

March 5, 1968

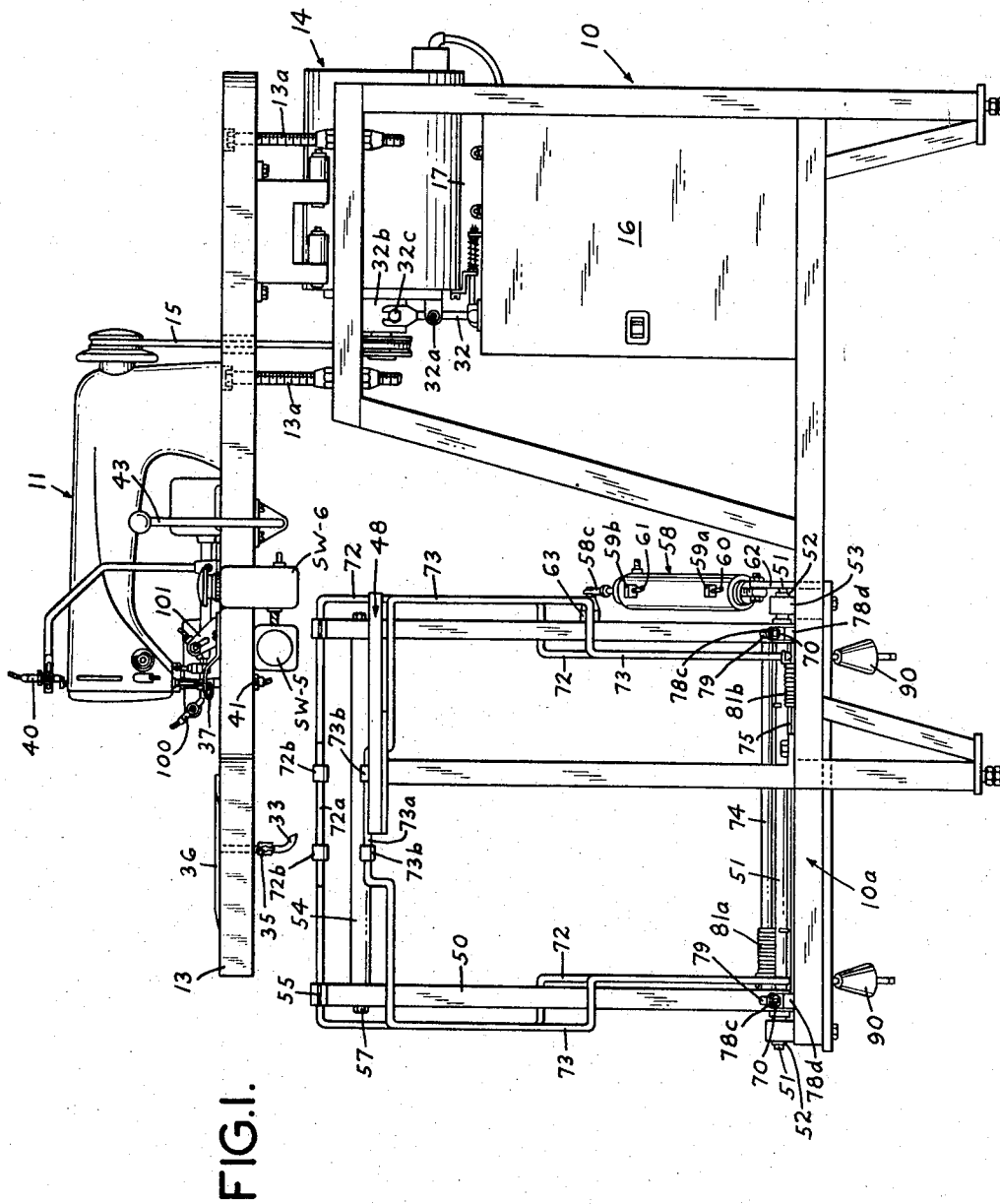
J. L. ROCKERATH

3,371,631

WORK-STACKING MECHANISM

Filed April 28, 1966

8 Sheets-Sheet 1



March 5, 1968

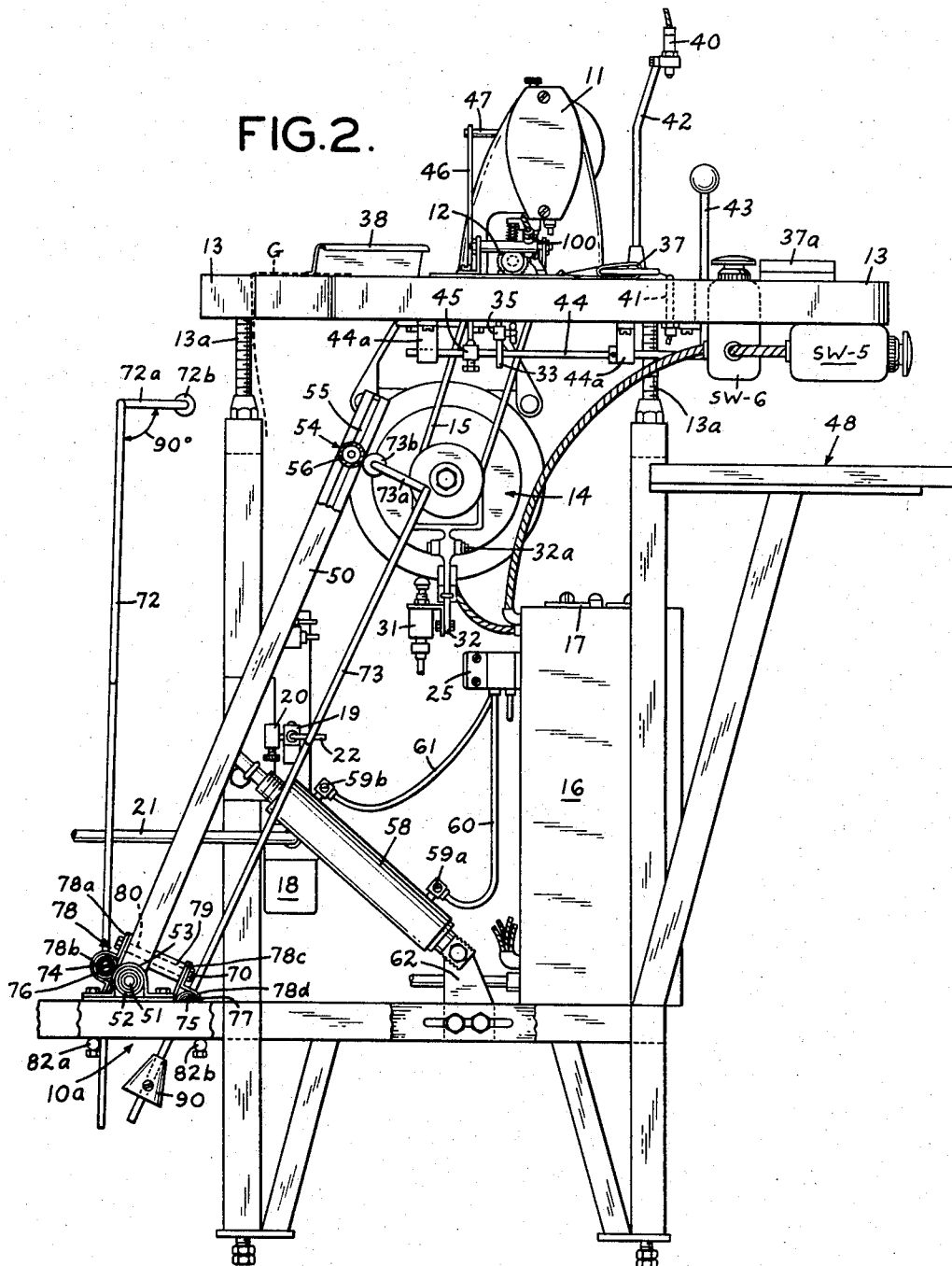
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WORK-STACKING MECHANISM

