

Jan. 7, 1969

J. W. A. OFF ET AL
MACHINE FOR AUTOMATICALLY LOADING AND UNLOADING
FABRIC CREASERS

3,420,515

Filed July 16, 1965

Sheet 1 of 12

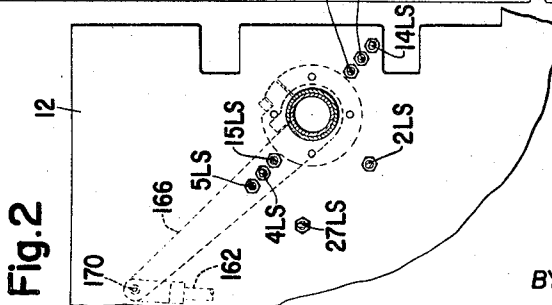
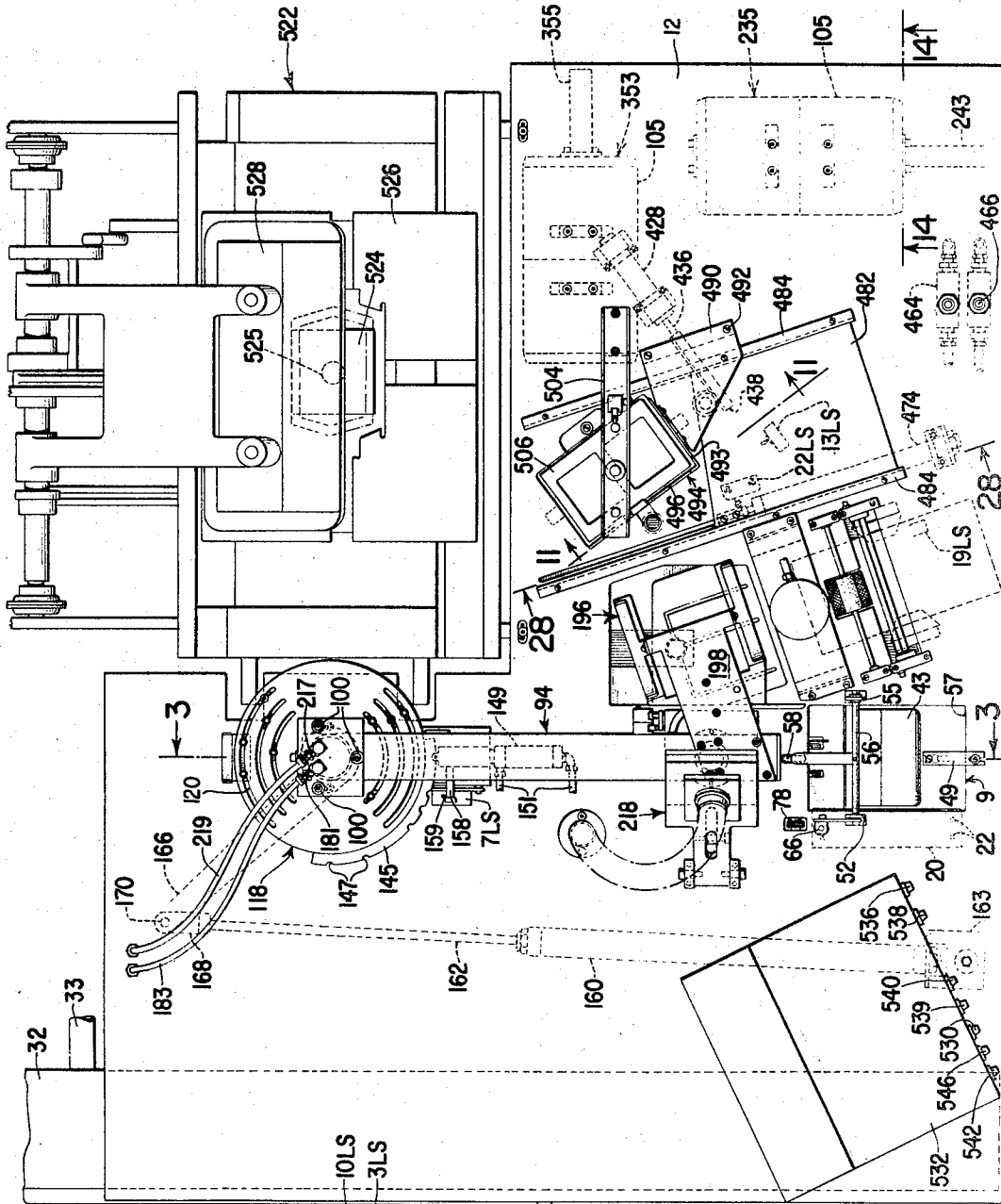


Fig. 1

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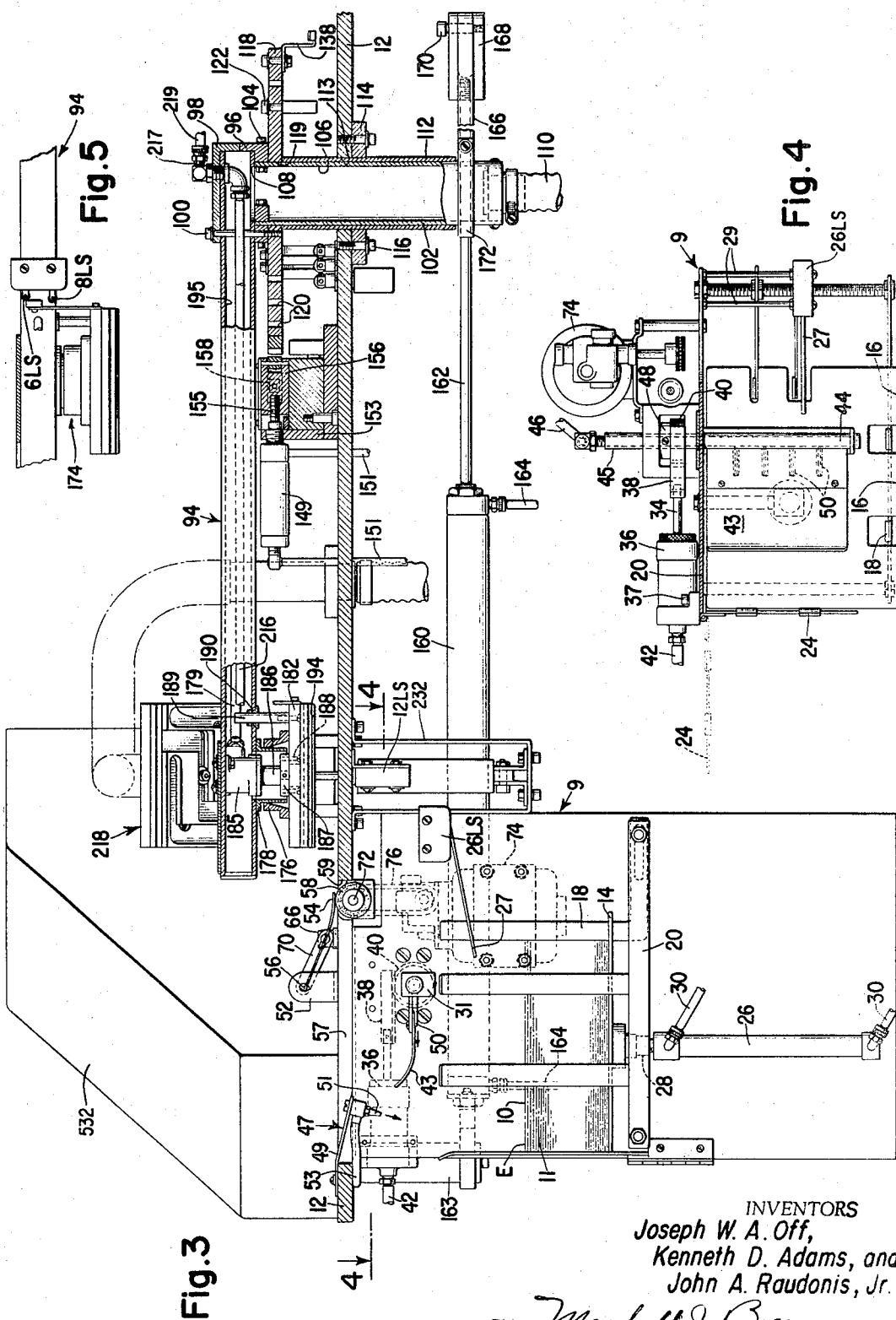
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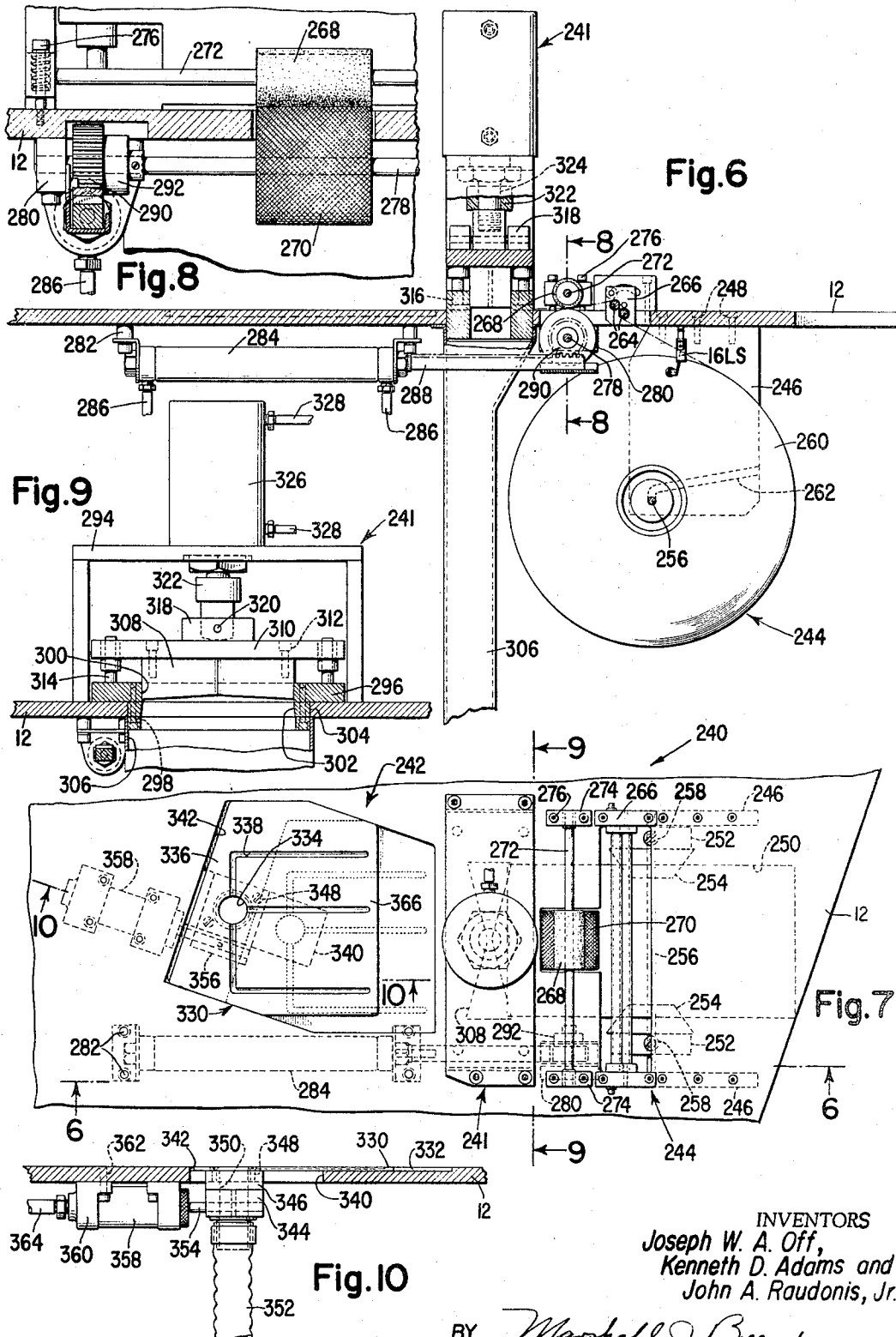
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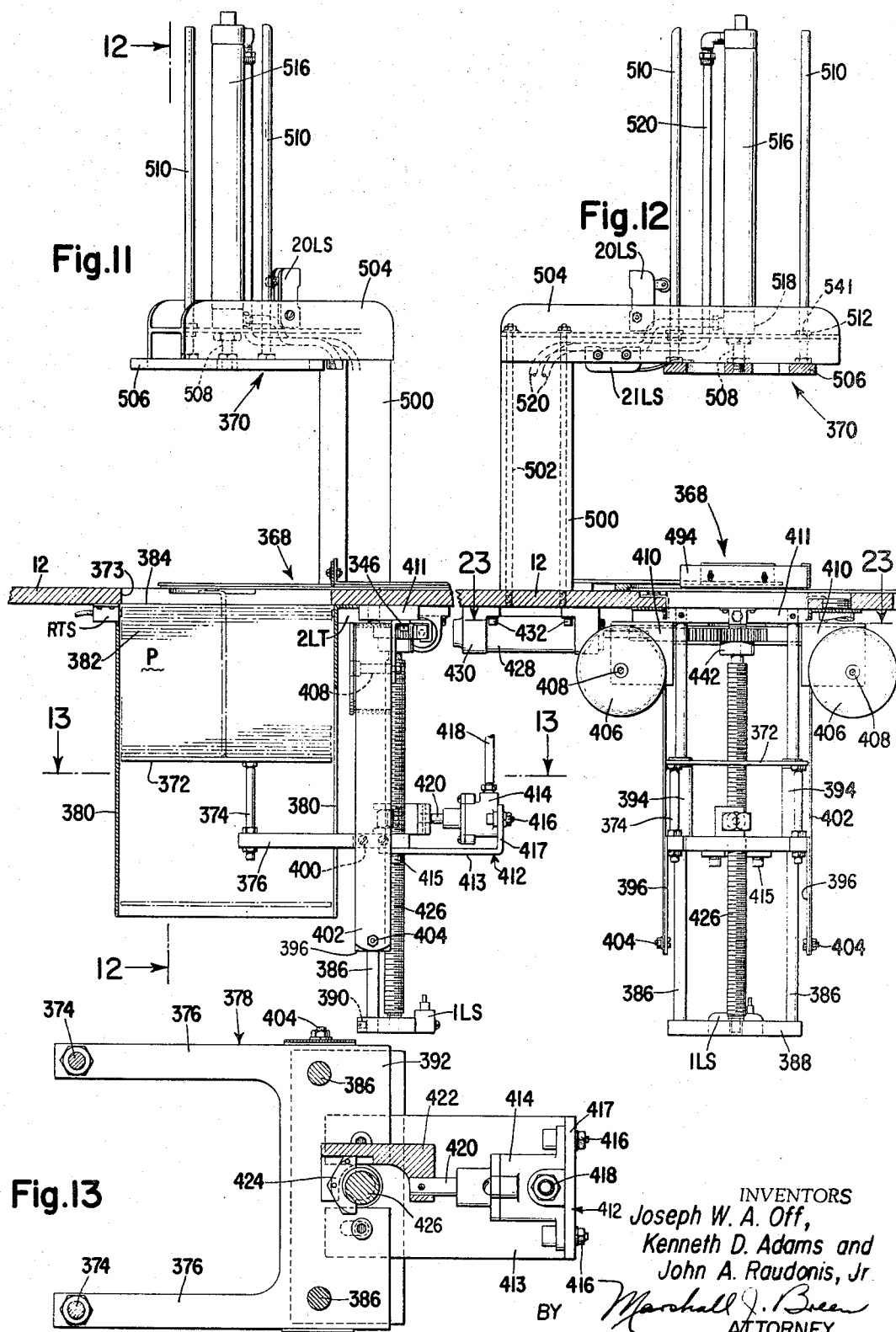
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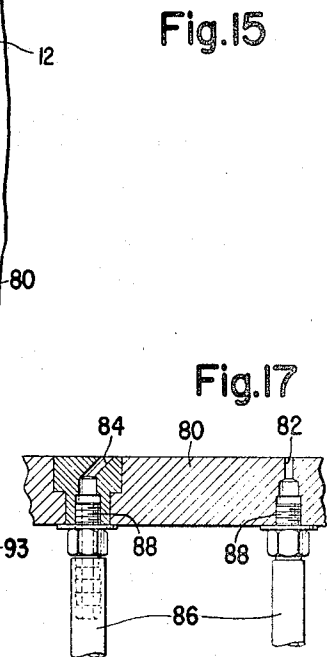
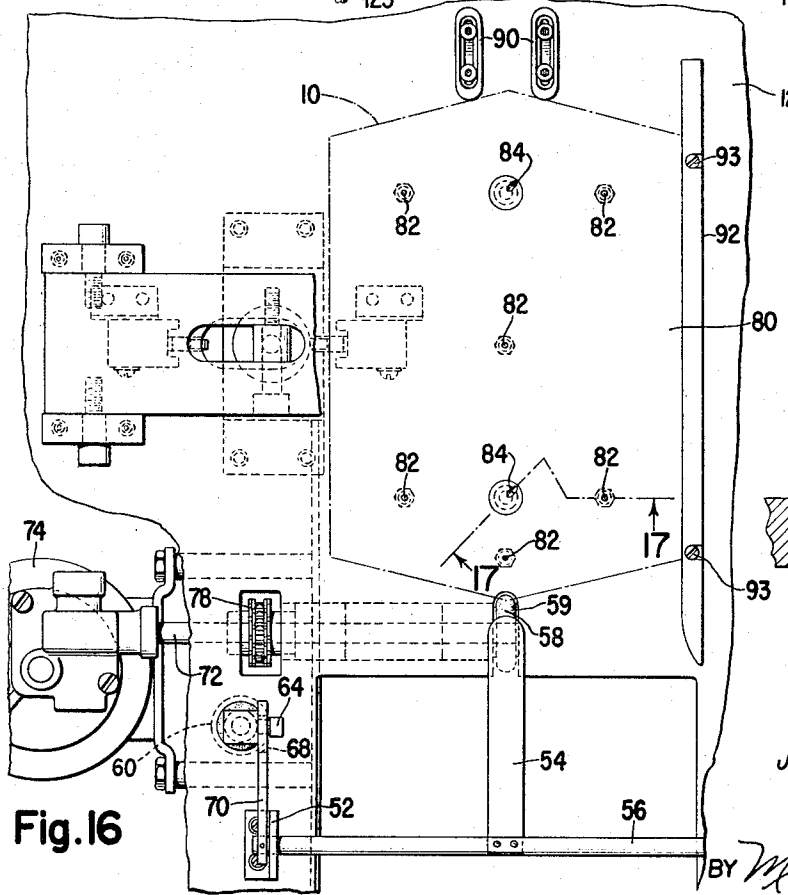
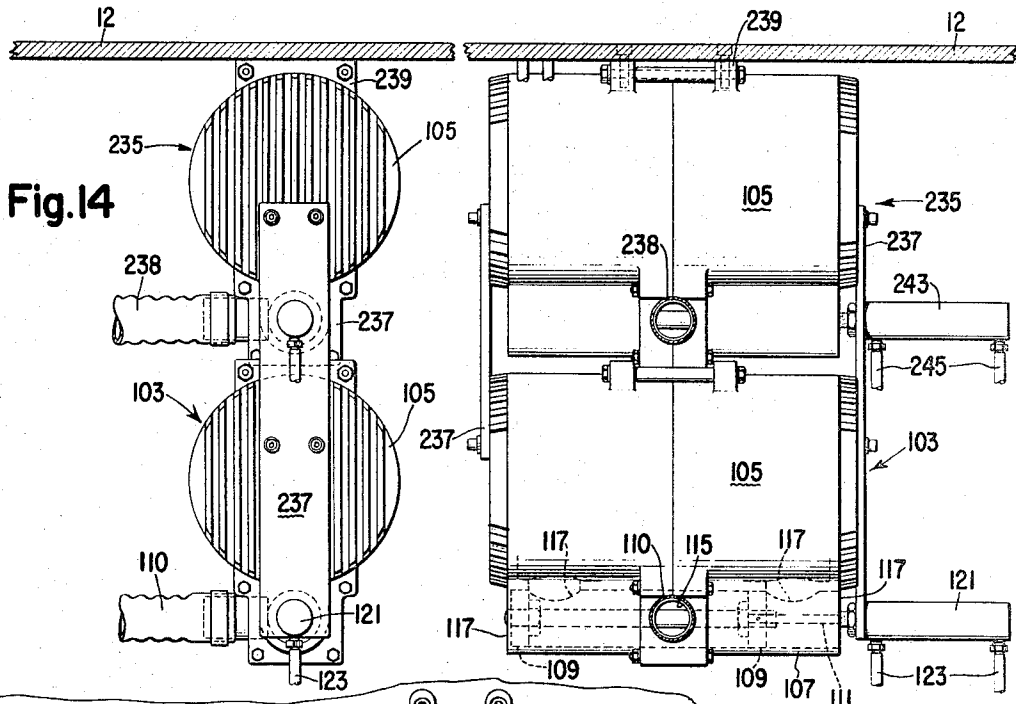
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Fig.18

