93—61

EUGENE R. CAPOZIO, *Primary Examiner.*

P. WILLIAMS, *Assistant Examiner.*