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8 Sheets-Sheet 2



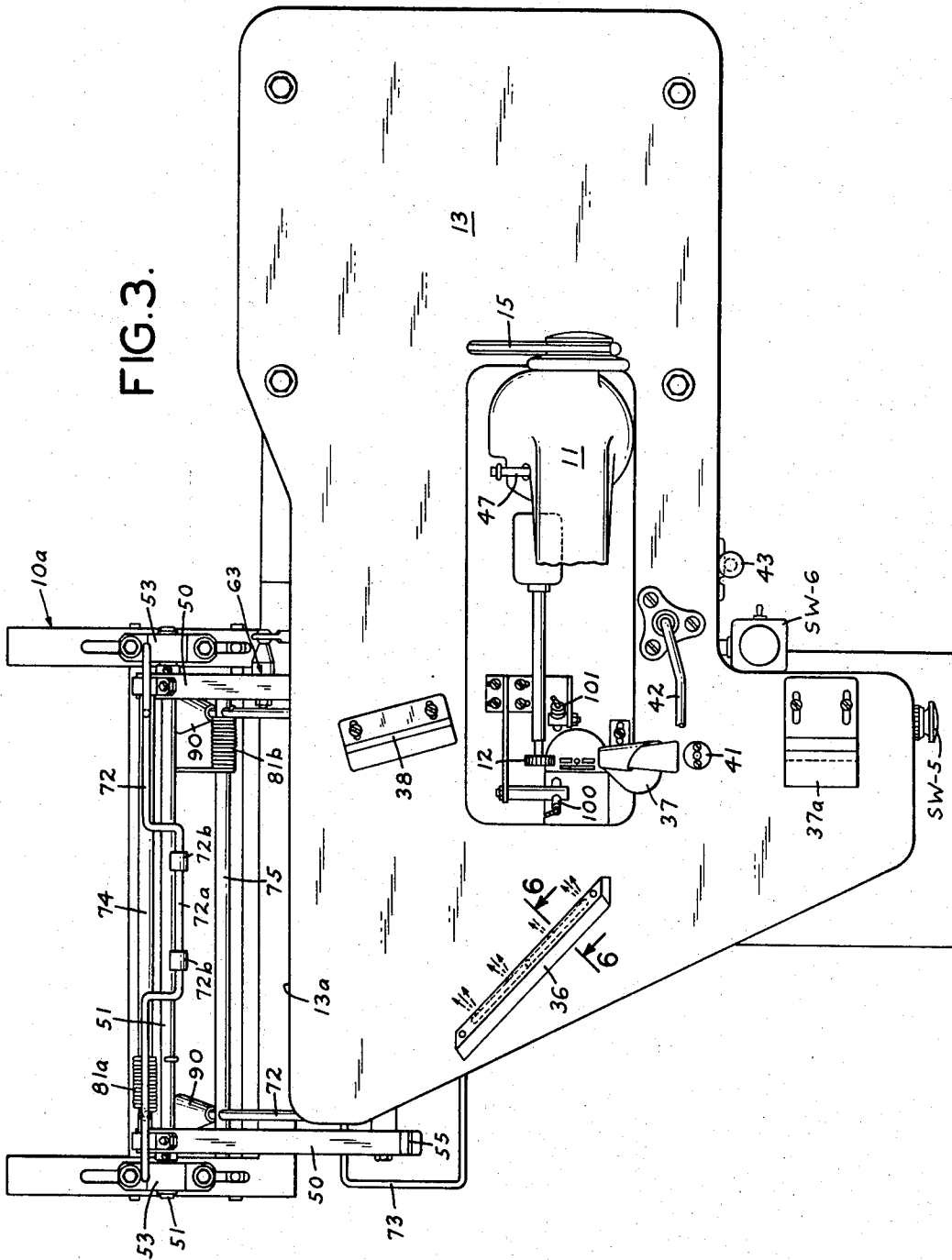
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**WORK-STACKING MECHANISM**

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Filed April 28, 1966

8 Sheets-Sheet 3



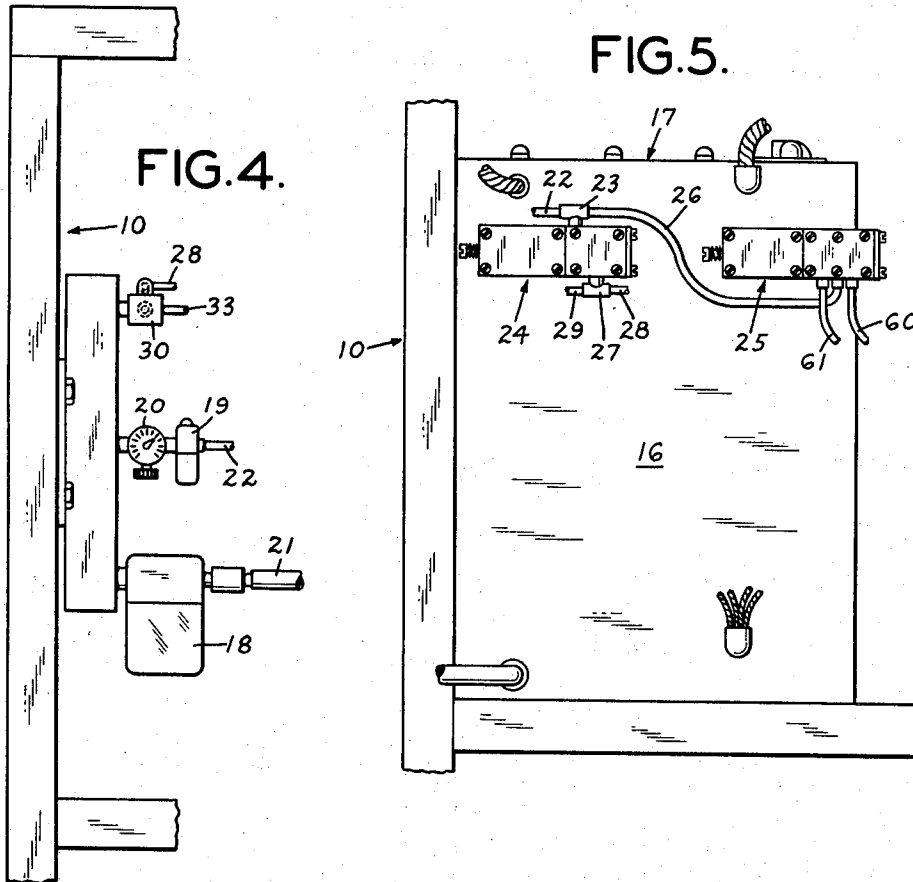
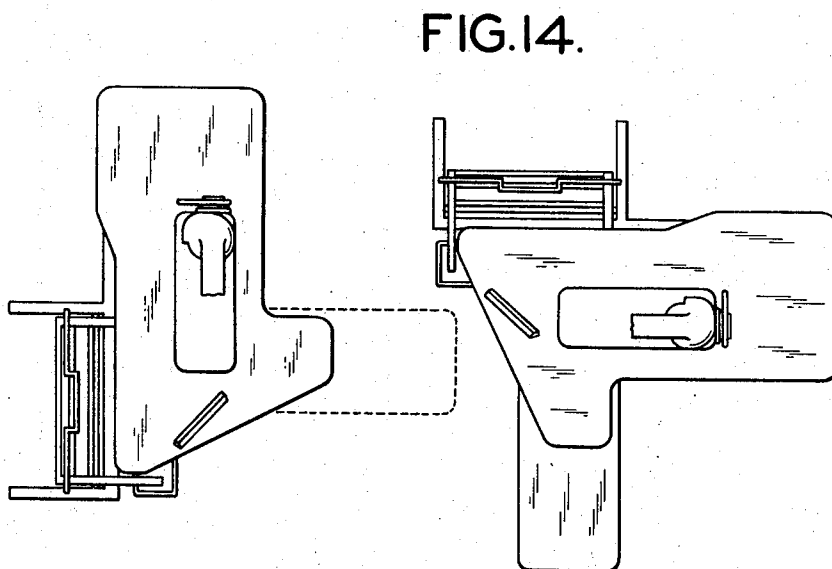
March 5, 1968

J. L. ROCKERATH  
WORK-STACKING MECHANISM

3,371,631

Filed April 28, 1966

8 Sheets-Sheet 4



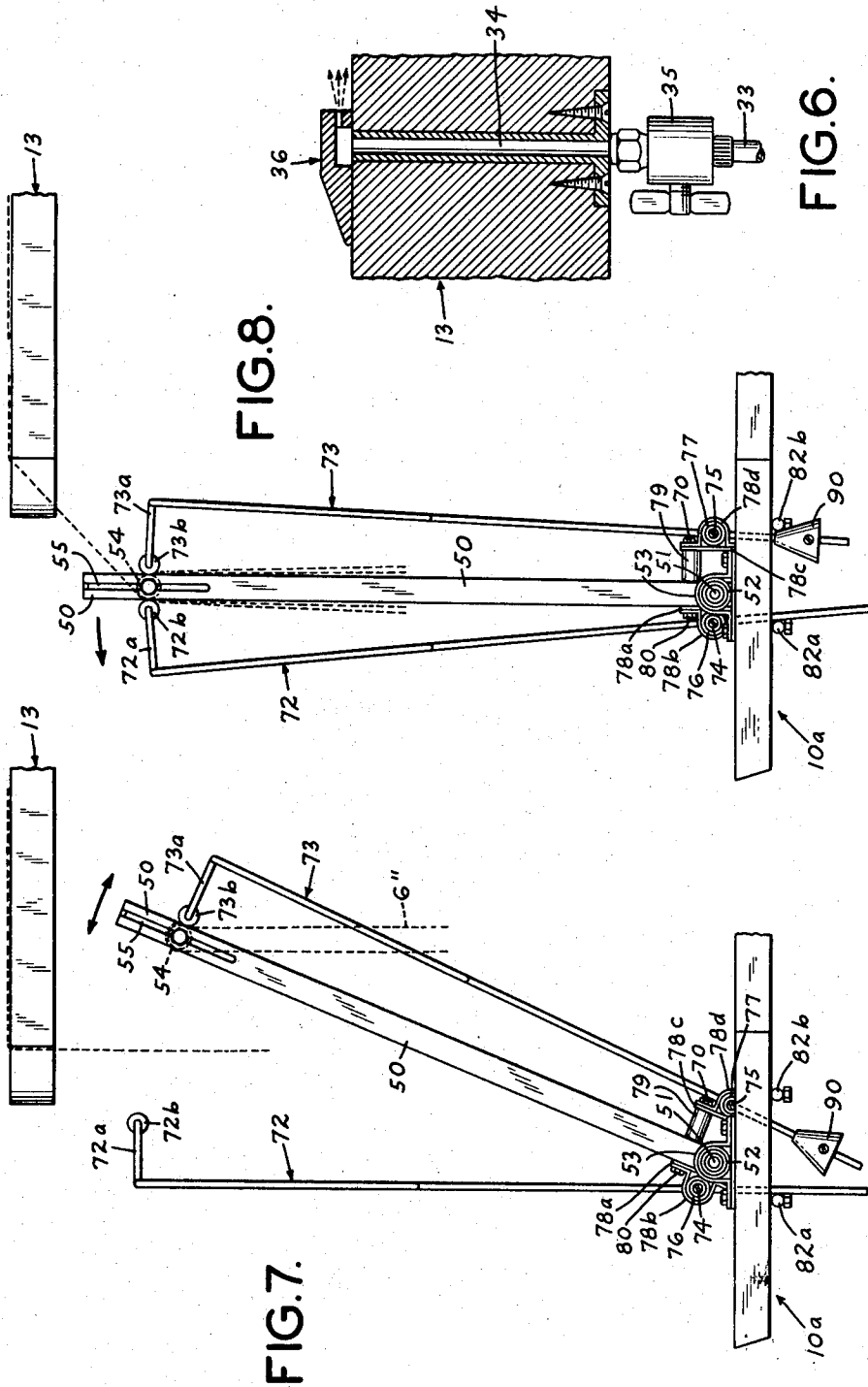
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J. L. ROCKERATH  
WORK-STACKING MECHANISM