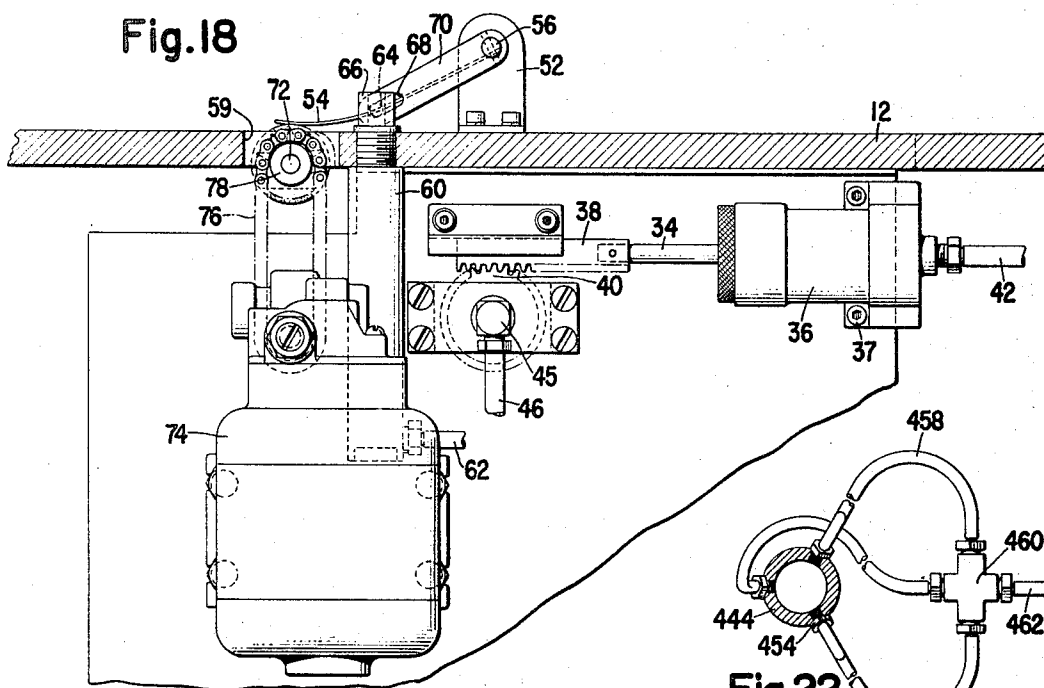


Fig.22

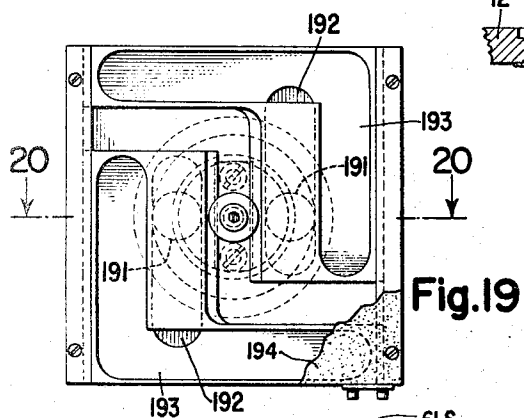


Fig.19

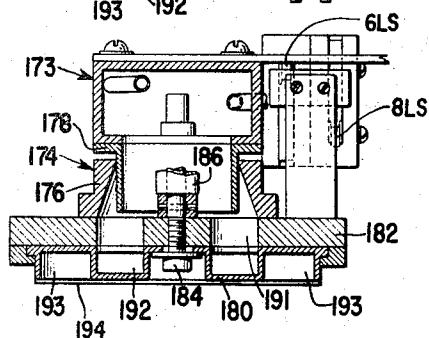


Fig.20

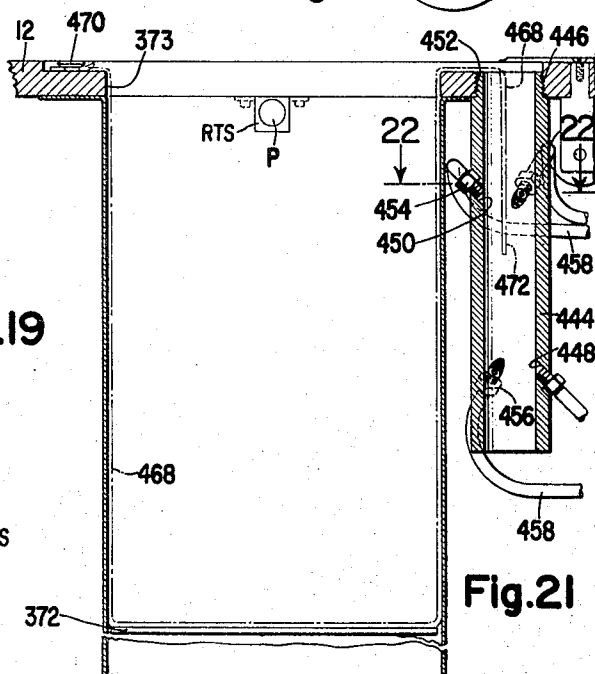


Fig.21

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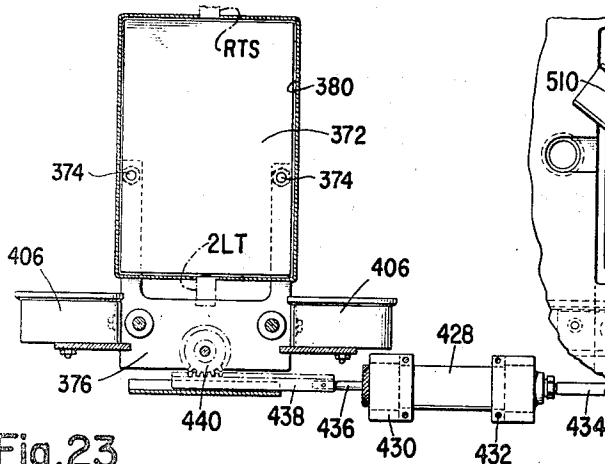


Fig. 23

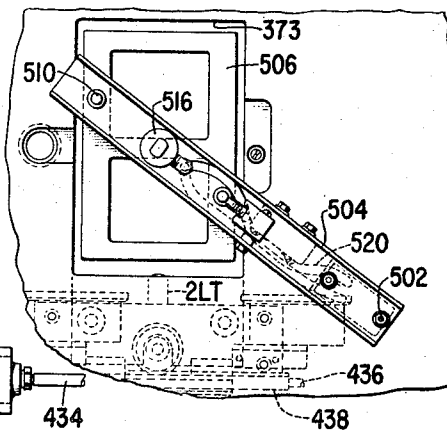


Fig. 24

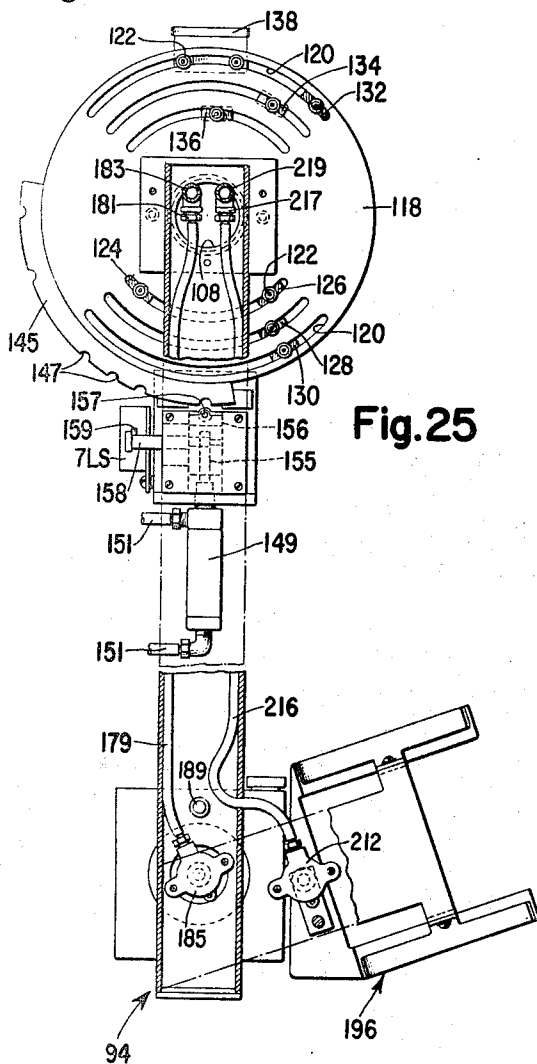


Fig. 25

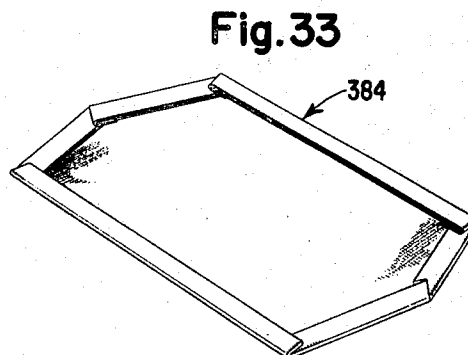


Fig. 33

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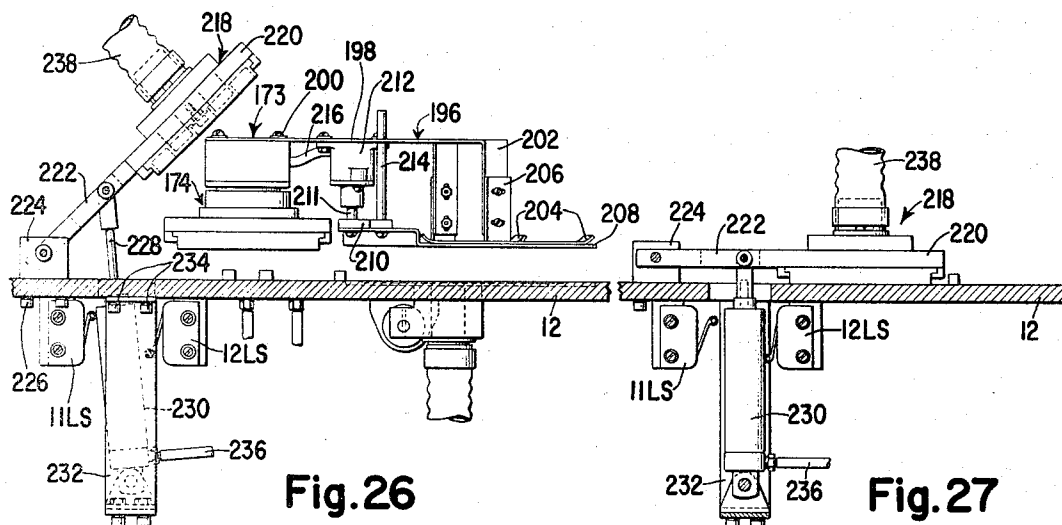


Fig. 26

Fig. 27

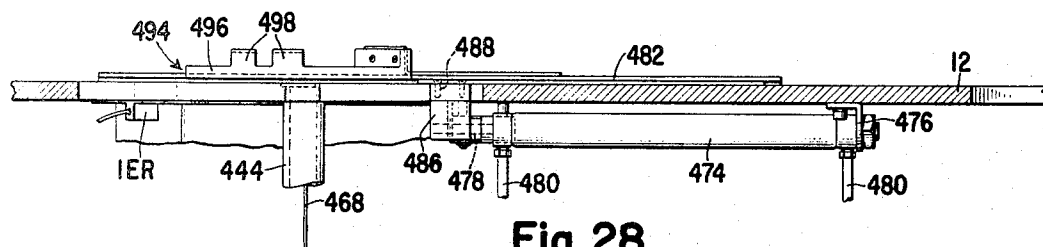


Fig. 28

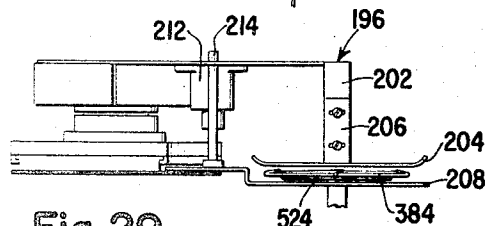


Fig. 29

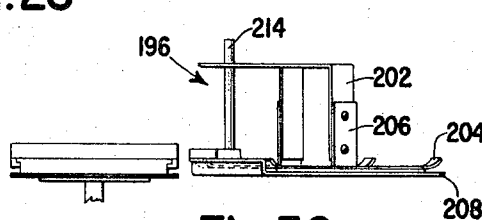


Fig. 30

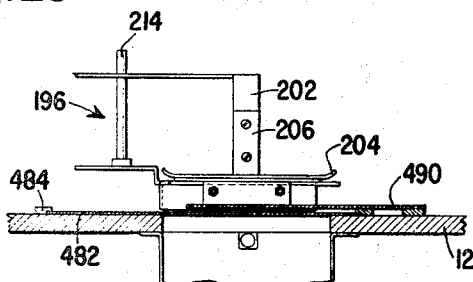


Fig. 31

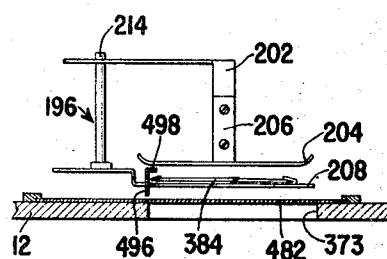


Fig. 32

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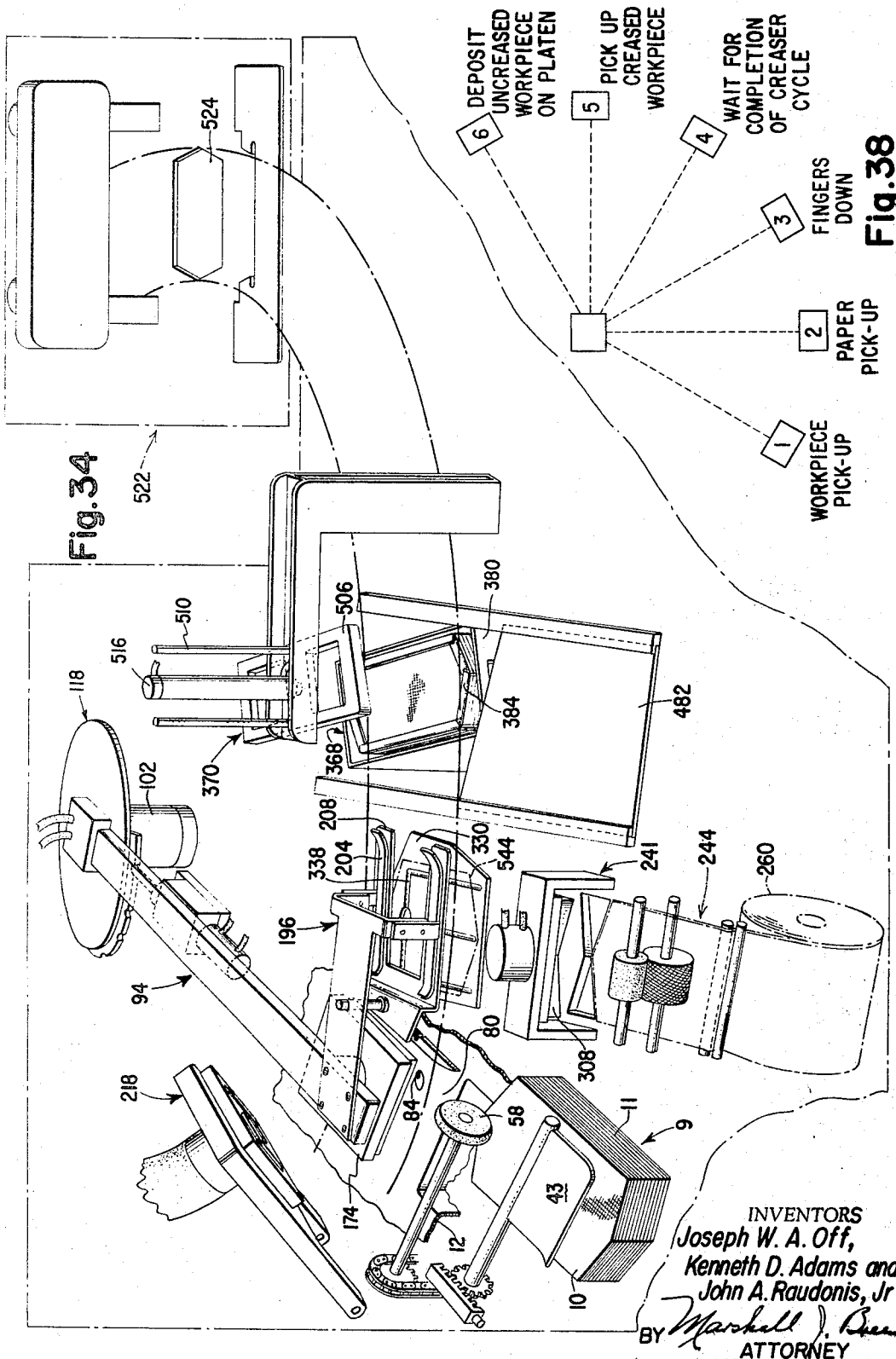
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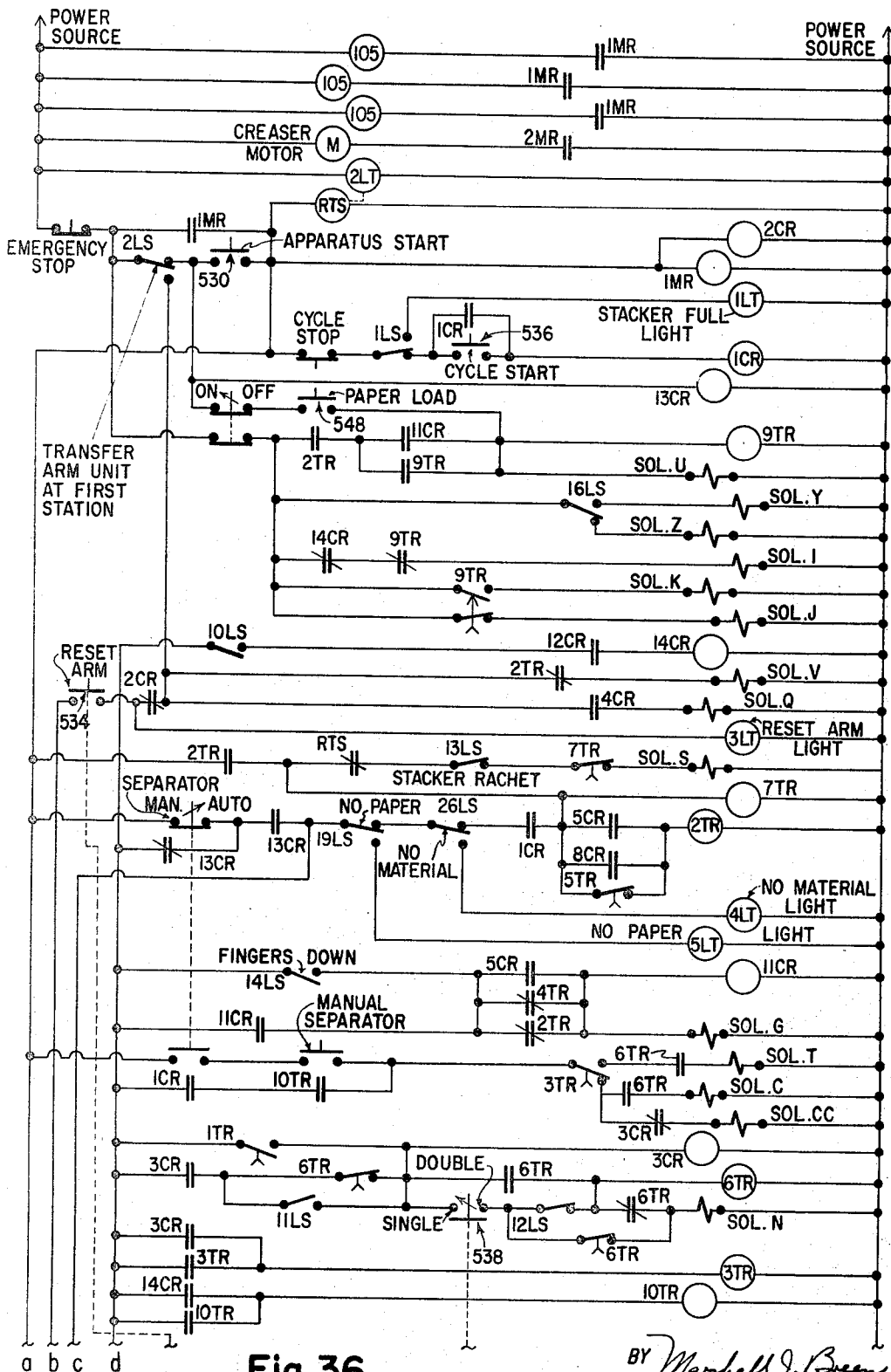


Fig. 36

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MACHINE FOR AUTOMATICALLY LOADING AND UNLOADING FABRIC CREASERS

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Filed July 16, 1965, Ser. No. 472,462

U.S. Cl. 270-45

19 Claims

Int. Cl. B42c 1/00

ABSTRACT OF THE DISCLOSURE

Apparatus for first picking up a piece of pre-cut fabric material and then a piece of paper backing and then conveying them together to a creasing machine for creasing, and finally conveying the creased together fabric and paper backing pieces to a stacking mechanism. The apparatus utilizes mechanism for producing vacuum and low pressure to position, hold and discharge the pieces of fabric material and paper backing.

The present invention relates to apparatus for automatically loading and unloading a fabric creaser, and more particularly to apparatus that automatically removes a pre-cut uncreased fabric piece from a stack of fabric pieces, transports the fabric piece to a creasing machine where it is creased, and subsequently removes it and finally stacks the creased product in a predetermined location.

It is the practice in industries utilizing fabric creaser machines of the type referred to above, to employ operators who manually load and unload the machines. Essentially, the loading and unloading operation comprises placing a fabric piece, such as a blank for a pocket, flap, cuff, placket or brassiere parts, with or without backing material as the case may be, upon the creaser platen, actuating the creaser machine which thereafter presses the fabric piece, removing the creased fabric piece from the platen and finally stacking the finished product as desired. These manual operations present a number of obstacles to any program for increasing efficiency and reducing cost in a highly competitive fabric industry. Thus, the number of creased fabric pieces produced per unit time depends largely upon the speed and dexterity of the operator, whose training requires a relatively long and costly program. In addition, the manual operation of the creaser requires the operator to place his hands within the confines of the creaser to load and unload the fabric pieces. A miscalculation of the creaser cycle by an operator striving for maximum speed could, result in an accident to his hands.

It is an object of the present invention, therefore, to provide apparatus that automatically loads and unloads a fabric creaser.

It is another object of this invention to provide an automatic fabric creaser loading and unloading apparatus that is safe, reliable and economical to operate.

It is a further object of the present invention to provide improved automatic material handling apparatus.

Having in mind the above and other objects that will be evident from an understanding of this disclosure, the invention comprises the devices, combinations and arrangements of parts as illustrated in the presently preferred embodiment of the invention which is hereinafter set forth in such detail as to enable those skilled in the art readily to understand the function, operation, construction and advantages of it when used in conjunction with the accompanying drawings in which:

FIG. 1 is a top plan view of the automatic fabric creaser apparatus of the present invention,

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FIG. 2 is a fragmentary view showing the plunger switches beneath the disc-shaped trigger plate illustrated in FIG. 1,

FIG. 3 is a sectional view taken substantially along line 4-4 of FIG. 3,

FIG. 5 is an elevational view of a portion of the vertically movable pick-up unit of the present invention,

FIG. 6 is a sectional view taken substantially along line 6-6 of FIG. 7,

FIG. 7 is a top view of FIG. 6, illustrating the paper backing assembly of the present invention,

FIG. 8 is an enlarged sectional view taken substantially along line 8-8 of FIG. 6,

FIG. 9 is a sectional view taken substantially along line 10-10 of FIG. 7,

FIG. 11 is an enlarged view taken substantially along line 11-11 of FIG. 1 and showing the stacker and tamper assemblies of the present invention,

FIG. 12 is a view taken substantially along line 12-12 of FIG. 11,

FIG. 13 is a top plan view, partly in section, taken substantially along line 13-13 of FIG. 11,

FIG. 14 is taken substantially along line 14-14 of FIG. 1 and shows an end view of two vacuum-pressure motor units utilized in the present invention,

FIG. 15 is a side elevational view of the motor units shown in FIG. 14,

FIG. 16 is an enlarged top plan view, partially broken away, of a portion of the work receiving platform of the present invention,

FIG. 17 is a sectional view taken substantially along line 17-17 of FIG. 16,

FIG. 18 is an elevational view partly in section of the driving means for the workpiece separator of the present invention,

FIG. 19 is a bottom view of the transfer head unit of the present invention,

FIG. 20 is a sectional view taken substantially along line 20-20 of FIG. 19,

FIG. 21 is a cross sectional view of a portion of the stacking and tying elements utilized in the present invention,

FIG. 22 is a sectional view taken substantially along line 22-22 of FIG. 22,

FIG. 23 is a top sectional view taken substantially along line 23-23 of FIG. 12,

FIG. 24 is a top plan view of the tamper assembly of the present invention,

FIG. 25 is a top plan view, partially in section and broken away, of the transfer arm unit of the present invention,

FIG. 26 is an end view of the auxiliary pick-up, transfer head and finished workpiece pick-up units of the present invention,

FIG. 27 is an end view of the auxiliary pick-up unit, in its lowered position,

FIG. 28 is a view taken substantially along line 28-28 of FIG. 1,

FIG. 29 is an elevational view showing the finished workpiece pick-up unit of the present invention about to retrieve the finished workpiece from the heating element of the creasing machine,

FIG. 30 is an elevational view of the finished workpiece pick-up unit of the present invention showing that unit carrying the finished workpiece clamped between the upper and lower fingers,

FIG. 31 is an elevational view of the finished workpiece pick-up unit of the present invention carrying the finished workpiece and paused over the stacker assembly,

FIG. 32 is an elevational view of the finished workpiece pick-up unit of the present invention in its open

position about to deposit the finished workpiece upon the shutter,

FIG. 33 is a perspective view of a finished workpiece produced by the apparatus of the present invention,

FIG. 34 is a schematic representation of selected portions of the present invention,

FIG. 35 is a schematic representation of a substantial portion of the pneumatic system utilized by the present invention,

FIGS. 36 and 37 are diagrams illustrating the various electrical elements utilized in the apparatus of the present invention and the manner in which they are interconnected and,

FIG. 38 is a diagram of the various stations through which the transfer arm unit of the present invention moves.