3,371,631

Filed April 28, 1966

8 Sheets-Sheet 5



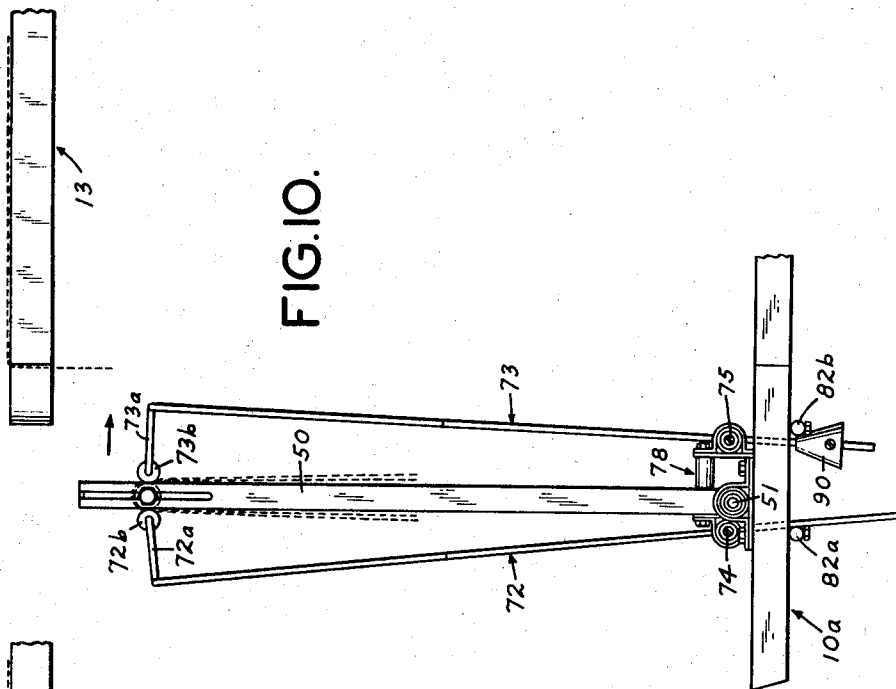
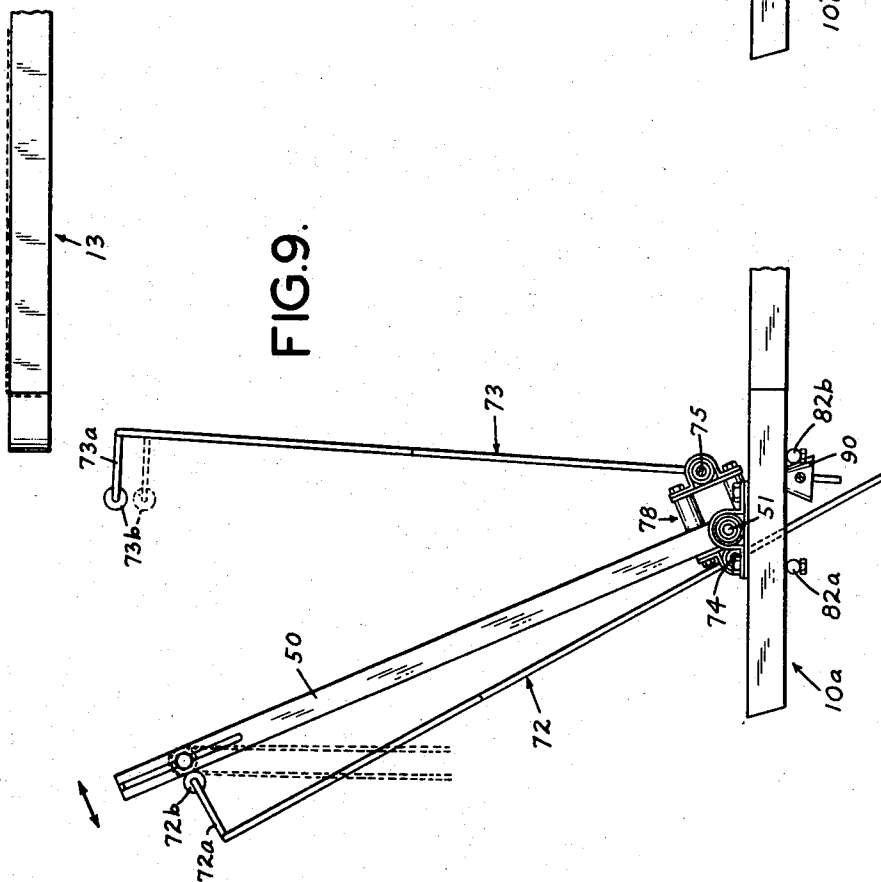
March 5, 1968

J. L. ROCKERATH  
WORK-STACKING MECHANISM

3,371,631

Filed April 28, 1966

8 Sheets-Sheet 6



March 5, 1968

J. L. ROCKERATH

3,371,631

WORK-STACKING MECHANISM

Filed April 28, 1966

8 Sheets-Sheet 7

FIG. II.

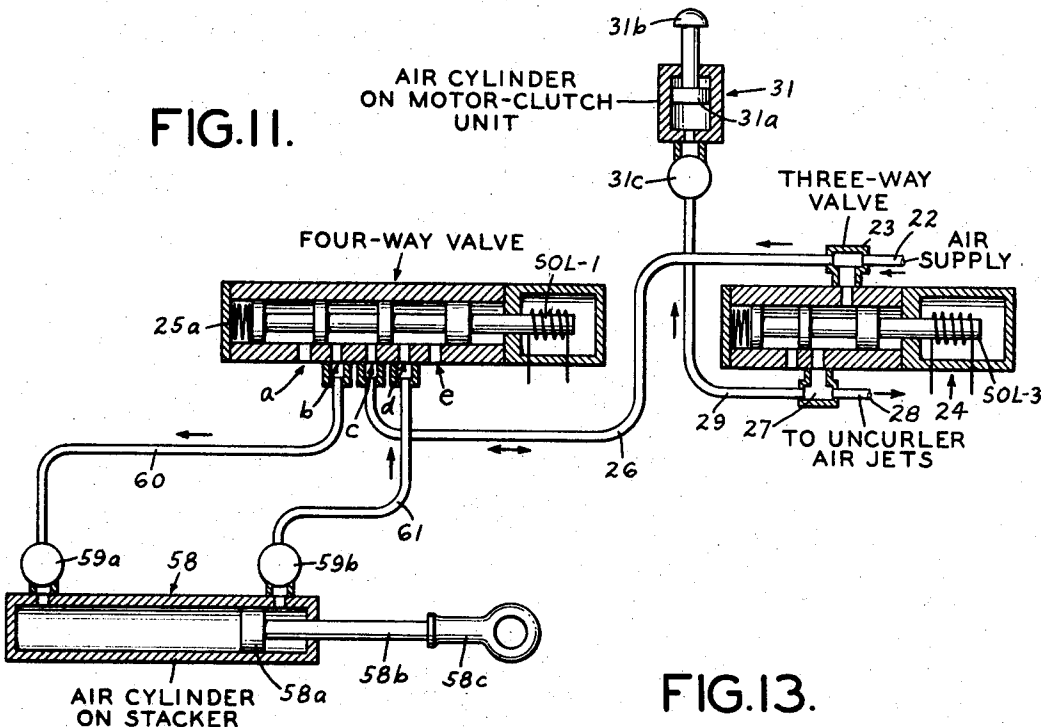
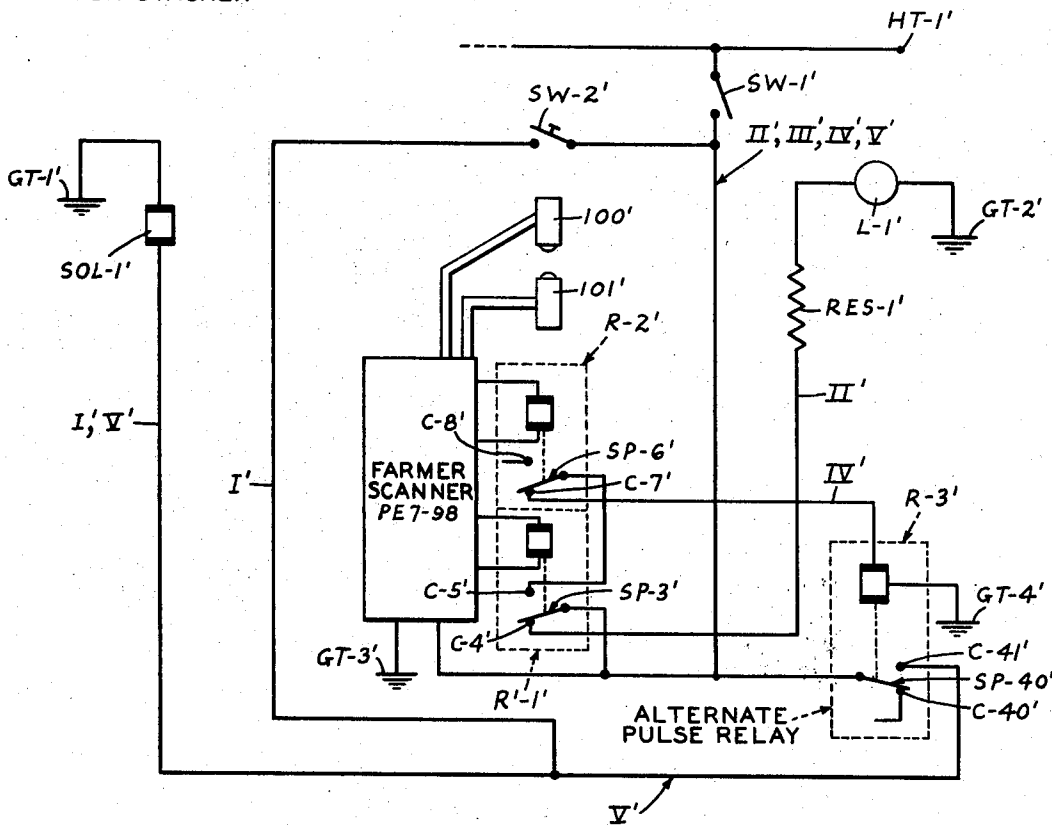


FIG. 13.



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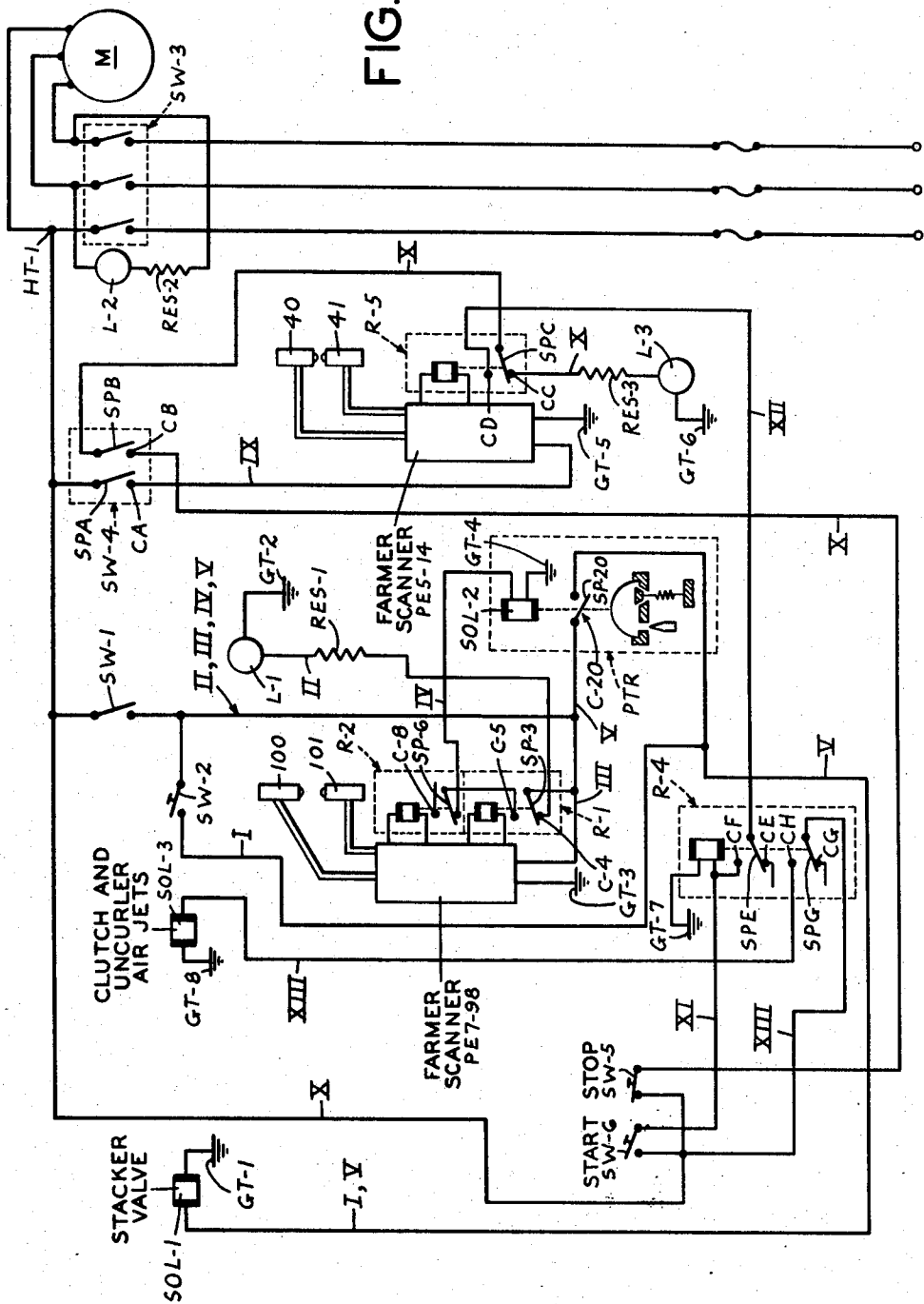
J. L. ROCKERATH  
WORK-STACKING MECHANISM

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Filed April 28, 1966

8 Sheets-Sheet 8

FIG. 12.



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## WORK-STACKING MECHANISM

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15 Claims. (Cl. 112—2)

This invention is concerned primarily with improvements developed in relation to the construction and control over the operation of a work-stacking mechanism. A further aspect of the invention involves the combination of the improved work-stacking mechanism with a sewing machine adapted to apply a line of stitching to the work-pieces which are then advanced to the work stacking mechanism for assembly of a suitable number of such work-pieces. Moreover the combination of the sewing machine and the work-stacking mechanism, in accordance with the present invention, is of such a character as to enable the disposition of two such combined units adjacent to each other and arranged at an angle of 90° to each other. By virtue of this arrangement of two of the improved units it is possible for a single operator to supply work-pieces successively, first to one unit and then the other. While the first unit is performing its stitching and advancing of the work, the operator is able to introduce another work-piece to the other unit. In the meantime the first unit will complete its operation and another work-piece may be supplied to it, while the second unit is performing its operation, and this cycle of operations may be repeatedly carried on over a period of time.

A feature of the invention is the provision of means for advancing successive pieces of substantially flat, flexible sections of material along a supporting surface toward an edge thereof from which the successive work-pieces will hang downwardly to a position beneath the supporting surface. The improved stacking mechanism of the present invention is then brought into play to pick up the overhanging portion of a section of the material and cause it to drape uniformly over the two sides of a stacker bar. Succeeding sections of the material are similarly and successively draped uniformly over the stacking bar. By draping the work-pieces uniformly is meant the disposition of substantially equal lengths of each section of material on opposite sides of the stacking bar.

A further feature of the invention resides in the mode of operation of the stacking mechanism. It involves the mounting of a stacking bar on rock arms which serve to swing the bar through an arcuate path passing through the vertical plane in which the overhanging portion of a section of the material is disposed in the manner explained above. Cooperating with the stacking bar are two work-piece holding or clamping members each arranged to cooperate with the stacking bar during only a portion of the movement of the latter through the arcuate path mentioned. One of these clamping members serves to hold a portion of the work-piece against the stacking bar on the forward side of the latter while the other serves to hold the work-piece against the stacking bar by cooperating with the opposite side of the latter. To enable the proper draping of the material over the stacking bar only one or the other of the clamping members is active during the major portion of the movement of the stacking bar through its arcuate path. However, for an instant, both clamping means may engage the sections of material draped over the stacking bar as the latter moves through about the central region of its arcuate path. Thus assuming that the stacking bar moves through an arc of about 45° to 60°, it will cooperate with one of the clamping or holding members during about half of that

2

arc and then with the other of the clamping or holding members during the other half of the arc. Provision is made for preventing the active portion of either of the clamping members from passing to any appreciable extent beyond the vertical plane extending through the axis about which the stacking bar is rocked or oscillated.

A further feature of the invention involves automatic controls over the operation of the stacking bar, so as to insure its engagement with the overhanging section of material along a line substantially midway between the forward and trailing ends of the section. As will be made clear from the detailed description of a preferred embodiment of the invention, to be given hereinafter, there are various adjustable means provided in the system for insuring smooth and uniform operation of the stacking mechanism to accomplish the specified result.

In accordance with one embodiment of the invention the stacking bar is adapted to pick up a section of material to be stacked only as the stacking bar moves in one direction along its arcuate path, namely rearwardly from the front side of the machine, and it is then returned idly to its original position to enable it to pick up a succeeding section of material. However in accordance with another embodiment of the invention the stacking bar is adapted to pick up a section of material to be stacked as the bar swings in each direction along its arcuate path. In this embodiment of the invention successive sections of material will be alternately stacked with the first having its face side up and the next having its face side down.

A special feature of the preferred embodiment of the invention is the provision of light responsive means for controlling the operation of the stacking mechanism. Thus the control over the operation of the stacking mechanism is exercised by the presence and the absence of a section of material in the path of a light beam from a light source to the light responsive member.

Various time delay features are incorporated in the structure contemplated by the invention for insuring the proper timing of operation of the several devices and the smoothness of operation of those devices.

In the overall combination there is also provided as a part of the preferred embodiment, a light responsive means for controlling the operation of the sewing machine employed for applying a seam to each section of material advanced along the supporting surface. This last mentioned light responsive means serves to control the timing and duration of the engagement of the clutch member provided in the usual transmitter from a motor to the driving belt for the sewing machine. Provision is made in this part of the system for continuing the engagement of the clutch, and that the continued operation of the sewing machine, for a predetermined number of cycles after the light responsive means would normally tend to throw out the clutch. It should be mentioned here that the light responsive means in question is disposed just in advance of the presser foot of the sewing machine, so that the delay in throwing out the clutch is desirable to enable completion of the stitching of a particular section of material after it passes beyond the beam of light which causes said light responsive means to function.

With the foregoing features of the invention in mind, the preferred embodiment of the invention will now be described in greater detail in relation to the accompanying drawings, in which:

FIG. 1 is a front elevational view of a unit having a supporting structure with a sewing machine on the top of a table board and a stacking apparatus disposed at the left and rearwardly of the sewing machine.