At the outset a brief description of the major units of the apparatus and the operation thereof will be given to enable the reader to obtain a clear picture of the overall design and function of the apparatus. This preview will also serve to assist the reader in understanding the detailed description that follows it.

FIGS. 34 and 38 are most pertinent to an understanding of the following description. Thus, a transfer arm unit 94 is adapted to swing in a horizontal plane above a work receiving platform 12 (FIG. 3). The transfer arm unit 94 is rotated by means, not shown in FIG. 34, which drive a hollow cylindrical leg 102 connected to the pivoted end of the unit 94. Connected to the free end of the unit 94 is a vertically movable pick-up unit 174 which follows a path such as illustrated by the dot-dash lines in FIG. 34, when the unit 94 is rotated. Also connected to the free end of the transfer arm unit 94 is a finished workpiece pick-up unit 196 extending outwardly from the free end at slightly less than right angles to the longitudinal axis of the arm unit, thereby allowing the finished workpiece pick-up unit 196 to lead the vertically movable pick-up unit 174 as the transfer arm unit rotates in a counterclockwise direction, as viewed from above the apparatus. As illustrated in FIGS. 34 and 38 the transfer arm unit 94 is positioned at the first of six stations, to be described more fully hereinbelow. The work receiving platform 12 includes an apertured workpiece pick-up section 80 located directly beneath the vertically movable pick-up unit 174 when the transfer arm unit 94 is at the first station. Pivotaly mounted on the workpiece platform 12 adjacent the apertured workpiece pick-up section 80 is an auxiliary pick-up unit 218, while situated directly forward of the section 80 is a workpiece separator unit 9, as viewed in FIG. 34.

Positioned on the work receiving platform 12 at what corresponds to station 2 is a slidable apertured paper slide plate 330, which, in its rearward position is situated directly below the path followed by the vertically movable pick-up unit 174. Positioned on the work receiving platform 12 directly forward of the plate 330, as viewed in FIG. 34, is a paper shaper unit 241 and directly forward of the unit 241 is a paper feed unit 244.

In the physical location corresponding to station 3 and positioned atop the work receiving platform 12 is a tamper assembly 370 and a slidable shutter 482. Located beneath the work receiving platform 12 and the tamper assembly 370 is a stacker assembly 368 which is adapted to receive and stack the finished workpieces 384. Situated at the end of the path followed by the vertically movable pick-up unit 174 during the counterclockwise swing of the transfer arm unit 94 is a creasing machine 522 including a workpiece receiving platen 524.

Turning now to an outline of the operation of the apparatus and assuming that the operator has already loaded a stack 11 of pre-cut workpieces 10 into the workpiece separator unit 9 and that the transfer arm unit 94 is at the first station, the workpiece pick-up station, he may actuate the apparatus by pressing a start button 530 and a cycle start button 536 (FIG. 1). It is noted that after the apparatus is started by pressing buttons 530 and 536

the apparatus operates completely automatically, thereby requiring no further acts on the part of the operator until a load of the workpieces have been creased and stacked and ready to be removed.

Pressing the button 530 actuates a plurality of motors 105 (FIGS. 1 and 14) that power units which supply alternately and on command a vacuum or a low pressure to the vertically movable pick-up unit 174; the auxiliary pick-up unit 218 and the paper slide plate 330. It is noted here that the automatic sequence of operations performed by the apparatus is programmed by an electrical and pneumatic system to be described in detail below. Immediately after cycle start button 536 is actuated and with vacuum applied to the bottom face of the vertically movable pick-up unit 174 that unit dips down to allow the pre-cut cloth workpiece 10, previously deposited on the aperture workpiece pick-up section 80, to be attracted by the vacuum to the bottom face of the unit. The pick-up unit 174 then retracts, carrying the workpiece along with it, and the transfer arm unit 94 rotates in a counterclockwise direction to station 2, the paper pick-up station, and comes to a halt with the pick-up unit 174 positioned directly above paper slide plate 330.

At this point in the sequence of operations the workpiece separator unit 9 is actuated and jets of air are directed along the underside of a foil 43 positioned above the stack 11. The pressures provided by the jets of air cause the pre-cut workpiece 10 to become attracted to the underside of the foil 43 and at that point the foil rotates upwardly carrying the workpiece 10 along with it. As the foil 43 reaches the end of its upward rotation the jets of air are shut off and the workpiece 10 is deposited on the work receiving platform 12, the leading edge of the workpiece being engaged by a rotating feed wheel 58, positioned in an opening in the platform 12, which feed wheel moves the workpiece onto the apertured workpiece pick-up section 80 where further means including angularly directed air channels 84 which direct jets of air along the undersurface of the workpiece, accurately position the workpiece preparatory to pick-up by the pick-up unit 174. If it is desirable that a double load be carried to the creasing machine 522 a selector switch 538 (FIG. 1) may be operated and the auxiliary pick-up unit 218 at this point will rotate downwardly to pick-up, by means of the vacuum present at the bottom face of the unit, the first cloth workpiece 10 previously deposited on the section 80. After the auxiliary pick-up unit 218 rotates back to its retracted position, all the while carrying the workpiece 10, the workpiece separator unit 9 is once again actuated and a second workpiece 10 is subsequently positioned on the workpiece pick-up section 80. After the second workpiece 10 is positioned on the section 80 the auxiliary pick-up unit 218 again rotates downwardly and as the bottom face of the unit approaches the section 80, now supporting the second workpiece 10, the vacuum is removed from the unit 218 and in its stead a low pressure is applied, thereby breaking the attraction of the first workpiece 10 to the bottom face of the unit 218 and subsequently allowing the deposit of the first workpiece atop and in alignment with the second workpiece. When the transfer arm unit 94 returns to the first station the vertically movable pick-up unit 174 may then pick-up two workpieces in the same manner as the single workpiece pick-up described above. The apparatus will continue to deliver double loads until the selector switch 538 is switched back to the single mode.

With the transfer arm unit 94 positioned at the second station the vertically movable pick-up unit 174 dips down toward the paper slide plate 330. The vacuum supplied to a plurality of air distribution slots 338, cut into the slide plate 330, to hold a previously deposited paper backing 544 on the slide plate is discontinued and a low pressure is applied. The low pressure is applied just as the bottom face of the pick-up unit 174 (carrying the workpiece or pieces 10) dips down and approaches the

slide plate 330 thereby allowing the vacuum at the bottom face of the unit 174 to pull the paper backing 544 flush up against the exposed surface of the workpiece 10. It is noted here that the cloth workpiece 10 is porous enough and the vacuum strong enough to provide a vacuum at the exposed face of the workpiece sufficient to hold the paper backing 544.

The pick-up unit 174 now retracts and the transfer arm unit 94 once again rotates in the counterclockwise direction. As the transfer arm unit 94 passes station 3, the fingers down station, a pair of spaced parallel vertically movable lower fingers 208, forming part of finished workpiece pick-up unit 196, drops a short distance thereby to produce a space between those fingers and a pair of corresponding fixed upper fingers 204. In addition, as the unit 94 passes station 3 the paper slide plate 330 moves along the work receiving platform 12 toward, and finally comes to a stop adjacent the paper shaper unit 241. A roll of backing paper 260 is rotated by the paper feed unit 244 positioning a predetermined length of the paper within the paper shaper unit 241 and a punch 308 is actuated which cuts and forms the predetermined length of paper to a shape and length corresponding to the size and shape of the pre-cut cloth workpiece 10. The punch 308 then retracts and the cut and shaped paper backing 544 which had been moved forwardly of the paper shaper unit 241 onto the paper slide plate 330 by the paper feed unit 244, is thereafter moved by the paper slide plate 330 which then slides forward into the pick-up position, the vacuum having been applied previously to the plate thereby to hold the paper backing securely in place, ready for the next cycle.

The transfer arm unit 94 now continues in the counterclockwise direction to station 4, the wait for completion of creaser cycle station, where, if the creasing machine 522 has not completed its cycle the arm unit will pause and wait for the completion of that cycle. Once the creasing machine has completed its cycle the transfer arm will continue its counterclockwise rotation to station 5. Or, if the creaser cycle had been completed when the arm unit reached station 4, it would continue on past that station to station 5.

As the transfer arm unit 94 approaches station 5 the pickup creased workpiece station, a previously deposited and creased workpiece positioned on the raised platen 524 slides onto the lower vertically movable finger 208, the platen lowers, the unit 94 comes to a stop and the lower fingers 208 move upwardly thereby to clamp the finished workpiece 384 securely between the upper fingers 204 and the lower fingers 208. At station 5 the cycle for the tamper assembly 370 is initiated. Thus, the shutter 482 slides towards the front of the apparatus and the finished workpiece 384 which had been resting on the shutter falls down onto the previously piled finished workpieces. The tamping head 506 now moves downwardly and presses the stacked, finished workpieces together thereby compressing the finished workpieces into a smaller space and making room for additional workpieces.

The transfer arm unit 94 once again moves in the counterclockwise direction, the finished workpiece pick-up unit 196 passing beyond the platen 524 and the vertically movable pick-up unit 174 halting at station 6, the deposit uncreased workpiece station, directly over the platen 524. At this station the vertically movable pick-up unit 174 dips down and deposits the workpiece and backing paper onto platen 524.

The transfer arm 94 now reverses its direction and moves in a clockwise direction past station 5 and station 4 to station 3. As the transfer arm unit 94 passes station 4 the creaser cycle is initiated, culminating in a creased together workpiece and backing paper resting on the raised platen 524 waiting to be picked up. At station 3 the lower fingers 208 move down from the fingers 204 and the finished workpiece 384 is deposited on shutter

482, which at this point is positioned directly beneath the vertically movable pick-up unit 196. The shutter 482 thereafter retracts allowing the finished workpiece 384 to fall down onto the stacker assembly 368.

The transfer arm unit 94 now moves again in the clockwise direction past station 2 and onto station 1 where the next cycle is automatically initiated.

WORKPIECE SEPARATOR UNIT

Turning now to a detailed description of the mechanical construction of the apparatus of this invention, FIGS. 1, 3, 4 and 18 are best suited to illustrate the workpiece separator unit 9 employed to remove the pre-cut workpiece 10 from the stack 11 of such workpieces and transport the same to the work receiving platform 12 which rests upon structure that supports the entire apparatus. A vertically movable pneumatically driven horizontal platform 14 supports the stack 11 and is adapted to position the stack, upon each cycle of operation, such that the topmost workpiece is always positioned at the same relative height immediately prior to the separation of the workpiece from the stack 11. The platform 14 includes a plurality of laterally extending fingers 16 integrally connected therewith. A plurality of upright stanchions 18, secured to support structure 20 which in turn is secured to the work receiving platform 12 by pins 22, fit between the fingers 16 thereby providing a guide for the platform 14 along its vertical travel path. A hinged retaining gate 24, secured to the support structure 20, provides the access to the platform 14 necessary to load the same with the workpieces 10. FIG. 4 shows the retaining gate 24 in its open position (dotted) and in its closed position (solid). A vertically arranged air operated cylinder 26 is secured beneath the platform 14. A piston rod 28 disposed within the air cylinder 26 is connected to the bottom of the platform 14. The piston rod 28 and the platform 14 are driven alternately up and down, on command, by air pressure directed to the cylinder 26 through fluid conduits 30. The upward movement of the platform 14 is arrested by the contact of the stack 11 with a stop bar 31, the pressure exerted on the piston rod 28 being just sufficient to hold the stack firmly up against the stop bar. Thus, the topmost workpiece is always positioned the same distance from the foil 43 when the platform 20 is at the top of its vertical run, prior to workpiece pickup as explained more fully below. A trigger arm 27, connected to a limit switch 26LS secured to support structure 20 by bolts 29, extends outwardly therefrom and is interposed in the path of travel of the platform 14. In a no load condition, that is, when the platform 14 is not holding any workpieces the limit switch is adapted to indicate to the operator, through light 4LT (FIG. 36), the no load condition.

At this point, it is noted that all of the fluid conduits (e.g. 30) indicated in this specification leading from pressure operated cylinders (e.i. 26) connect to a central valve panel 32 (FIG. 1). Valve panel 32 houses a plurality of solenoid operated valves indicated in the pneumatic diagram shown in FIG. 35 which connect the fluid conduits to a suitable fluid pressure source (not shown) through a main fluid conduit 33. All of the solenoid operated valves, with the exception of the valves operated by SOL. AA, SOL. BB and SOL. J, are conventional normally closed 3-way valves, while the excepted valves are conventional normally open 3-way valves. The remaining valves depicted in FIG. 35 are indicated by the designations VP and VPR. The VP valves are variable pressure needle valves which permit the passage of air at a predetermined controlled rate in both directions, while the VPR valves permit the passage of air at a predetermined controlled rate in one direction and at an uncontrolled rate in the other direction. As indicated by FIG. 35 a plurality of regulators control the air pressure to the various air cylinders and an air filter and lubricators are also provided.

A piston rod 34 (FIG. 4) disposed in an air operated

spring return cylinder 36 secured to support structure 20 by screws 37 is connected to a rack 38 which cooperatively engages a pinion 40. A fluid conduit 42 leads from the cylinder 36 to the central valve panel 32. The foil 43 is secured by one end to a hollow rod 44 which extends the length of the foil and beyond through the support structure 20 to a coupling unit 45 which connects the hollow rod to a fluid conduit 46 that leads to the central valve panel 32. The pinion 40 is operatively connected to a clutch 48 which in turn is connected to hollow rod 44. A plurality of nozzles 50 are positioned contiguous with the underside of the foil 43 and are in fluid connection with the hollow rod 44. The nozzles 50 are designed to direct a stream of air along the underside of the foil 43 toward the free end thereof. A bracket 49 secured by one end to the work receiving platform 12 supports air separator 47, which includes a nozzle 51. The operating end of the nozzle 51 is positioned by the bracket 49 to allow the open-end of the nozzle to face downwardly toward the stack 11, and a conduit 53 provides fluid connection from the nozzle 51 to the central valve panel 32.

Secured to the top surface of the work receiving platform 12 are a pair of spaced uprights 52 and 55. The uprights 52 and 55 support a pivotal rod 56 journaled therein and a finger clamp 54 is connected by one of its ends to rod 56 intermediate the rod ends. Rod 56 extends across and above a substantially rectangular cutout 57 in the platform 12, the stack 11 being situated directly beneath the cutout. In its operating position, the free end of the finger clamp 54 engages the feed wheel 58 which projects upwardly through a slot 59 in the work receiving platform 12 above and to the rear of the foil 43, as viewed in FIG. 1. As seen more clearly in FIG. 18, an air actuated spring return cylinder 60 is secured to and depends downwardly from the work receiving platform 12 and houses a piston rod 66. A conduit 62 leads from the bottom portion of the cylinder 60 to the central valve panel 32. A driving pin 64 extending laterally of and connected to the top of the piston rod 66 is adapted to slidably engage a slot 68 cutout of a pivot arm 70 fixedly secured to the end of the pivotal rod 56. Actuation of the cylinder 60 initiates an upward movement of the piston rod 66 which in turn urges the pivot arm 70 upwardly through the intermediacy of the driving pin 64, thereby pivoting the rod 56 and raising the finger clamp 54 upwardly and out of contact with the feed wheel 58. The feed wheel 58 is mounted upon a spindle 72 which in turn is driven by a feed motor 74 at a constant rate of speed through the intermediacy of a chain 76 connecting the drive of the motor to a sprocket wheel 78 secured to the spindle 72.

Although a description of the operation of the work transfer unit as described above is set forth in the copending application of Reid, Ser. No. 213,433, filed July 30, 1962 now abandoned, wherein a similar unit is described, a brief description of the operation of the unit described above is now set forth. At the beginning of a typical cycle for the workpiece separator unit 9, the piston rod 28 is actuated by air pressure conducted to the cylinder 26 through the conduit 30 thereby raising the platform 14 to the point where the top of the stack 11 of workpieces 10 comes to rest against the underside of the stop bar 31. At this point in the cycle streams of air are directed through the nozzles 50 and the nozzle 51, the air streams being directed as indicated by the arrows in FIG. 3. As described more fully in the above noted application Ser. No. 213,433, the topmost workpiece in the stack of workpieces 10 is attracted to the under surface of the foil 43. At this point the cylinders 36 and 60 are actuated, the former serving to rotate the foil 43 upwardly and deposit the forward edge E of the workpiece 10 on the work receiving platform 12 in contact with the feed wheel 58. Meanwhile the piston 66 has been actuated by the cylinder 60 thereby to rotate the finger clamp 54 upwardly and away from

the wheel 58 to allow the deposit of workpiece 10 on the wheel. The blast of air from the nozzles 50 and the nozzle 51 are then cut off and the finger clamp 54 is returned to its original position thereby clamping workpiece 10 between the wheel 58 and the finger clamp, foil 43 is returned to its starting position and the platform 14 is returned to its original retracted position. With the workpiece 10 now clamped between the feed wheel 58 and the finger clamp 54, the rotation of the wheel moves the workpiece forward along the work receiving platform 12 and onto the workpiece pick-up section 80 of the work receiving platform 12. It is noted that the air blast of the nozzle 51 is directed down toward the edge E of the workpiece 10. This air blast serves to prevent any workpieces under the topmost workpiece 10 from being pulled upwardly along with the topmost workpiece because the air blast, as the edges of the workpieces curl upwardly, drives a wedge of pressure between the topmost workpiece and the workpieces immediately below thereby pushing the other layers back onto the stack 11.

As seen more clearly in FIG. 16, the apertured workpiece pick-up section 80 of work receiving platform 12 is located immediately forward of the feed wheel 58. A plurality of vertically directed air channels 82 extends upwardly through the section 80 (FIG. 17). In addition, two spaced, angularly directed air channels 84 in line with feed wheel 58, extend through plate 80. Nozzles 88 conduct air under pressure to channels 82 and 84 from conduits 86 which connect the nozzles 88 to the central valve panel 32. A pair of spaced adjustable stops 90 are positioned forward of and contiguous with section 80, and a side stop 92 contiguous with the section 80 at the right side thereof extends the length of the section and is secured to the work receiving platform 12 by screws 93. As the workpiece 10 is moved forward by wheel 58 onto the section 80 the streams of air directed through channels 84 urge the workpiece against stops 90 and 92 thereby to position the workpiece preparatory to its pick-up by the vertically movable pick-up unit 174. The structure and operation of channels such as the angularly directed air channels 84 is set forth in the copending application of Off, Ser. No. 365,575, filed May 7, 1964 now patent No. 3,268,222.

TRANSFER ARM UNIT

The hollow transfer arm unit 94, swingable in a horizontal plane, is mounted on the work receiving platform 12, as seen more clearly by reference to FIGS. 1, 3 and 25. The tail portion of the transfer arm unit 94 is secured between a lower clamping plate 96 and an upper clamping plate 98, bolts 100 serving to lock the transfer arm to the clamping plates. The lower clamping plate 96 is in turn secured to the upper section of the downwardly depending hollow cylindrical leg 102, the inner surface of the lower clamping plate 96 contacting the outer surface of the cylindrical leg 102 and encompassing the same. Bolts 104 serve to secure the lower clamping plate to the top section of the cylindrical leg 102. A passage 106, defined by the hollow cylindrical leg 102 aligns with an aperture 108 in the tail of the transfer arm 94 thereby to provide a fluid passage from the transfer arm through the cylindrical leg 102, and further through a conduit 110 connected to the bottom end of the cylindrical leg to a vacuum-pressure motor unit 103. The hollow cylindrical leg 102 is slidably and concentrically mounted within a hollow support cylinder 112. The cylinder 112 depends downwardly through an opening 113 in the work receiving platform 12 and is fixedly secured to the work receiving platform 12 by means of a split ring clamp 114 secured to the bottom surface of the work receiving platform 12 by bolts 116.

The vacuum-pressure motor unit 103 (FIGS. 14 and 15) includes a motor 105 and a hollow cylinder 107 having two pistons 109 mounted on a piston rod 111. The cylinder 107 includes feed port 115 and openings 117. One end of the piston rod 111 is housed in and moved

by an air actuated cylinder 121 which is connected to the control valve panel 32 by conduits 123. The motor unit 103 is adapted to provide either a vacuum or a pressure at the feed port 115, depending upon the position of the pistons 109 which are in turn controlled by the air actuated cylinder 121.

Support cylinder 112 carries a disc-shaped trigger plate 118 which includes an aperture 119 adapted to receive the cylindrical leg 102. Trigger plate 118 is fixedly secured between the top of the support cylinder 112 and the bottom of the lower clamping plate 96 and is held in place by bolts 100 which extend downwardly through the upper end of the lower clamping plate and into the trigger plate. The trigger plate 118 includes a plurality of slits 120 through which a plurality of bolts 122 depend, such bolts serving to support a plurality of downwardly depending trigger fingers 124, 126, 128, 130, 132, 134, 136 and 138.

As seen more clearly in FIG. 2, a plurality of plunger switches 27LS, 2LS, 14LS, 3LS, 10LS, 15LS, 5LS and 4LS are secured to the work receiving platform 12 beneath trigger plate 118 by any suitable means. Each plunger switch is positioned in the path of a corresponding depending trigger finger, each trigger finger extending downwardly a distance sufficient to contact its mating plunger switch as that mated trigger finger passes over the plunger switch. The actuation of the plunger switches serves to initiate certain predetermined fabric creaser apparatus operations in a prescribed order as the transfer arm and the trigger plate rotate, as will be described more fully hereinbelow.

Secured to and extending partially around the periphery of the trigger plate 118 is a cam 145 having a plurality of indentations 147. Beneath the transfer arm unit 94 and adjacent trigger plate 118 an air cylinder 149 having conduits 151 connecting it to the central valve panel 32 is mounted upon a support 153 and drives a piston rod 155 which in turn drives a plunger 156 also mounted on the support 153. A button 157 secured to the end of the plunger 156 is adapted to selectively engage indentations 147 of the cam 145 when the air cylinder 149 is actuated. A trigger finger 158 is also connected to the plunger 156 and extends laterally therefrom. A limit switch 7LS, secured to the side of the support 153 includes a finger 159 that projects upwardly in the path of the trigger finger 158. Each indentation 147 on the cam 145 corresponds to a station in the horizontal travel of the transfer arm unit 94 and at each such station the air cylinder 149 is actuated moving the plunger 156 and therefore button 157 into engagement with the indentation, said engagement tending to lock the trigger plate and the transfer arm unit, to which the trigger plate is secured, in position at that station and provide a positive stop for the unit. Simultaneous with the actuation of the plunger 156 the trigger finger 158 contacts finger 159 thereby actuating the limit switch 7LS, the limit switch remaining actuated so long as the air cylinder 149 remains actuated. While the switch 7LS remains actuated the intelligence communicated thereby is adapted to instruct a control system to refrain from initiating any horizontal movement of the transfer arm unit. Thus, the transfer arm unit cannot move during the period that the plunger 156 is in the forward or actuated position.

The drive mechanism (FIGS. 1 and 3) for the transfer arm unit 94 includes an air actuated cylinder 160 adapted to drive a piston rod 162, the air cylinder being supported at one end by a mounting unit 163 which in turn is secured to and depends downwardly from the work receiving platform 12. A pair of conduits 164 are in fluid connection with each end of the cylinder 160 and lead to the central valve panel 32. The piston rod 162 is pivotally connected to a transfer arm drive rod 166 through the intermediacy of a U-shaped bracket 168 and pivot pin 170. The transfer arm drive rod 166 is fixedly secured to a clamping bracket 172 in turn affixed to the bottom portion of the hollow cylindrical leg 102. Actuation of the cylinder 160 moves

the piston rod 162 thereby to rotate hollow cylindrical leg 102 within the hollow support cylinder 112 to provide horizontal movement of the transfer arm unit 94.

The forward end of the transfer arm 94 is adapted to support a transfer head unit 173, as shown more clearly in FIGS. 3, 19 and 20. The transfer head unit includes the vertically movable pick-up unit 174. The vertically movable pick-up unit 174 includes a collar 176 adapted to slidably engage a hollow cylindrical leg 178 which is connected to and depends downwardly from the transfer arm 94. Plates 180 and 182 are held in back to back relationship by a bolt 184 in turn connected to the bottom of a piston rod 186. A spring return air cylinder 185 which actuates the piston rod 186 is housed within the transfer head unit 173 and is secured to the underside of the roof of the transfer arm 94. The air cylinder 185 is fluidly connected to the valve panel 32 through conduit 179, coupling 181 and conduit 183. A piston collar 187 connected to the piston rod 186 is secured to the plate 182 by bolts 188. The bottom end of a guide pin 189 is affixed to the plate 182 and projects upwardly through a grommet 190 inserted in and extending through an aperture in the floor of the transfer arm 94. Grommet 190 is adapted to be slidably engaged by the guide pin 189 thereby providing proper orientation of the vertically movable pick-up unit 174. The plate 182 includes vertical passages 191 which are in fluid connection with horizontal passages 192 in turn fluidly connected with the elbow portion of L-shaped slots 193. A soft felt lining 194 is secured to and covers the entire bottom face of the vertically movable pick-up unit 174 which, however, is sufficiently porous to allow the passage of air therethrough. The particular arrangement of the L-shaped slots and the fluid connection to the elbow portion of said slots is designed to provide an even distribution of air pressure over the surface of the felt lining 194. From the foregoing it can be understood that a fluid path extends from the conduit 110 through the passage defined by the hollow cylindrical leg 102, passage 195 of transfer arm 94, the passage defined by hollow cylinder 178 and finally through passages 191 and 192 to the L-shaped slots 193.

The finished workpiece pick-up unit 196 (FIG. 26) includes a substantially rectangular support plate 198 secured at one end by bolts 200 to the top of the transfer head unit 173, the plate 198 thereby serving to support the entire pick-up unit. The support plate 198 extends outwardly from the transfer head unit 173 at approximately right angles to the longitudinal axis of the transfer arm unit 94, such positioning allowing the pickup unit to precede or lead the transfer head unit as the whole is rotated in a counterclockwise direction, as viewed from above. A pair of spaced legs 202 are integrally formed with and depend downwardly from the free end of the rectangular support plate 198. The pair of horizontal fixed upper fingers 204 are secured to the downwardly depending legs 202 by means of uprights 206 which are integrally connected to the fingers 204 and extend upwardly therefrom. The pair of lower horizontally disposed vertically movable fingers 208 are aligned with the upper horizontal fingers 204 to allow the top surface of the fingers 208 to contact the bottom surface of the fingers 204. The fingers 208 are connected at one end to a bar 210 which in turn is connected to and supported by a piston rod 211 of the spring return air cylinder 212. A guide pin 214 is also connected to the bar 210 and projects upwardly through an aperture in the rectangular support plate 198 thereby to provide proper orientation for the fingers 208 as they are moved vertically. The spring return air cylinder 212 is secured to the underside of the rectangular support plate 198 and is connected to the central valve panel 32 through a conduit 216, a coupling 217 and a conduit 219. The actuation of the cylinder 212 forces the fingers 208 downwardly thereby opening a space between the lower fingers 208 and the upper fingers 204 preparatory to picking up or depositing

the finished workpiece 384, as shown more clearly in FIGS. 29 and 32.

AUXILIARY PICK-UP UNIT

The auxiliary pick-up unit 218 (FIGS. 26 and 27), similar to the vertically movable pick-up unit 174, includes an apertured plate 220 which is formed with an extension 222 pivotally mounted by its free end on a support 224 secured to the work receiving platform 12 by bolts 226. A piston rod 228 is pivotally connected to the extension 222 intermediate the length thereof, the piston rod being housed in an air cylinder 230 in turn pivotally connected at its lower end to the U-shaped support 232 which depends downwardly from and is connected to the underside of the work receiving platform 12 by bolts 234. A pair of conduits 236 lead from the air cylinder 230 to the central valve panel 32. A conduit 238 connects the input of the auxiliary pick-up unit to a vacuum-pressure motor unit 235 (FIGS. 14 and 15) similar to the motor unit 103 and connected thereabove by support structure 237, the motor unit 235 being connected to the underside of the work-receiving platform 12 by a support structure 239. An air actuated cylinder 243 fluidly connected by conduits 245 to the central valve panel 32 serves to operate the motor unit 235 as the air actuated cylinder 121 operates the motor unit 103. The auxiliary pick-up unit 218 and its mountings are designed to bring the unit down, in its operational mode, flush against the workpiece pick-up section 80, i.e., the same position that the vertically movable pick-up plate 174 occupies in its operational mode.

PAPER BACKING ASSEMBLY

A paper backing assembly 240 depicted in detail in FIGS. 6-10, is positioned to the right of the material separator unit 9, as viewed facing the front of the automatic fabric creaser apparatus, and includes the paper shaper unit 241, a paper positioner unit 242 and the paper feed unit 244.