FIG. 2 is a side elevational view of the unit, as seen from the left in FIG. 1;

FIG. 3 is a plan view of the unit shown in FIG. 1;

3

FIG. 4 is a detail view, in side elevation, showing the devices connected with the pressurized air system embodied in the unit;

FIG. 5 is a rear view of a control box carried by the supporting structure, and shows a plurality of valves embodied in the control system;

FIG. 6 is an enlarged sectional view through a portion of the table top, taken along the line 6—6 of FIG. 3, showing means for discharging air beneath the work-pieces to uncurl the same and to facilitate movement of the work-piece along the table top;

FIG. 7 is an elevational view of the stacking bar and clamping or holding means in their normal, stationary position;

FIG. 8 is a view of the parts shown in FIG. 7 in the position assumed when the stacking bar is moving outwardly and is in the mid-position of its outward movement;

FIG. 9 is a view similar to FIG. 7, but showing the parts on their inward or return stroke;

FIG. 10 is a view similar to FIG. 8 but showing the relationship of various elements as the stacking bar is returning to its normal stationary position;

FIG. 11 is a view, partly in cross-section, of two control valves embodied in the system, the air cylinder which operates the stacker being shown schematically and not in the actual position assumed in the unit as illustrated in the earlier figures;

FIG. 12 is a circuit diagram illustrating the circuits by which various solenoids are operated in the course of use of the machine;

FIG. 13 is another circuit diagram showing a different arrangement of circuits and devices enabling the stacker bar to pick-up a work-piece on its movement in each direction along the arcuate path; and

FIG. 14 is a block diagram showing the arrangement of two of the combined units in a manner enabling a single operator to supply work to each of them alternately.

Referring now to FIGS. 1-7, the sewing machine designated 11 is mounted on a table top 13 carried by a supporting structure 10 arranged for vertical adjustment to maintain it in the desired position and location in relation to the floor. A plurality of bolts 13a are provided for adjustably securing the table top 13 to the frame structure 10 at a desired elevation. A motor and clutch unit 14, commonly designated a transmitter, is secured to the underside of the table top 13 in a desired position in relation to the sewing machine. A pulley on the transmitter 14 is connected by a belt 15 with a pulley on the main drive shaft of the sewing machine. Toward the front of the supporting structure 10 there is fixedly mounted a control box 16 having on its surface a control panel 17 incorporating various control devices for predetermining the operation of certain elements of the unit to be more fully described hereinafter. These control devices are not specifically designated, since their nature will be understood by persons having general knowledge in this field. Adjacent the rear side of the supporting structure 10, and disposed in rear of the control box 16, is an adjustable filter-lubrication-pressure regulator unit having components designated 18, 19 and 20 (FIG. 4). Air from a source under pressure (not shown) is conducted through a hose 21 to said regulator unit 18, 19, 20. Another hose 22 extending from said regulator unit delivers air to a manifold 23 (FIGS. 5 and 11) from which a part of the air under pressure is delivered to the valve structure 24. Another portion of the air is delivered through a line 26 to the valve 25. These valves 24 and 25 are mounted on the rear wall of the control box 16, as illustrated in FIG. 5. Another manifold 27, extending from the valve 24 and which receives air therefrom, serves to deliver this air under pressure in two directions. Thus it is connected by a hose line 28 with a valve 30 mounted above the regulator unit 18, 19, 20, as shown in FIG. 4. From the valve 30 the air is delivered through a line 33 to a tubular

4

connection 34 extending through the work supporting table-board 13 (FIG. 6). A valve 35 provided at the upper end of hose line 33 may be adjusted to regulate the quantity of air discharged through the tube 34. At its upper end the latter delivers the air to a bar 36 having a longitudinally extending channel provided with a series of openings in the side wall thereof for discharging jets of air in the direction indicated in FIG. 3. These air jets serve to uncurl and flatten out portions of the work-pieces being advanced to and through the sewing machine. They also reduce the frictional resistance of the work-pieces in their movement along the table top, and in fact impart a force tending to assist in such movement.

Returning now to the manifold 27, another portion of the air delivered to it is passed through a hose line 29 to an air cylinder 31. The latter, as best shown in FIG. 2, is mounted on a laterally extending arm of a lever 32 which is pivotally connected at 32a (FIG. 1) with a portion of the housing of the transmitter unit 14. The upper end of lever 32 is branched to cooperate with a clutch operating member 32b forming part of the transmitter unit. Each branch of the lever 32 is forked, as best shown in FIG. 1, to cooperate with a bolt or stud 32c carried by the clutch operating member. The cylinder 31 contains a piston 31a having an axially extending stem the upper end of which is provided with a rounded head 31b arranged to cooperate with the undersurface of the electric transmitter 14. As air is introduced into the cylinder 31 the latter is moved downwardly in relation to the piston to rock the lever 32 about its pivotal axis 32a and thus bring about engagement of the clutch. Suitable spring means, not shown, normally urges the clutch into a disengaged position, therefore the clutch is held engaged only so long as the cylinder 31 is maintained in its lowered position by the air introduced into the cylinder. In order to avoid a too rapid downward movement of cylinder 31, and thus a too sudden engagement of the clutch, a control valve 31c is provided in the line through which air is delivered into the cylinder. The same is true with respect to the discharge of air from the cylinder when the clutch is to be disengaged, such air being discharged downwardly from the line 29 and through the control valve 24 when the latter is shifted to its normal, inactive position, at a selected time determined by the movement of the workpieces through the stitching zone of the sewing machine. As will be explained later, in discussing the circuit diagram of FIG. 12, the valve 24 is shifted into the position shown in FIG. 11 by the energizing of a solenoid designated SOL-3. Such energization of the solenoid occurs whenever work is being fed to the sewing machine and serves to interrupt a light beam from a light source to a light responsive element. When such light beam is interrupted upon the introduction of the forward end of a work-piece into the stitching region, it will remain interrupted until the trailing end of the work-piece passes beyond a point just in advance of that at which the work is introduced to the stitching zone.

The sewing machine utilized in connection with the form of the invention now being described is preferably of the character of that sold by Union Special Machine Company under the style designation 61400 P. It incorporates a feed roller, designated 12 in the accompanying drawings, which is driven from the main shaft of the machine by an eccentric drive of the character disclosed in the patent to Hayes et al. No. 2,730,977, granted Jan. 17, 1956. The feed roller 12, however, is of the type designated by said Union Special Machine Company as No. 61439-T. It has a width of .250" and a diameter of 1 $\frac{15}{64}$ ", and it has teeth around its periphery extending across the width of the roller which are of the general character of teeth normally provided in a feed dog. This feed roller 12 is disposed just rearwardly of the presser foot of the machine and in alinement with the line of stitch formation. Thus when the trailing end of one work-piece leaves the stitch forming zone a thread chain is

produced which is carried directly beneath the feed roller 12. The latter urges the work-piece, and then the thread chain mentioned, against a plate of the general character of that designated 149 in said Hayes et al. patent. When the feed roller is acting only on the thread chain which connects the trailing end of one work-piece with the forward end of the next work-piece, the teeth on the feed roller tend to mash and thus greatly weaken the tensile strength of the thread chain. This eliminates the necessity of a thread cutter and it enables the thread chain to be readily torn apart when the sewn work-piece is grasped and moved away from the rear side of the sewing machine by the stacking mechanism in the manner to be hereinafter more fully described.

To the top of the table board there are secured various other devices which may be mentioned at this time. These include a preliminary folder 37a through which the operator first passes successive work-pieces and from which the operator then advances the forward end of each work-piece to a final folder 37 which serves to fold one edge of the material into the desired form for the production of the hem to be provided therein. Beyond the delivery side of the sewing machine there is mounted on the table top a guide member 38 which serves to direct the sewn section of material in proper relation to the stacking mechanism. It will be understood that the advance of the material at this time is being performed by the feed roller 12 and assisted by the air jets from the member 36, as previously described.

Just in advance of the hem folder 37 there is mounted a light source 40 carried by an upwardly and laterally extending arm 42. This light source directs a beam of light downwardly toward the work table into the region of a light responsive member 41 embedded in the table top and having an electrical connection, of the character to be hereinafter described, to the circuit system which controls the operation of the transmitter clutch, and thus controls the operation of the sewing machine.

For the purpose of indicating how the control over the operation of the sewing machine is accomplished, reference may now be had to FIG. 12 of the drawings. As shown in that figure there are a number of manually operated switches for setting the apparatus into operation. These include switches SW-1, SW-4 and SW-3. The latter when closed serves to connect the driving motor M of the transmitter with a suitable electrical source adapted to supply a 220 volt three-phase alternating current to the motor for operating the same. Switches SW-1 and SW-4 are connected into one of the three lines of the triple pole switch SW-3 and circuits are closed therefrom to "ground" in the manner to be explained. Assuming that all three of these switches have been closed, current may be delivered from terminal HT-1 to various circuits in the control system. One of these circuits, designated X, extends to a starting switch SW-6 which is normally open. A branch from line X extends to a normally closed stop switch SW-5 and from there to various other points in the circuitry.

When the operator has delivered a section of work to be hemmed through the preliminary folder 37a and then through the final folder 37 the material cuts off the beam of light from light source 40 to the light responsive element 41. This light source and light responsive element are a part of a scanner unit of the type sold by the Farmer Electric Products Company under the designation PE5-14. It is so adjusted that it is arranged to bring about the operation of relay R-5 whenever the light responsive means 41 is in a dark condition, i.e. when light from light source 40 to the element 41 is interrupted by the passage of a work-piece therebetween.