The paper feed unit 244 includes a pair of spaced parallel downwardly depending support plates 246, which are connected to the work receiving platform 12 by bolts 248, and are positioned one on each side of a rectangular cut-out 250 in the work receiving platform. A pair of spaced rollers 252 having inclined surfaces 254 are fixedly secured to a rod 256 by screws 258, the rod being rotatably mounted on the plates 246. The roll of paper 260 may be mounted on the rollers 252 by first loosening one of the screws 258 and then removing the roller 252 secured by that screw and slipping the rod 256 through the axis of the roll of paper and thereafter replacing the roller 252 and securing the same by tightening the loosened screw 258. Next, the operator must slip the ends of the With the roll of paper 260 in place the operator must pass rod 256 along guideways 262 cut into the plates 246 and finally into its operating position as shown in FIG. 6, the leading edge of the paper between a pair of guide rollers 264, mounted between blocks 266 in turn adjustably mounted on the work receiving platform 12, and thence between an upper free wheeling roller 268 and a lower driven roller 270. The upper free wheeling roller 268 is fixedly secured to a rod 272 rotatably mounted between supports 274 in turn adjustably secured to the work receiving platform 12 by bolts 276. The lower driven roller 270 is fixedly secured to a drive rod 278 rotatably mounted between downwardly depending supports 280 which are secured to the underside of the work receiving platform 12. A pair of bolts 282 which are connected to and depend downwardly from the work receiving platform 12 serve to support an air cylinder 284 fluidly connected to the central valve panel 32 by conduits 286. The air cylinder 284 drives a piston rack 288 which is adapted to engage a pinion 290 and drive the rod 278 and the attached lower driven roller 270 through a one way clutch 292. In its fully extended position the piston rack 288 is adapted to engage the plunger of a limit switch 16LS

secured to and depending downwardly from the work receiving platform 12. A limit switch 19LS (FIG. 1) is secured to the underside of the work receiving platform 12 and is adapted to indicate to the operator through light 5LT (FIG. 36) the absence of paper feeding between guide rollers 264. The paper shaper unit 241 is interposed between the paper positioning unit 242 and the paper feed unit 244 and includes a housing 294 which encloses the paper shaping mechanism. A die 296 is secured to the work receiving platform 12 by bolts 298. The die 296 includes a centrally positioned cut-out 300 formed in the shape of a double triangle with the apex of each triangle point to point. A pair of downwardly depending guide walls 302 integrally formed with the die 296 extend down through an aperture 304 in the work receiving platform 12. A chute 306 connected to the underside of the work receiving platform 12 directly beneath the aperture 304 extends downwardly to a waste paper receptacle (not shown). The punch 308 formed in the shape of the double triangle of cut-out 300 is fixedly secured to the punch drive plate 310 by bolts 312 and depends downwardly therefrom. Guide pins 314 are fixedly secured to and depend downwardly from the drive plate 310 and slidably engage a guide hole 316 in the die 296 to orient and guide the punch 308 along its vertical path of travel. The punch drive plate 310 includes a pair of spaced supports 318 which extend upwardly from the center of the plate 310 and support a rod 320 extending between the supports (FIG. 9). A rod 320 passes through the bottom portion of the cylindrically shaped connecting member 322 secured to one end of a piston rod 324 housed in and actuated by an air cylinder 326 mounted upon and secured to the top of the housing 294. A pair of conduits 328 connect the air cylinder 326 to the central valve panel 32.

The paper positioner unit 242 includes the paper delivery plate 330 adapted to slide along the work receiving platform 12 within a plate channel 332 cut out of the top of the surface of the work receiving platform 12. The paper delivery plate 330 includes an aperture 334 located near the trailing end 336 of the plate and a plurality of air distribution slots 338 cut into the top surface of the plate which slots in combination form an E-shaped air distribution network with the aperture 334 meeting the slots at the point where the middle leg of the three horizontal legs intercepts the vertical leg. A rectangular slot 340 is cut through the bed of the plate channel 332 and extends from the edge 342 thereof to a point intermediate the length of the channel. A hollow guide 344 having a rectangular head 346 adapted to slidably engage the rectangular slot 340 is connected to the bottom of the paper delivery plate 330 beneath the aperture 334 by bolts 348. The hollow guide 344 includes a passage 350 which provides a fluid connection to aperture 334 from a conduit 352, connected to the guide 344, which in turn leads to a vacuum-pressure motor unit 353 (FIG. 1) operated by an air actuated cylinder 355 and is similar in structure and operation to the vacuum-pressure motor units 103 and 235. A piston rod 354 is secured to an extension 356 of the guide 344 and is driven by an air actuated spring return cylinder 358. The cylinder 358 is mounted upon supports 360 which are secured to the underside of the work receiving platform 12 by bolts 362. A conduit 364 connected to one end of the cylinder 358 leads to the central valve panel 32 through which the pressure necessary to actuate the piston and drive guide 344 forward is delivered. The forward motion of the hollow guide 344 moves the paper delivery plate 330 forward to the dotted position shown in FIG. 7, where the leading edge 366 comes to rest adjacent to and parallel with the paper shaper unit 241.

The stacker assembly 368 and the tamper assembly 370, as seen more clearly in FIGS. 11-13, 23 and 24, are positioned to the right of the paper backing assembly 240, as viewed from the front of the fabric creaser apparatus, the tamper assembly extending vertically above the work receiving platform 12 with a substantial portion of the

stacker assembly depending downwardly from the work receiving platform 12 and beneath the tamper assembly 370.

STACKER ASSEMBLY

Turning first to a description of the stacker assembly 368, a vertically movable work receiving plate 372 is supported by a pair of spaced parallel vertically extending bars 374 connected to the free ends of legs 376 of U-shaped support 378. A rectangular guide 380 depends downwardly from and is connected to the underside of the work receiving platform 12 and is positioned around the periphery of the vertical path along which the work receiving plate 372 travels, directly beneath an opening 373 in the platform 12, thereby serving to contain and properly orient a stack 382 of the finished workpieces 384. A pair of spaced parallel rods 386 are connected to and depend downwardly from a support block 411 connected to the work receiving platform 12. The rods 386 support a plate 388, set screws 390 serving to secure the plate 388 to the rods. A connecting leg 392 of the U-shaped support 378 is secured to spaced parallel cylindrical bearings 394 which are connected to and extend through suitable apertures in the connecting leg. The bearings 394 are adapted to slidably engage the rods 386 thereby guiding the U-shaped support 378 along its vertical path. Two downwardly depending spaced parallel plates 396 are connected to the edge of two sides of the connecting leg 392 of the U-shaped support 378 by bolts 400. One end of a pair of coiled metallic tapes 402 are secured to the free ends of the plates 396 by bolts 404, the tapes being biased to exert an upward force on the plates 396 which in turn tend to urge the U-shaped support 378 in an upward direction. The tapes 402 are mounted upon spools 406 which in turn are mounted upon rods 408 rotatably mounted on downwardly depending right angled plates 410 in turn secured to the support block 411 connected to the underside of the work receiving platform 12.

An L-shaped support plate 412 is secured by the end of its horizontal leg 413 to the connecting leg 392 of the U-shaped support 378 by bolts 415 and serves to support an air actuated spring return cylinder 414 which is supported by bolts 416 on vertical leg 417 of the support plate. A conduit 418 connects the cylinder 414 to the central valve panel 32. The cylinder 414 drives a piston rod 420 which is connected to a U-shaped connecting link 422. A grooved semi-circular jaw 424 is secured to the U-shaped connecting link 422 and in its operating mode threadably engages a lead screw 426 journaled between support block 411 and the plate 388. A two-way air cylinder 428 (FIG. 23) is mounted upon a pair of support clamps 430 which in turn are secured to the underside of the work receiving platform 12 by bolts 432. A pair of conduits 434 connect the cylinder 428 to the central valve panel 32. The cylinder 428 houses a piston rod 436 which drives a rack 438 that engages the teeth of a pinion 440. The pinion 440 in turn is connected to the screw 426 through the intermediacy of a one-way clutch 442 (FIG. 12). Thus, actuation of the cylinder 428 reciprocates the rod 436 and the rack 438 which drives the pinion 440 and imparts a rotary motion to the screw 426 through the one-way clutch 442. When the grooved semi-circular jaw 424 is operatively connected to the lead screw 426 the rotation of the latter serves to drive the work receiving plate 372 downwardly, through the intermediacy of the bars 374, U-shaped support 378, L-shaped support plate 412, cylinder 414, piston rod 420 and U-shaped connecting link 422. A limit switch 13LS (FIG. 1) is secured to the underside of platform 12 and is arranged so that its trigger arm is interposed in the path of travel of rack 438.

As seen more clearly in FIG. 11 a light 2LT and a conventional transistorized sensitive relay unit RTS including a photocell P are secured to the underside of the work receiving platform 12 on opposite sides of the opening 373. The light 2LT is aligned with photocell P to allow the light beam from 2LT to strike photocell P except when, as shown in FIG. 11, the stack of finished workpieces 384

blocks the path of the light beam. As the finished workpieces 384 are deposited on the work receiving plate 372 they form an ever higher stack which eventually blocks the path of the light beam emanating from light 2LT. When this occurs, the cylinder 428 is actuated by the relay unit RTS driving the plate 372 downwardly thereby making room for more finished workpieces. It is noted that the individual workpieces 384 as they fall through the opening 373 and pass through the 2LT light beam do not sufficiently block the light beam to energize the relay for RTS. This system of gradually lowering the work receiving plate 372 whenever the stack of finished workpieces reach a predetermined height tends to keep the top of the stack near the opening 373 in the platform 12. Thus, the finished workpieces 384 never have to fall more than a short distance to reach the top of the stack. This short distance does not give the workpieces time to become canted in one direction or another and end up in disarray on the stack. This system therefore, provides a neatly piled level stack of finished workpieces.

Depending downwardly from the work receiving platform 12 adjacent the stacker assembly 368 is a hollow elongated open-ended cylinder 444 (FIG. 21) which includes grooves 446 cut into the outer surface of a neck portion at one end of the cylinder. A first set of three apertures 448 are cut through the wall of the cylinder 444 near the bottom thereof, each of the apertures being spaced equidistant about the periphery of the cylinder and angled in an upward direction. A second set of three apertures 450 cut through the wall of the cylinder 444 in the upper portion of the cylinder 444 are positioned similarly to the first set of three apertures, but are angled in a downward direction. A threaded aperture 452 in the work receiving platform 12 allows cylinder 444 to threadably engage work receiving platform 12. Two sets of three nozzles 454 and 456 are fitted into, respectively, the upper and lower sets of the apertures 450 and 448. Each set of the three nozzles has connected thereto conduits 458 which lead to a three way connector 460 (FIG. 22) which in turn is connected through a conduit 462 to the central valve panel 32. A pair of switches 464 and 466 (FIG. 1) are mounted on the work receiving platform 12 and serve to provide a means by which the operator may manually operate the corresponding valve and actuate the air pressure source for the upper and lower sets of nozzles, respectively. As seen more clearly in FIG. 21, a tie cord 468 is affixed by one end to a button 470 then drops down through the aperture 373 in the work receiving platform 12 to and along work receiving plate 372 and thence upwardly through the aperture 373 and finally down into the cylinder 444. When air is directed to the upper set of three nozzles 454 the streams of air cooperate to exert a downward pull upon the free end 472 of the tie cord 468 thereby holding the cord in place while the finished workpieces 384 are dropped onto the work receiving plate 372. When it is desired to remove the end 472 of the tie cord to allow the operator to tie the bundle of the finished workpieces he merely shuts off the air supply source to the upper set of three nozzles 454 by actuating the switch 464 and then turning on the air supply to the lower set of three nozzles 456 by actuating the switch 466. When the lower set of three nozzles is actuated the upwardly directed air stream serves to blow the cord up through the cylinder 444 so that the operator may grasp the same and tie the bundle of finished workpieces.

Reference to FIG. 28 discloses a two-way air actuated cylinder 474 suspended beneath the work receiving platform 12 by brackets 476 and includes a piston 478 connected to and housed within the cylinder. A pair of conduits 480 are connected one to each end of the cylinder 474 and lead to the central valve panel 32. The shutter 482 is slidably mounted on the work receiving platform 12 between two parallel guide tracks 484 secured to the top of the work receiving platform. A drive plate 486 connected by one end to the shutter 482 by bolts 488 is

connected by the other end to and is driven by the piston rod 478. In the extended position of the piston rod 478 the shutter 482 is moved to a point where it covers the opening 373, while in the retracted position the shutter is moved clear of the opening 373, as shown in FIG. 1. A support plate 490 (FIG. 1) is secured to the top surface of the work receiving platform 12 by bolts 492 and extends over and slightly above the path traveled by the shutter 482 intermediate the path length. A substantially right angled scraper 494 having arms 493 and 496 is secured to one end of the support plate 490 and is positioned slightly above the path of travel of the shutter. The arm 496 includes a plurality of spaced workpiece engaging fingers 498 (FIGS. 28 and 32) which project vertically upward and then bend at right angles in the direction of the opening 373, parallel with the work receiving platform 12. A limit switch 22LS (FIG. 1) is secured to the underside of platform 12 and is disposed to allow the interception of its trigger finger by rod 478 of cylinder 474.

TAMPER ASSEMBLY

The tamper assembly 370 (FIGS. 11, 12 and 24) includes a vertical support stanchion 500 projecting upwardly from the work receiving platform 12 and positioned adjacent the path of the shutter 482. The stanchion 500 is secured to the top surface of the work receiving platform 12 by elongated bolts 502 which threadedly engage the platform 12. The bolts 502 also serve to secure a laterally extending arm 504 to the top of the stanchion 500. The arm 504 extends over the opening 373 at a height above the work receiving platform 12 sufficient to allow the paper backing pick-up unit 196 to pass safely therebeneath. The arm 504 supports a two-way air cylinder 516 which houses a piston rod 508 that is secured to the tamping head 506 which tamping head is adapted for vertical movement beneath the arm 504. A pair of guide rods 510 are secured to and project upwardly from each end of the tamping head 506 through grommets 512 captured by apertures 514 in the arm 504. The guide rods 510 serve to orient the tamping head 506 during its vertical travel. The cylinder 516 is secured to the laterally extending arm 504 by a collar clamp 518. A pair of conduits 520 fluidly connect each end of the cylinder 516 to the central valve panel 32. A pair of limit switches 20LS and 21LS are secured to the arm 504.

CREASER MACHINE

The creaser machine 522 is positioned at the right rear of the work receiving platform 12, as seen more clearly in FIG. 1, and includes the vertically movable platen 524 connected to a fixed pressing head 526, the platen being positioned beneath a movable pressing arm 528. The platen 524 is actuated by a two-way air cylinder 525 connected thereto. The creaser machine 522 is a conventional heated folding machine and a description thereof is made only to the extent necessary to describe its function in the operation of the automatic fabric creaser apparatus.

OPERATION

When the transfer arm unit 94 is positioned at the first station with the vertically movable pick-up unit 174 in its retracted position above the apertured workpiece pick-up section 80 and after the operator has loaded the platform 14 with a stack 11 of the pre-cut cloth workpieces 10 and has mounted a roll of backing paper 260 on the paper backing assembly 240 the automatic fabric creaser apparatus is ready to be operated. The reader may refer to FIGS. 35-37, illustrating schematically the electrical and pneumatic elements and their connections, to enable him to follow the detailed description of the operation of the automatic fabric creaser apparatus set forth below, wherein one complete cycle of the apparatus is followed. It is noted here that in the electrical diagrams the designation "LS" after a number indicates a limit switch, a circle with a character reference ending in "R" (with the ex-

ception of ITR) indicates a coil for a relay and short vertical lines with a character reference ending in "R" indicate the contacts, normally open or normally closed as the case may be, for the corresponding lettered relay coil while the remaining symbols having reference characters ending in "R" indicate a time delay contact for the corresponding relay coil.

When the apparatus start button 530, physically located on control console 532 (FIG. 1), is actuated 1MR and 2CR are energized in turn energizing motors 105, control relay 5CR and solenoid SOL. P, 13CR is energized. It is noted at this point that all of the solenoids described herein operate the valves (illustrated schematically in FIG. 35) which in turn actuate the corresponding two-way or spring return pneumatic cylinder which drives the particular element associated with it. Thus, when SOL. P, the cam lock in solenoid, is energized the two-way air cylinder 149 is actuated driving piston rod 155 forward thereby to actuate 7LS, de-energizing 5CR. SOL. M and SOL. O the platen 524 up and finger clamp 54 up solenoids respectively are energized. When the platen 524 moves up 9LS is tripped thereby energizing 10CR.

To digress somewhat, when the transfer arm unit 94 is not positioned at the first station, 2LS actuated, 2CR is not energized, the shutter 482 forward solenoid, SOL. V is energized and the reset arm light 3LT is energized. In this condition, the apparatus cannot be started by actuating the switch 530, therefore, means are provided to return the transfer arm unit 94 to the first station. Thus, a reset arm switch 534 is actuated energizing 6CR and SOL. AA, the transfer arm unit 94 clockwise solenoid, causing the arm unit 94 to rotate in a clockwise direction until it reaches the first station, 2LS actuated. With the arm unit 94 at the first station the shutter 472 forward solenoid, SOL. V, and 6CR are de-energized. The hold (paper) vacuum on solenoid, SOL. I which actuates the two-way cylinder 243, SOL. J the reset paper feed which actuates two-way cylinder 284 and 13CR are energized.

Now with the arm unit 94 at the first station, button 530 depressed, and assuming that a pre-cut cloth workpiece 10 has been positioned on workpiece pick-up section 80 during a previous cycle, a cycle start button 536 is depressed and 1CR and a timing relay 2TR are energized. The stacker down solenoid, SOL. S, is energized if the light beam produced by light 2LT is broken by the stack of finished workpieces 384 because the interruption of the beam of light infringing upon the photocell for RTS serves to initiate the closing of the contact of RTS. SOL. S in turn actuates the two-way air cylinder 428 thereby to ratchet the lead screw 426 and lower the work receiving plate 372 a short predetermined distance. The forward motion of piston rod 436 of the cylinder 428 brings it into engagement with 13LS (FIG. 1) thereby to actuate the same opening SOL. S which in turn actuates cylinder 428 to again ratchet lead screw 426. The ratcheting continues until either the timing relay 7TR contact opens or the light beam once again reaches the photocell for RTS. It is noted here that when the work receiving plate 372 has been lowered to the bottom of its run, indicating a full load of finished workpieces, the horizontal leg 413 trips the plunger for 1LS shutting off the apparatus and lighting 1LT. At this point, the operator actuates switch 466, the tie wrap out switch, which permits jets of air to be directed through nozzles 456 that blows the loose end of the cord 468 up through and out of cylinder 444 where the operator may grasp the same and tie the bundle of finished workpieces. Next the operator, by depressing switch 542, the stacker up switch, energizes SOL. W which in turn actuates the spring return cylinder 414 thereby to remove the jaw 424 from threaded engagement with the lead screw 426. At this point, the upwardly directed bias produced by the coiled metallic tapes 402 brings the work receiving plate back up to the top of its run allowing the operator easily to remove the

tied stack of finished workpieces and prepare the apparatus for further operation.

Since 2TR has been energized the 2TR normally open contacts are closed and SOL. H, the vertically movable pick-up unit 174 solenoid is energized thereby to actuate the spring return air cylinder 185 causing the unit 174 to dip down toward the workpiece pick-up section 80. The downward movement of the pickup unit 174 serves to release 6LS and operate 8LS. When the time delay contacts of 2TR reach the end of their timing period SOL. H is de-energized and 12CR is energized. When SOL. H is de-energized the spring portion of the spring return cylinder 185 becomes effective to return the pick-up unit 174 to its original retracted position. When the pick-up unit 174 dips down onto the pre-cut cloth workpiece 10 positioned atop section 80 the suction at the underside of the unit, produced by the vacuum from vacuum-pressure motor unit 103 attracts the cloth to said underside. As the pick-up unit 174 begins to pull away from the pick-up section 80, plate air blast off 1 solenoid, SOL. E, is energized allowing jets of air to be directed through the vertical air channels 82 in section 80. The vertically directed jets of air serve to break a natural attraction or suction between the cloth and the plate thereby facilitating a smooth withdrawal from the plate 80 by the pick-up unit 174. 8LS is released as pick-up unit 174 moves upwardly, and 6LS is operated and 4CR and SOL. E are de-energized. 6CR is energized and SOL. P is de-energized thereby deactivating the cylinder 149 allowing the piston rod 155 to return to its original position releasing 7LS (FIG. 25). At this point, the transfer arm unit 94 is ready for counterclockwise rotation.

The actuation of 6CR closes the normally open 6CR contacts and 5CR and SOL. BB, the transfer arm counterclockwise motion solenoid, are energized. The transfer arm unit 94 now rotates in the CCW direction releasing the limit switch 2LS which deenergizes 13CR.

When the transfer arm unit 94 has rotated to the second station the limit switch 10LS is tripped, 14CR is energized and SOL. I the hold (paper) vacuum on solenoid is released. The actuation of 14CR closes the normally open contacts of 14CR thereby energizing 10TR and at this time SOL. CC is energized closing contact CCS thereby actuating a separation cam timer 1TR and the feed motor 74. The actuation of 1TR initiates the cycle for the workpiece separator unit 9, described more fully hereinbelow. SOL. H the pick-up unit down solenoid is energized, 6LS is released and 8LS is tripped. At this point, since SOL. I the hold (paper) vacuum on solenoid has been released and cylinder 243 has been actuated to shift the vacuum-pressure motor unit 235 from the vacuum to the pressure mode, a small amount of air pressure is directed against the underside of the piece of paper backing 544 which had been positioned during a prior cycle (as described infra). The paper backing 544 is attracted by the vacuum at the bottom of pick-up unit 174 to the face thereof and is pulled flush against the underside of the previously attracted cloth workpiece 10 with the aid of the air pressure directed against the underside of the paper backing. When the cycle for the timed contacts of relay 10TR has run its course, SOL. H the pick-up unit down solenoid is de-energized, 8LS is released and 6LS is operated as pick-up unit 174 is moved back up to its retracted position. 6CR is energized, SOL. P, the cam lock in solenoid is de-energized, releasing 7LS. 5CR and transfer arm motion CCW solenoid SOL. BB are energized and the transfer arm unit 94 is again rotated in a counterclockwise direction.

As the transfer arm unit 94 begins to rotate again 10LS is released and 14CR is de-energized. When the unit 94 reaches station 3 limit switches 3LS and 14LS are tripped, it being noted here that tripping 3LS on the counterclockwise swing of the unit 94 does not initiate any other operation. Tripping 14LS serves to energize 11CR and SLO. G, the lower fingers solenoid. Energizing

SOL. G serves to actuate the spring return air cylinder 212 which moves the piston rod 211 down and spaces the vertically movable fingers 208 from the upper fixed fingers 204 as illustrated in FIGS. 29 and 32. 9TR and SOL. U the paper slide plate back solenoid are energized. Actuation of 9TR operates to de-energize SOL. I. When the time delay for the timed contacts of 9TR has run its course SOL. J the reset paper feed solenoid is de-energized and SOL. K the paper feed solenoid is energized. The actuation of SOL. K causes the piston rack 288 of two-way air cylinder 284 to move toward 16LS (FIG. 6) and trip 16LS when the piston rack reaches its forwardmost position. Tripping 16LS serves to de-energize the raise punch solenoid, SOL. Z and energize the lower punch solenoid, SOL. Y. Thus, the two-way air cylinder 326 is actuated and drives the punch 308 downwardly to sever a piece of backing paper from the main body of the paper, the trailing and leading edges of the severed piece of paper 544 being formed to correspond to the trailing and leading edges of the pre-cut cloth workpiece 10. The piece of paper severed is of the same size as the workpiece 10 and is in position to be moved forward by the paper plate 330 to the pick-up position. A manually operated switch 548 permits the operator, after loading a new roll of paper, to position the piece of paper backing 544 on the plate 330.

The transfer arm unit 94 now continues to move in the counterclockwise direction until it reaches station 4 where the limit switch 15LS is tripped. At this point, if the creaser platen 524 is not in its raised position (9LS operated) 10CR is de-energized, 6CR is de-energized, the cam lock-in solenoid, SOL. P, is energized, 7LS is operated and the transfer arm CCW solenoid, SOL. BB is de-energized. Thus, when the creaser platen is up the transfer arm unit halts its counterclockwise movement and waits for the completion of the creaser cycle and the lifting of the platen 524 (9LS operated). If the creaser platen had been in its raised position (9LS operated) when the transfer arm unit 94 had reached station 4 the control relay 10CR would have been energized and the arm unit would have moved onto station 5 without stopping at station 4.

After station 4 is passed by the transfer arm unit 94, moving in the counterclockwise direction, 15LS is released and 9CR is de-energized. As the transfer arm unit 94 continues to move in the counterclockwise direction 27LS is tripped but it has no effect at this time on the sequence of operations, as it will have on the clockwise swing of the arm unit. 27LS remains tripped because the plunger for the switch was actuated by the elongated trigger finger 138. The transfer arm unit 94 continues on to station 5 where 4LS is tripped. As the transfer arm unit 94 came up to station 5, a previously creased cloth workpiece and accompanying backing paper perched atop the creaser platen 524 slid between the upper fingers 204 and the lower movable fingers 208, as seen more clearly in FIG. 29. Tripping 4LS energizes 4TR opening the normally closed 4TR contacts causing 6CR and SOL. G to be de-energized. SOL. P and 5CR are energized. Thus, the transfer arm unit 94 comes to a halt at station 5 and the lower vertically movable fingers 208 move upwardly thereby to clamp the creased cloth workpiece and the backing paper between the lower fingers and the upper fixed fingers 204, as seen more clearly in FIG. 30. Actuation of 4TR closes the normally open 4TR contacts energizing 2MR and actuating the creaser motor and the creaser plate 524 moves downwardly until the end creaser cycle limit switch 23LS is tripped, thereby to de-energize 2MR. 7LS is operated de-energizing 5CR and 11CR. With 22LS actuated when 8CR is energized the tamping cycle commences.

When 8CR is energized SOL. R the tamper down solenoid is energized and the two-way air cylinder 516 is actuated driving the tamping head 506 downwardly and actuating 21LS the tamper-up limit switch and closing

the contact for 21LS shown in FIG. 37. When the tamping head 506 nears the bottom of its downward travel the tamper down limit switch 20LS is actuated and the contact for 20LS is closed. When 20LS is actuated 7CR is energized opening the normally closed 7CR contacts and de-energizing SOL. R. The tamping head 506 now moves back to its retracted position releasing 20LS and then 21LS which serves to de-energize 8CR, ending the tamping cycle. It is noted here that if the tamper has not completed its cycle when transfer arm unit 94 is ready to rotate in the clockwise direction 2TR will not be de-energized and the transfer arm unit will remain at station 5 (on the clockwise swing) until the tamper cycle has been completed. A manually operated switch 546 permits the operator to disconnect the automatic operation of the tamper cycle.

When the time delay for the timed contact of 4TR has run its course 6CR is energized and the cam lock-in solenoid, SOL. P, is de-energized, releasing limit switch 7LS and removing button 157 from engagement with cam 145. 5CR and the transfer arm CCW solenoid SOL. BB are energized thereby rotating the transfer arm unit 94 in the counterclockwise direction the short distance to station 6, 4LS being released when the arm unit begins to rotate. 5LS is tripped at station 6, energizing 5TR. 6CR is de-energized and SOL. P the cam lock-in solenoid is energized actuating 7LS. 5CR and SOL. BB the transfer arm CCW solenoid are de-energized halting the transfer arm unit 94 at station 6. The deactivation of 5CR serves to energize SOL. H the pick-up unit down solenoid, 6LS being thereafter released and 8LS tripped. Tripping limit switch 8LS energizes 4CR and SOL. G is energized shutting off the vacuum to the vertically movable pick-up unit 174. Thus, the pick-up unit 174 is lowered when that unit is directly over the plate 524, thereby to deposit its load of either one or two uncreased workpieces and the accompanying paper backing onto the platen when the vacuum holding the workpiece and the backing paper is shut off.

When the time delay for the timed contacts of 5TR has run its course 2TR is de-energized. 9TR and SOL. U the paper slide plate back solenoid are then de-energized. De-energizing 9TR closes the normally closed 9TR contacts and SOL. I the hold (paper) vacuum on and SOL. V the shutter forward solenoids are energized. In addition SOL. K the paper feed solenoid is de-energized and SOL. J the reset paper feed solenoid is energized. De-energizing SOL. K releases 16LS thereby de-energizing SOL. Y, the lower punch solenoid. The deactivation of 2TR de-energizes 12CR and 7TR. 4TR, 5 TR and SOL. H the pick-up unit down solenoid are all de-energized. As the pick-up unit is moved back to its retracted position 8LS is released and 6LS is once again tripped. SOL. P the cam lock-in solenoid is de-energized releasing 7LS and transfer arm unit 94 is free to rotate again.

Releasing 7LS permits 5CR to be energized and SOL. AA the transfer arm motion clockwise solenoid is energized (2TR now being de-energized) rotating transfer arm unit 94 in the clockwise direction. Movement of the arm unit 94 releases 5LS without any operational effect and a short time later 27LS is released. When 27LS is released 4CR is de-energized thereby de-energizing SOL. 9 and providing for a vacuum once again at the bottom face of the pick-up unit 174. As the transfer arm 94 continues in the clockwise direction, 4LS is tripped but with no operational effect. The continued rotation of the arm unit 94 brings about the actuation of 15LS thereby to energize 9CR which in turn provides for the actuation of 2MR thereby energizing the creaser motor M. 15LS is released as the transfer arm unit 94 continues in the clockwise direction thereby de-energizing 9CR (no operational effect). 24LS now closes and 23LS opens thereby de-energizing 2MR and shutting off the creaser motor M and energizing 8TR. After the time delay for the timed contact of 8TR has run 2MR is energized activating the creaser motor.

23LS then closes, 24LS opens and 9LS the creaser platen up limit switch closes. 10CR is energized, 2MR is de-energized and the creaser cycle is now completed.

Meanwhile, the transfer arm unit 94 continues moving in the clockwise direction until it reaches station 3 where 14LS and 3LS are tripped. Actuation of 14LS permits 11CR and SOL. G the lower fingers solenoid to be energized. The actuation of 3LS energizes 4TR which in turn initiates the deactivation of 6CR closing the normally closed 6CR contacts thereby to energize SOL. P the cam lock-in solenoid. With SOL. P energized 7LS is actuated and 5CR and SOL. AA, the transfer arm motion CW solenoid, are de-energized and the arm unit comes to a halt in the position shown in FIG. 32. After the time delay for the timed contact of 4TR has run out 6CR is energized which in turn causes the deactivation of SOL. P releasing 7LS and energizing SOL. AA. Thus the transfer arm unit 94 once again begins moving in the clockwise direction. As the transfer arm unit begins to move away from station 3, the finished workpiece 384 is caught and held by the arm 496 and the spaced workpiece engaging fingers 498 (FIG. 32) until the vertically movable lower fingers 208 have passed beyond the opening 373 thereby allowing the finished workpiece to fall down onto the shutter 482 which at this point is in its forward position over opening 373.