By reference to FIG. 12 it will be noted that when the starting switch SW-6 is temporarily closed, by manual operation by the operator, a circuit from X to XI will be closed to ground at GT-7 through a coil of a relay R-4. This will cause arms SPE and SPG to swing upwardly

into engagement with contacts CF and CH respectively. A circuit is thus completed from lines X and XIII through SPG, CH and the extension of line XIII to and through the clutch and uncurler controlling solenoid SOL-3 to ground at GT-8. This will operate the clutch to begin the operation of the sewing machine, and it will also bring about delivery of air to the air jet providing member 36. It will be understood that these two results are achieved by the shifting of the valve stem within the valve unit 24 toward the left into the position shown in FIG. 11. When the starting switch SW-6 is released by the operator, the circuit to the solenoid SOL-3 is continued to be closed by circuits under control of the scanner PE5-14. It will be recalled that the relay R-5 of this scanner unit will be energized so long as the work-piece is in the path of the beam of light from source 40 to light response means 41. Therefore the contact SPC will be lifted and held in engagement with contact CD. This results in the delivery of current from HT-1 through line X to switch SW-5, further through line X to switch arm SPB of SW-4, then down to and through SPC to contact CD of relay R-5 and then through line XII and contacts SPE and CF of relay R-4 to the coil of the latter and then to ground. Thus the relay R-4 will remain in a completed circuit even though the starting switch SW-6 has been released by the operator, so that the solenoid SOL-3 remains energized by the circuit through the lines X and XIII. The sewing machine will thus remain in operation until the trailing end of the work-piece has passed beyond the light beam from source 40 to light responsive means 41. Furthermore a time delay is incorporated in relay R-5 so that the opening of the circuit through the coil of the latter does not take place until the sewing machine has completed a predetermined number of cycles. The number of cycles, and hence the number of stitches formed, as a result of this delay may be varied by an appropriate adjustment of a knob or dial (not shown) provided on the scanner PE5-14, to bring about the completion of the stitching of the section being passed through the machine, and the production of a desired number of stitches in a thread chain connecting that work-piece with the next one supplied by the operator of the machine.

There are several points that should be mentioned in connection with the foregoing. Firstly, it is frequently possible for the operator to introduce a new work-piece into the hem folder 37 and move it into a position over the light responsive element 41 before the time delay provided in the PE5-14 scanner has run out. When this is done, the sewing machine will continue to operate on the newly introduced work-piece without the necessity of operating the switch SW-6 to start the machine. A second feature to be noted is that in the event the operator should find it necessary to stop the machine before its automatic stopping is brought about in the manner described above, this may be done by opening the normally closed stop switch SW-5. This will break the circuit to the lines X which are at this time interconnected by the stop switch SW-5. It will be appreciated that such stopping of the sewing machine will normally only become necessary when some misoperation of the sewing machine has been noted by the operator. As soon as the misoperation has been corrected the machine may be started again by operating the start switch SW-6. It will again re-energize relay R-4 and restore the circuitry into its normal operation described above.

Another device incorporated in the sewing machine is a lever 43, having a knob at its upper end positioned for easy engagement by the hand of the operator, this lever serving to operate the usual pressure foot lifting mechanism of the sewing machine. As best shown in FIG. 2, the lower end of lever 43 is connected with a rod 44 mounted for turning movement through a suitable arc in brackets 44a carried by the underside of the table top 13. Secured to rod 44 is one end of a crank arm 45 which

has its outer end connected with the lower end of a vertically disposed link or rod 46. The upper end of the latter is connected with a conventional stud or arm 47 carried by a rock shaft mounted in or on the overhanging arm of the machine, and having secured thereto adjacent its end within the head of the sewing machine an arm connected by a link with the pressure bar which carries the normally downwardly spring-urged presser foot. Lever 43, as will be understood, will be operated by the operator to lift the presser foot as new work-pieces are supplied to the machine, or to facilitate adjustment of the work if this should become necessary due to its misalignment with the stitch-forming devices.

The supporting structure 10 is also preferably provided with a material supporting platform 48 on which the work to be dealt with is placed, in a position convenient for the operator to remove one work-piece after another to be supplied to the sewing machine. If two sewing machines are provided at 90° angles in relation to each other, as diagrammatically shown in FIG. 14, the supporting structures therefor may each be provided with a material support 48 from which the single operator will alternately remove work-pieces to supply them to the corresponding sewing machine. However one of the material supports 48 may be omitted, if desired, to enable the two units to be placed somewhat closer to each other, and the operator will then place a selected stack of work-pieces on the one material support provided and will feed these alternately to one machine and then the other.

Turning now to the improved stacking mechanism, this is preferably mounted on an extension 10a of the supporting structure 10 (FIGS. 1 and 2) which carries the table top 13, sewing machine 11, and other parts previously described. The stacking mechanism comprises two laterally spaced arms 50 which are preferably in the form of square tubes. These are rigidly secured at their lower ends to a rock shaft 51 journaled in bearings 52 carried by said frame extension 10a. The journal bearings 52 are secured to the frame portion 10a by suitable strap means 53. At their upper ends the arms 50 are interconnected by a transversely extending stacking bar 54. This stacking bar may consist of a round bar having threaded, reduced diameter end portions which extend into and through vertical slots 55 provided in the upper ends of the arms 50. A nut co-operating with the thread portions of the stacking bar at each end thereof may be suitably tightened to retain the stacking bar in a selected position along the slots 55. If desired, the stacking bar 54, in lieu of being a solid round bar may be of hollow tubular form, as indicated at 56 in FIG. 2. This will serve to reduce the inertia forces that will develop during the rocking or oscillatory motion of the arms 50 and stacking bar 54. When such tubular form of stacking bar is employed, each end is plugged off with elements having a threaded axial bore therein adapted to receive the threaded ends of bolts 57 which extend through the slots 55 from the outer sides of the arms 50 and are tightened into the threaded openings in the plugs at the ends of tube 56 to retain the same rigidity. An air cylinder 58 is provided for oscillating the stacker arms and the interconnecting stacking bar to carry the latter through a suitable arc of 50° to 60°. The lower end of the air cylinder, as shown in FIGS. 1 and 2 is mounted for rocking movement upon a bracket member 62 secured to the support frame 10a. The air cylinder is of a double action type having an intake-exhaust port at each end so that air under pressure may be introduced into and exhausted from the portions of the cylinder provided at opposite sides of a slidable piston 58a within the cylinder. This piston has a rod 58b connected therewith (see FIG. 11), and the outer end of the latter is connected by a member 58c with one of the arms 50. Air cylinder 58 is provided with intake-exhaust ports at each end as mentioned above to which air under pressure is supplied by hose lines 60 and 61, or from which the air under pressure within the cylinder may be exhausted at appropriate

times during the operation of the system. Check valves 59a and 59b are provided in the two ports communicating with the hose lines 60 and 61, as best shown in FIG. 11. The member 58c, at the outer end of the piston rod, has a strap portion which cooperates with a ball shaped end of a stud 63 rigidly secured to one of the arms 50 at a point intermediate the ends of the latter. It will be apparent from the foregoing that as air under pressure is introduced into the cylinder 58 through the line 60 the piston 58a will be forced outwardly (i.e. toward the right in FIG. 11) and the stacker arms 50, together with the stacking bar 54, will be swung outwardly (i.e. in a counterclockwise direction as shown in FIG. 2). During this movement of the piston 58a the hose line 61 will be connected through the valve 25 with an exhaust port e to discharge the air therefrom into the atmosphere. When the stacking bar is to be swung in the opposite direction the reverse condition will exist, and air under pressure will be introduced into the right end of the cylinder 58 (FIG. 11) through the line 61 and air will be exhausted from the left end of the cylinder through the hose line 60. The arrangement is such that a smooth operation of the piston and the stacking bar is insured at all times.

It will be apparent from FIGS. 1, 2 and 3 that the stacking bar is carried by the arms 50 along an arcuate path, at one time in the direction in which the work-pieces are advanced along the table top 13 and at times in the opposite direction.

As best shown in FIGS. 7-10 inclusive, the stacking bar 54 is being rocked outwardly (i.e. toward the left FIG. 2) will engage the overhanging portion of the material to be stacked and will thus pick-up this material. To insure retaining the work-pieces successively picked-up by the stacking bar 54 in a desired arrangement on this stacking bar, a pair of clamping or holding devices designated generally as 72 and 73 are provided. The clamping device 72 is on the outward side of the stacking bar (i.e. the left side as shown in FIG. 2) while the clamping device 73 is on the right or forward side of the stacking bar. Each of the clamping devices 72 and 73 comprises a generally U-shaped member, disposed in inverted relation to the frame structure, with the generally downwardly extending portions thereof having the arms of the U spaced somewhat more closely at their lower ends than at their upper ends. For this purpose the arms of the U-shaped elements are bent laterally at an intermediate point, as best shown in FIG. 1. The upper portions of the members 72 and 73, which serve to interconnect the generally vertically disposed arms or legs of the latter, are each provided with a central portion (72a for member 72 and 73a for member 73) that is offset in relation to the end portions thereof. Thus these upper portions of the inverted U-shaped members have bends therein at the ends of the central portions mentioned, which serve to position said central portions at an angle of about 90° to the axes of the generally vertically extending arm or leg portions of the members. Preferably two or more circular friction members, (designated 72b and 73b) are provided on the central portions of the transversely extending parts of the members 72 and 73, and it is these friction members which engage the work-pieces at predetermined times to retain them properly and firmly in place on the stacking bar 54. This arrangement has been found highly desirable, since it enables the retention of the work-pieces on the stacking bar in proper position, with no interference from the extra thickness of the work-pieces that may be present, such as along at least one of the longitudinal edges thereof resulting from the provision of the hem along such edge or edges.

The lower ends of the legs of the U-shaped member 72 pass through openings adjacent the opposite ends of a rock shaft 74, and they are retained in a selected, adjusted position in relation to rock shaft 74 by means of set screws (not shown). In a similar manner the lower ends of the inverted U-shaped member 73 are passed through

openings in a rock shaft 75 and retained thereby in a selected, adjusted position. The rock shaft 74 is rotatably journaled at its opposite ends in bearing elements 76 which are strapped to a pair of bracket assemblies designated generally as 78. Similarly the rock shaft 75 is journaled at its opposite ends in bearings 77 which are strapped to the bracket assemblies 78 adjacent the opposite ends of the rock shaft. The bracket assemblies 78 are secured to the stacking bar carrying arms 50. For this purpose each of the bracket assemblies comprises two bolts 80 extending through bores in the respective stacker arms 50, these bores being located above and below the rock shaft 51 which carries the stacker arms. For retaining the bearings 76 and 77 on the bracket assemblies 78, suitable clamp plate and strap means are provided. Thus a clamp plate 78a and a strap means 78b are affixed by the bolts 80 to the rear side (i.e. left side in FIG. 2) of each of the stacker arms 50. On the stems of each of the bolts 80, which protrude from the front sides of the stacker arms (i.e. toward the right in FIG. 2) there are provided spacer sleeves 79 which are firmly held in place by nuts 70. These nuts are disposed outwardly (toward the right in FIG. 2) of a clamp plate 78c and strap means 78d for retaining the various parts in assembled relation and for retaining the bearings 76 and 77 on the bracket assemblies 78.

As previously indicated, the work clamping or holding means carried by the members 72 and 73 are spring urged toward the stacking bar 54. For this purpose a torsion spring 81a coiled around the rock shaft 74 has one end thereof hooked around the rock shaft 51 and the other end engaging the rear side of one of the upwardly extending legs of member 72. Similarly a torsion spring 81b is coiled around the rock shaft 75 and has one end hooked over the rock shaft 51 and the other end engaged with the front side of one of the legs of the member 73. Thus it will be seen that the member 72 is urged in a clockwise direction (FIG. 2) while member 73 is urged in a counterclockwise direction. By virtue of the employment of the spacer sleeves 79 between the arms 50 and the bearings 77 for the rock shaft 75 the latter is spaced further away from the rock shaft 51 than are the bearings 76 for the rock shaft 74. This means that the work holding and clamping member 73 will be given a greater amount of longitudinal movement than will the member 72 as these members are swung upon the rocking of the stacker bar carrying arms 50. The purpose of this will be explained hereinafter.

The extent to which the members 72 and 73 may be urged by their springs in the directions indicated is limited by the provision of certain stop elements. Thus a stop element 82a, secured to the frame extension 10a, extends into the path of the lower end of member 72 so as to prevent this from rocking forwardly to a greater extent than is indicated in FIG. 7. As there shown, the element 72 has its leg portions extending substantially vertically. Similarly a stop element 82b, secured to the frame extension 10a, extends into the path of the lower end of member 73 so as to prevent its clockwise movement beyond the position shown in FIG. 9, which is substantially, but not quite, a truly vertical position. The stop element 82b does not directly cooperate with a leg of the member 73, but is arranged to cooperate with a conical member 90 adjustably secured to a leg of member 73 adjacent its lower end. This arrangement is such that as the member 73 is lifted and lowered, in the course of the swinging of the stacker bar carrying arms 50, the material engaging elements 73b will move along a strictly vertical path as shown in FIG. 9. It has been found more important for the purpose of the invention to insure this strictly vertical movement of the elements 73b and maximum rearward movement of the member 73, under the spring force, that is the case with respect to the forward swinging of member 72. In fact it has been found desirable to have the work engaging elements 72b move slightly further

forward under spring action than a strictly vertical line extending from the axis of the shaft 51 about which the stacker bar carrying arms 50 are rocked.

Turning now to the control system for the stacker mechanism, there is provided, as has previously been stated, an electric light source 100 and a light responsive element 101 (FIG. 1) disposed just beyond the presser foot of the sewing machine and forwardly of the feed roller 12. Both the light source and the light responsive means are mounted above the table top and the beam of light from the light source to the light responsive means is reflected to the latter whenever a reflecting surface on the sewing machine, positioned at the top of the work supporting table 13, is not covered by the work being stitched. However when a work-piece is being fed through the sewing machine it will cover the reflecting surface and thus cut-off the beam of light from the light source to the light responsive element. The foregoing light and light responsive means are connected with a scanner of the type sold by the Farmer Electric Products Company under the designation PE7. More particularly it is of the type designated PE7-98 which includes a time delay in the energization of one of the two relays incorporated in this device.

Referring to the circuitry system diagrammatically shown in FIG. 12, the scanner mentioned above has a primary relay R-1 and a secondary relay R-2. When the solenoids provided in each of these relays are energized by the absence of any work-piece, that would cut-off the beam of light to the light responsive element 101, the switch arm SP-3 will be shifted away from contact C-4 into engagement with contact C-5. Also the switch arm SP-6 will be lifted away from contact C-7 into engagement with a contact C-8 which is not connected with any circuit. This would be the condition of the system when it is first put into operation without any work-piece being passed through the sewing machine. It will be understood that in putting the system into operation the switches SW-1, SW-4 and SW-3 will all be swung from the inactive positions shown in FIG. 12 to their closed or active positions, serving to connect the system into the power line which, as previously stated, is a 220 volt three-phase source supplied for the operation of the motor M. That part of the power source used for the operation of the circuitry system being described will constitute a 220 volt 60 cycle current. None of the circuits in the scanner control part of the system will at this time be closed except for the circuit designated III which delivers current to the PE7-98 scanner and from the latter to ground terminal GT-3.

Now as a work-piece is being acted upon and passes over the light reflecting surface which directs the beam from source 100 to light responsive element 101 the latter will be inactivated and the two relays R-1 and R-2 will be placed in the condition illustrated in FIG. 12. At this time a circuit II will be completed from the line extending downwardly from switch SW-1 to switch arm SP-3 and contact C-4 up to LITE L-1 and to ground at GT-2. This circuit includes a resistor RES-1 to reduce the voltage of the current delivered to L-1. After the work-piece has been advanced beyond the presser foot of the machine, and has exposed the light reflecting surface adjacent the rear side of the presser foot, the light beam will again be reflected to the light responsive element 101 and bring about the operation of the relays R-1 and R-2.

Relay R-1 will be operated immediately, but relay R-2 includes a known type of time delay provided in Farmer scanners of the type above specified, which time delay may be adjusted to provide the desired number of seconds before the circuit designated IV will be opened by lifting arm SP-6 away from contact C-7. Thus a solenoid designated SOL-2 in a pneumatic time delay relay device designated PTR will remain energized until the relay R-2 is operated upon expiration of its time delay. Whenever circuit IV is closed through solenoid SOL-2 to

11

ground at GT-4 a switch arm SP-20 will be drawn upwardly into engagement with contact C-20. This will close a circuit V extending to the solenoid SOL-1 to ground at GT-1. It should be mentioned here that the relay PTR contains a pneumatic time delay, illustrated schematically in FIG. 12, for retaining the switch arm SP-20 in engagement with contact C-20 for a suitable number of seconds after solenoid SOL-2 is de-energized upon the operation of relay R-2.

Referring now to FIG. 11 it will be noted that energizing of solenoid SOL-1 will cause the valve 25 to assume the position there shown. This brings about delivery of air from line 26 through port *c* to port *b* and then through line 60 to the left or lower end of air cylinder 58. As has previously been mentioned the rate of flow of air into cylinder 58 at this time may be controlled by appropriate adjustment of valve 59a. As the air is thus introduced into the cylinder the piston 58b will be urged outwardly, toward the right in FIG. 11 but actually upwardly as the cylinder is shown in FIGS. 1 and 2. The time delay involved in relay PTR after solenoid SOL-2 is deenergized is selected to be sufficient to enable completion of the operation of the piston 58b in the manner mentioned above. When circuit V is opened by the downward movement of switch arm SP-20, after the time delay mentioned, the solenoid SOL-1 will be de-energized and the spring 25a will urge the valve piston within cylinder 25 toward the right (FIG. 11.) This will close off delivery from line 26 into line 60 and instead cause delivery of air under pressure from line 26 into line 61 and then through adjustable control valve 59b into the right end of cylinder 58. Accordingly the stacking bar carrying arms 50 will be drawn inwardly again. It should be mentioned here that whenever air under pressure is delivered through line 60 into the left end of cylinder 58 air will be discharged from the right end of said cylinder through line 61 to exhaust port *e*. Similarly when air is delivered under pressure through line 61 to the right end of cylinder 58 air will be discharged from the left end of said cylinder through line 60 to exhaust port *a* of valve 25. It will be understood from the foregoing that when a work-piece is ready to be stacked, by exposing the light responsive element 101 to a light beam, the stacker bar 54 will be swung outwardly and then returned with a smooth operation and sufficiently slowly not to set up disturbing vibrational forces and the creation of objectionable noise.

The foregoing cycle of operation of the stacking mechanism will be repeated as successive pieces of work are advanced through and beyond the light beam between source 100 and element 101. At any time, the operator may bring about the operation of the stacking mechanism to swing the stacking bar outwardly by closing a normally open switch SW-2 (FIG. 12). This closes a circuit designated I. Usually switch SW-2 will be manually operated only when a desired number of work-pieces have been stacked on the bar 54 and the operator desires to remove the collected work-pieces. Upon subsequent opening switch SW-2 the stacking bar will be restored to its inward position.