As the transfer arm unit 94 moves away from station 3 in the clockwise direction 3LS and 14LS are released and 4TR is de-energized. Further clockwise motion of the arm unit 94 trips 10LS with no corresponding operational effect and finally brings the arm unit back to its starting point at station 1 where 2LS is tripped. The shutter slide forward solenoid SOL. V is de-energized thereby retracting the shutter 482. The arm 393 of the right angled scraper 494 depends close enough to the shutter 482 to block the workpiece and prevent it from moving with the shutter as it is retracted thereby allowing the finished workpiece 384 to fall through the opening 373 onto the work receiving plate 372. 13CR is energized, 11CR and SOL. G are de-energized and 3CR and 3TR are de-energized. 10TR is de-energized when the 13CR normally closed contact opens, 2TR is energized and a new cycle begins automatically.

A description of the operational cycle of workpiece separator unit 9, first in the single workpiece mode and then in the double workpiece mode is now set forth below.

Referring first to the single mode, with the platen up solenoid, SOL. M and the finger clamp up solenoid, SOL. O energized, when the transfer arm unit 94 rotates in the counterclockwise direction tripping 10LS, SOL. CC is energized closing contact CCS and actuating 1TR and feed motor 74. The separation cam time ITR, of conventional construction, includes a motor which drives the timer through a predetermined distance at a predetermined speed, thereby providing a programmed switching cycle for the ITR contacts which in turn initiates the following cycle of operation for the workpiece separator unit 9. SOL. B the positioning jets solenoid is energized directing streams of air through the angularly directed air channels 84 in the apertured workpiece pick-up section 80. The foil air blast solenoid, SOL. A and separator air blast solenoid, SOL. D are energized and jets of air are directed along the underside of the foil 43 through the nozzles 50 and also through the nozzle 51 of the air separator 47. The foil up solenoid, SOL. F, is energized rotating the foil upwardly and simultaneously separating the top workpiece from the stack of workpieces and flipping the top workpiece onto the work receiving platform 12 and into engagement with the feed wheel 58. The foil air blast solenoid, SOL. A and SOL. D are de-energized. The platen up solenoid, SOL. M, is de-energized and the platen down solenoid, SOL. L is energized. SOL. O, the finger clamp up solenoid, is energized along with 3CR. When 3CR is energized the normally closed 3CR contacts open and SOL. CC, is de-energized. Finally, the feed motor 74 and the separation cam timer

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1TR are de-energized as the CCS contact opens, completing the "single" workpiece cycle.

Turning now to the double mode, the switch 538 is turned to the "double" position. In the double mode the apparatus delivers two pre-cut cloth workpieces 10 and a paper backing to the creasing machine. The first part of the cycle for the double mode is the same as the single mode sequence. However, at the end of the first part of the double mode cycle when 3CR is energized, 3TR is energized and SOL. N, the auxiliary unit down solenoid is also energized. The auxiliary pick-up unit 218 then pivots downwardly releasing 11LS and 12LS is actuated. At this point, the vacuum present in the auxiliary pick-up unit 218 attracts cloth workpiece 10, deposited on the apertured workpiece pick-up section 80 at the completion of the first part of the present cycle, to the bottom face of unit 218. Actuation of 12LS serves to energize 6TR and SOL. C the plate air blast off 2 solenoid is then energized. The time delay for the timed contacts of 6TR having now run its course SOL. N is de-energized moving the auxiliary pick-up unit 218 upwardly thereby to release 12LS and actuate 11LS, de-energizing 6TR. At this point the auxiliary pick-up unit is in its retracted position holding a cloth workpiece 10. 3CR is de-energized and SOL. CC, the cam timer solenoid is energized and a separation cycle is once again initiated, culminating in the deposit of another cloth workpiece on the apertured workpiece pick-up section 80. When 3CR is energized by the corresponding ITR contact the auxiliary pick-up unit, still carrying the cloth workpiece 10, pivots downwardly and as it approaches the section 80 the plate air blast 2 solenoid SOL. C, is de-energized because at this point the delay for the timed contact of 3TR runs out. Then the auxiliary unit vacuum off solenoid, SOL. T is energized. The workpiece that was carried by the auxiliary pick-up unit is then deposited atop the workpiece positioned on the section 80 during the first part of the cycle. With the two workpieces now positioned on the section 80 the apparatus is in condition to transfer and crease the two cloth workpieces in the same manner as in the single workpiece operation.

Numerous alterations of the structure herein disclosed will suggest themselves to those skilled in the art. However, it is to be understood that the present disclosure relates to a preferred embodiment of our invention which is for purposes of illustration only and not to be construed as a limitation of the invention. All such modifications which do not depart from the spirit of the invention are intended to be included within the scope of the appended claims.

Having thus described the nature of this invention, what we claim herein is:

1. Automatic loading apparatus for a creasing machine, comprising a work receiving platform, control means for initiating the automatic operation of the apparatus, means for placing a workpiece of a particular shape and size in a predetermined location on the work receiving platform, means for forming and paper backing into the same shape and size as said workpiece, means for positioning said paper backing on the work receiving platform in a predetermined location spaced from the predetermined workpiece location, and means for picking up and transporting the workpiece and paper backing to the creasing machine for creasing, said last named means including a horizontally swingable transfer arm unit means for sequentially moving said arm unit in a horizontal plane from a position above said workpiece location to a position above said paper backing location and then to a position above said creasing machine, said transfer arm unit having a vertically movable pick-up device, means operating said pick-up device first to lift the workpiece from said work receiving platform when said transfer arm unit is at said workpiece location and then to lift the paper backing from the work receiving platform when said transfer arm unit is at said

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paper backing location and release both the workpiece and the paper backing together onto the creasing machine.

2. In apparatus in accordance with claim 1 wherein said vertically movable pick-up device is pneumatically driven and includes a bottom face and means for utilizing a vacuum to hold the workpieces and paper backing flush up against said bottom face.

3. Automatic loading and unloading apparatus for a creasing machine, comprising a work receiving platform, control means for initiating the automatic operation of the apparatus, means for placing a workpiece in a pick-up position on the work receiving platform, means for forming a backing material piece from a roll of backing material into the size and shape of said workpiece, means for positioning the piece of backing material in a predetermined location, spaced from the pick-up position of the workpiece, on the work receiving platform, means for separately and sequentially picking up and transporting both the workpiece and the backing material piece to the creasing machine for creasing the workpiece and backing material piece together, means for removing the creased together workpiece and backing material piece from the creasing machine and means for stacking the creased together workpiece and backing material piece removal from the creasing machine.

4. In apparatus in accordance with claim 3, wherein said stacking means includes means for automatically deactivating the apparatus after a predetermined amount of the creased together workpieces and backing material piece have been stacked.

5. In apparatus in accordance with claim 3, wherein said pick-up and transport means includes a horizontally swingable transfer arm unit, said horizontally swingable transfer arm unit including a vertically movable pick-up device adapted to separately and sequentially lift the workpiece and the backing material piece from the work receiving platform and then release the workpiece and backing material piece onto the creasing machine.

6. In apparatus in accordance with claim 5 wherein said means for removing the creased together workpiece and backing material piece from the creasing machine includes clamping means secured to said horizontally swingable transfer arm unit for clamping the creased workpiece and backing material piece and for releasing the creased workpiece and backing material piece, whereby the creased workpiece and backing material piece is clamped, removed from the creasing machine and deposited on the stacking means.

7. In apparatus in accordance with claim 6 wherein said stacking means includes a vertically movable unit adapted to receive each creased together workpiece and backing material deposited by the clamping means, said unit being adapted to adjust its height according to the number of creased together workpieces and backing material piece deposited thereon and means for driving said vertically movable unit.

8. Automatic loading apparatus for a creasing machine, comprising a work receiving platform, control means for initiating the automatic operation of the apparatus, means for placing a workpiece on the work receiving platform, means for forming and positioning backing material on the work receiving platform, means for first picking up the workpiece and then picking up the backing material and then transporting both the workpiece and the backing materials together to the creasing machine where they are creased together, said last named means including a transfer arm unit and means for driving said transfer arm unit in the sequential order necessary to first pick-up the workpiece and then the backing material and transport them to the creasing machine.

9. Automatic loading apparatus in accordance with claim 8 wherein said pick-up and transport means includes a pneumatically driven vertically movable pick-up device having a bottom face and means for utilizing a vacuum to hold the workpiece flush up against the bot-

tom face and to hold the backing material flush up against said workpiece.

10. Automatic loading and unloading apparatus for a creasing machine, comprising a work receiving platform, means for placing a workpiece on the work receiving platform, means for transporting the workpiece to and from the creasing machine, said transporting means including a movable arm unit and trigger members connected to said movable arm unit, means for removing the workpiece from the creasing machine after creasing, means for stacking the creased workpiece, means for initiating the automatic operation of the apparatus and means responsive to the operation of the transporting means for automatically directing the transporting means in a predetermined sequential order, said responsive means including a plurality of electrical switches actuated by said trigger members as said arm unit is moved.

11. Automatic loading and unloading apparatus for a creasing machine, comprising a work receiving platform, means for initiating the automatic operation of the apparatus, means for placing workpieces on the work receiving platform, auxiliary means in cooperation with said last named means for placing a first one of said workpieces on top of a second one of said workpieces on said auxiliary means including a movable arm unit, said arm unit including a substantially flat face, said face being formed with an aperture, motor means having a first mode for producing a vacuum and a second mode for producing a low pressure, control means for selecting the mode for the motor means, a fluid conduit connecting the output of said motor means to said face aperture, said arm unit being adapted to move downwardly to said work receiving platform when said motor means is in said first mode to attract the second workpiece to said face and thereafter move upwardly away from said work receiving platform at which time said workpiece placing means places said first workpiece on said work receiving platform, thereafter said arm unit moves downwardly to said work receiving platform and said control means places said motor means in said second mode thereby to permit said arm unit to place said first workpiece on top of said second workpiece and in alignment therewith, means for picking up and transporting the first and second workpieces to the creasing machine, means for removing the workpieces from the creasing machine after creasing, and means for stacking the creased workpieces.

12. In apparatus in accordance with claim 11 wherein said means for picking up and transporting the first and second workpieces includes a transfer arm unit swingable in a horizontal plane above the work receiving platform, said transfer arm unit including a pneumatically driven vertically movable pick-up device having a bottom face and means for utilizing a vacuum to hold the workpieces flush up against the bottom face.

13. Automatic loading and unloading apparatus for material working apparatus comprising control means for initiating the operation of the automatic loading and unloading apparatus, a work receiving platform, means for placing a material piece on the work receiving platform, means for picking up and transporting the material piece to the material working apparatus for working, means for removing the material piece from the material working apparatus after the material piece has been worked on, means for stacking the worked material piece, said pick-up and transport means including a horizontally swingable arm unit, said arm unit including a pneumatically driven vertically movable pick-up device, said pick-up device having a bottom face and means for utilizing a vacuum to hold the material piece flush up against the bottom face, said means for removing the material piece from the material working apparatus including clamping means, secured to said horizontally swingable arm unit, for clamping the worked material piece and for releasing the worked material piece, whereby the worked

material piece is clamped, removed from the material working apparatus and deposited on the stacking means.

14. Automatic loading and unloading apparatus for a creasing machine comprising control means for initiating and carrying out the automatic operation of the apparatus, structure for supporting the apparatus, a horizontally swingable transfer arm unit, said arm unit including means for picking up and depositing workpieces, said last named means including a vertically movable pick-up head, said pick-up head being formed with an aperture, means for positioning the workpieces in a predetermined location suitable for pick up by the pick-up head, means for stacking the workpieces, means for moving said transfer arm unit in a horizontal plane from the workpiece pick-up location to the creasing machine and then to the stacking means, motor means having a first mode for producing a vacuum and a second mode for producing a low pressure, control means for selecting the mode for the motor means, a fluid conduit connecting the output of said motor means to said pick-up head aperture, said control means operating to place said motor means in said first mode for vacuum pick-up by said pick-up head at the workpiece pick-up location and thereafter place said motor means in said second mode when said pick-up head reaches the creasing machine to break the vacuum and apply low pressure to the workpiece which low pressure applies a force to the workpiece to blow the workpiece down onto the creasing machine, said transfer arm unit including means for removing the workpieces from the creasing machine and subsequently depositing the workpieces on the stacking means and means for automatically terminating the operation of the apparatus after a predetermined amount of workpieces have been stacked.

15. Automatic loading and unloading apparatus for a creasing machine comprising a work receiving platform, control means for initiating the automatic operation of the apparatus, means for depositing a workpiece on the work receiving platform after a prior deposited workpiece has been removed therefrom, means for picking up and transporting each workpiece to the creasing machine for creasing, means for operating the creasing machine after the creasing machine receives each workpiece, means for removing each workpiece from the creasing machine after each workpiece has been creased, means for stacking each workpiece after the workpiece has been creased and removed from the creasing machine, said means for picking up and transporting each workpiece to the creasing means including a horizontally swingable transfer arm unit, means for operating said transfer arm unit and sequentially moving said arm unit in a horizontal plane from the point of uncreased workpiece pick-up to the creasing machine and then to the stacking means and finally back to the point of uncreased workpiece pick-up, said arm unit including a vertically movable pick-up device, said vertically movable pick-up device including a bottom face parallel with said work receiving platform, means for utilizing a vacuum to attract the workpiece from said work receiving platform and hold the workpiece flush up against said bottom face, means for breaking the vacuum when said transfer unit reaches a predetermined position in alignment with the creasing machine to allow the uncreased workpiece to be deposited on the creasing machine, said means for removing the workpiece from the creasing machine after the workpiece has been creased including clamping means, secured to said horizontally swingable transfer arm unit, for clamping the creased workpiece and for thereafter releasing the creased workpiece onto the stacking means when said transfer arm unit is moved to said stacking means, whereby the creased workpiece is clamped, removed from the creasing machine and delivered to the stacking means for stacking.

16. In apparatus in accordance with claim 15 wherein said stacking means includes a vertically movable unit

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adapted to receive the workpieces deposited by the clamping means, said unit being adapted to adjust its height according to the amount of creased workpieces deposited thereon and means for driving said vertically movable unit.

17. In apparatus in accordance with claim 15 including means for tamping the stacked workpieces after each creased workpiece has been stacked.

18. In apparatus in accordance with claim 15 including pneumatic means for positioning each workpiece on the work receiving platform in vertical and horizontal alignment with said pick-up device.

19. Automatic loading and unloading apparatus for a creasing machine comprising a work receiving platform, means for initiating the automatic operation of the apparatus, means for placing a workpiece on the work receiving platform, means for picking up and transporting the workpiece to the creasing machine for creasing, means for removing the workpiece from the creasing machine after the workpiece has been creased, means for stacking the workpiece after the workpiece has been creased and removed from the creasing machine, said stacking means including means for automatically tamping the stacked creased workpieces after each creased workpiece is stacked, said stacking means including

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pneumatic means for positioning a tie cord for the creased workpieces while the creased workpieces are being stacked and for repositioning the tie cord preparatory to tying the stacked creased workpieces.

References Cited

UNITED STATES PATENTS

1,656,391	1/1928	Rosenthal et al.	270—61 X
1,958,096	5/1934	Piepenbring et al.	270—61
2,550,920	5/1951	Gilbert	214—1 X
2,596,068	5/1952	Bunch et al.	270—58
2,744,461	5/1956	Genco	100—34
2,888,862	6/1959	Williams	270—58 X
2,915,201	12/1959	Calehuff et al.	214—1
2,972,477	2/1961	Austin	270—58
3,031,906	5/1962	Holman	214—1 X
3,114,543	12/1963	Bishop et al.	270—58
3,194,551	7/1965	Herr et al.	271—14

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U.S. Cl. X.R.

270—58, 61; 112—2; 289—15; 271—74