Referring to FIGS. 7-10 inclusive, these illustrate the timing of the movement of the stacking bar carrying arms 50 and the cooperation of the stacking bar and the clamping or holding elements in bringing about the desired uniform stacking of successive work-pieces. In FIG. 7 the normal position of the various parts is shown in relation to the table top 13 and the downwardly hanging portion of the material to be stacked. At the appropriate time to bring about a uniform disposition of each section of material on the stacking bar the arms 50 are swung by the operation of piston 58a in the manner explained. When the stacking bar reaches the position shown in FIG. 8 it will have carried the depending portion of the work-piece against the clamping or holding elements 72b, and in view of the various time delay features described

12

above this will occur just when the mid-point of a particular work-piece is adapted to rest upon the top of the stacking bar 54. As the arms 50 swing outwardly they pull away from the stacking or holding elements 73b and provide room for the portion of the work-piece being drawn away from the table 13 to drop downwardly without danger of becoming engaged with the elements 73b. Also during this further movement of the arms 50 into the position shown in FIG. 9 the elements 72b on the clamping or holding member 72 will rather firmly hold the work-pieces in proper position on the stacking bar. Then as the arms 50 swing back toward the right the stacking bar will be carried against the elements 73b on the clamping or holding means 73 and the latter takes over the job of insuring retention of the work-pieces properly on the stacking bar. On the continued inward stroke of the arms 50, from the position shown in FIG. 10 back to that shown in FIG. 7, the stacking bar will be disengaged from the elements 72b and the latter will be retained in a position not to interfere with the downward movement of the overhanging portion of the next work-piece. By virtue of the downward movement of the elements 73b as they are first engaged by the work-pieces on the stacking bar, these elements serve to insure straightening out of the material around the stacking bar and eliminate any tendency of any portions of the work-pieces to extend upwardly or outwardly away from the stacking bar. It has been found that the construction shown and described works very effectively and simply in bringing about the stacking of successive work-pieces to form a desired smooth collection of such work-pieces.

In the circuit diagram of FIG. 12 there are illustrated various lights designated L-1, L-2, and L-3. These are simply provided to give the operator an indication of the operative condition of various elements of the construction. As previously explained, the light L-1 indicates to the operator when the stacking bar is about ready to receive another section of material. It darkens when the relay R-1 is energized, but is restored to its light condition when a new piece of material intercepts the beam of light from 100 to 101 and is approaching the position in which it may be picked up. Light L-2 is energized upon the closing of switch SW-3 to show the operator that the motor is in operation. Light L-3 is lit-up by circuit X which is completed, in the manner previously explained, when the sewing machine is ready to receive a work-piece. Suitable resistances RES-1, RES-2 and RES-3 are provided in the circuits extending to the various lights mentioned so that they may be operated at a desired voltage.

In FIG. 13 there is shown a modified circuit, in diagrammatic form which may be used to enable the stacking bar to pick-up a work-piece on its outward swinging movement and then pick-up another work-piece on its inward swinging movement. This will of course result in placing alternate work-pieces on the stacking bar in right side up position and the other alternate work-pieces in right side down position. Only that part of the circuitry identified with the scanner PE7-98 is shown, but it will be understood that the circuitry for controlling the operation of the sewing machine, if this is included in the overall construction, will be the same as illustrated in FIG. 12.

Current from source HT-1' will be passed downwardly through switch SW-1', which will be shifted to its closed position when the system is in operation. The circuit will be completed to the Farmer scanner PE7-98 and to ground at GT-3'. Also a circuit will be completed through switch arm SP-3' to contact C-4' and line II' through resistor RES-1' and "LITE" L-1' to ground at GT-2' whenever a work-piece is being advanced through the light beam from 100' to 101'. Thus the operator will be advised of the movement of a workpiece toward its stacking position. Thus when the work-piece is being advanced, and its forward end passes over the light reflecting surface which directs a beam of light from source 100' to

light responsive element 101', the light L-1' will be lighted. Also the relays R-1' and R-2' will be de-energized and the switch arms SP-3' and SP-6' will assume the positions shown in FIG. 13. Then as the trailing end of the work leaves the sewing machine and serves to expose the reflecting surface that directs the beam of light to element 101', the relays R-1' and R-2' will be operated, with a slight time delay in the operation of relay R-2'. Prompt operation of relay R-1' will break the circuit II' so that the light L-1' will go out. However during the relatively short time delay provided in this embodiment for the operation of relay R-2', the circuit IV' will be completed through a relay R-3' which is an alternate pulse relay of well known construction. The circuit through the coil of this relay will be completed to ground at GT-4'. This will cause the lifting of switch arm SP-40' into engagement with contact C-41' and thus close a circuit V' to solenoid SOL-1' and to ground at GT-1', and will cause the outward swinging of the stacking bar to pick-up the work-piece then depending downwardly from the table top 13. While the relay R-3' is energized for only a very brief interval, this is enough to throw the switch arm in the direction described, and it will be retained there until another pulse is transmitted to the relay by the next work-piece passing through the beam of light from 100' to 101'. Circuit V' will remain activated through solenoid SOL-1' so long as switch arm SP-40' of relay R-3' remains in engagement with contact C-41'. Thus the stacker will be held in its outward position.

When another work-piece is supplied to the apparatus and is advanced over the light reflecting surface to cut-off the beam from light 100' to light responsive element 101' the relays R-1' and R-2' will be inactivated and the parts thereof restored to the position shown in FIG. 13. As the work-piece continues to be advanced by the sewing machine and/or the feed roller corresponding with that designated 12 in connection with the first embodiment of the invention, and the trailing end of the second work-piece passes beyond the light reflecting surface mentioned, the relays R-1' and R-2' will again be activated in the same manner as before with the result that another pulse will be transmitted to relay R-3'. The construction of the latter is such that the switch arm SP-40' will then be returned to the position shown in FIG. 13, and the circuit V' to solenoid SOL-1' will be de-energized. At this time the spring 25a of valve 25 will shift the position-like valve stem of the latter toward the right from the position shown in FIG. 11, and the stacking bar will be returned forwardly to pick-up the new work-piece that has been delivered into a position with a downwardly hanging portion in the path of the stacking bar.

It will be understood that the foregoing sequence of operations will be repeated as new work-pieces are advanced through the light beam from light 100' to light responsive element 101', so that the first in each series of alternate work-piece will be stacked right side up on the stacking bar and the second in each series of alternate work-pieces will be stacked right side down on the stacking bar.

When the circuitry described above in relation to FIG. 13 is utilized, it will of course be necessary to change the location of the stacking bar, its carrying arms, and the clamping or holding elements 72b and 73b from that illustrated in relation to the first embodiment of the invention. This is because of the necessity of retaining the clamping elements 73b to the right of the path of the downwardly moving portion of the next work-piece when the stacking bar is held in its outward position in the manner described above. This can be done by shifting the pivotal axis 51, about which the arms 50 are rocked, into a position within or slightly to the right of the plane in which the downwardly hanging portion of the material is disposed. Also the location of the stop means 82a and 82b and the form of the members 72 and 73 should be

such that the holding or clamping elements 72b and 73b will be stopped upon the swinging of the members 72 and 73, under spring action, in a position somewhat to the left and right, respectively, of the downwardly hanging portion of the material to be picked up.

While certain preferred embodiments of the invention have been described in considerable detail in the foregoing, it will be understood that various changes may be made in the structure shown and described within the scope of the appended claims.

What is claimed is:

1. Apparatus for stacking relatively flat pieces of flexible material which comprises, means providing a supporting surface along which said pieces may be advanced, said means having an edge toward which said pieces are advanced, means for advancing successive pieces of said material toward said edge and into overhanging relationship to said edge, a stacking bar swingable in an arc below said supporting surface partly in a region beneath the latter and partly outwardly from said edge thereof, said bar being maintained in substantially parallel relation to said edge and carried through the region in which the overhanging portions of successive workpieces are disposed, clamping means at opposite sides of said bar and spring urged toward the latter, means for detaining said clamping means against any substantial movement beyond the path of the overhanging portions of the pieces opposite to the side on which they cooperate with said bar, and means for swinging said bar to engage and pick-up successive pieces of the material.
2. Apparatus as set forth in claim 1 in which at least one of said clamping means is in cooperation with said bar to retain the pieces of material in predetermined position thereon at all times during the operation of the apparatus.
3. Apparatus as set forth in claim 1 in which said clamping means are rockably mounted to swing along only predetermined portions of the arcuate path of said stacking bar.
4. Apparatus as set forth in claim 1 in which said stacking bar is carried by at least one arm rockable about a fixed pivot, said clamping means each being carried by at least one arm mounted for rocking movement about a pivot carried by said arm which carries the stacking bar.
5. Apparatus as set forth in claim 4 in which the pivot about which said arm carrying one of said clamping means is rocked is disposed at a greater distance from said fixed pivot than is the pivot about which the arm carrying the other of said clamping means is rocked.
6. Apparatus as set forth in claim 4 having means enabling the adjustment of the effective length of the various arms specified to adapt material pieces being stacked from time to time, which may be of different length, to be equally disposed along opposite sides of the stacking bar.
7. Apparatus as set forth in claim 4 in which each of said clamping means comprises a bar extending transversely from the arm which carries the same, said transversely extending bar of each clamping means having a portion thereof extending in a direction toward said stacking bar and another portion of restricted length extending parallel with said stacking bar for cooperation therewith, thereby enabling proper stacking of pieces having different thickness in different regions.
8. In apparatus as set forth in claim 1, control means for controlling the operation of said means for swinging said bar in response to the advance of a piece of material being stacked to a position in which its trailing end is at a predetermined point in its travel.
9. In apparatus as set forth in claim 8, said control means comprising a source of light and a light responsive member in the path of a beam of light from said source of light.
10. Apparatus as set forth in claim 1 in which said last recited means comprises a piston operated by air under pressure, and means for controlling the delivery of air to

15

and the release of air from opposite sides of said piston to enable reciprocation thereof in properly timed relation to cause draping of the pieces of material with equal lengths at opposite sides of said stacking bar.

11. Apparatus as set forth in claim 10 in which electrical circuits are provided for controlling the delivery of air to and the release of air from opposite sides of said piston, a light beam creating source, and light responsive means for energizing and de-energizing of said circuits in accordance with whether said light responsive means does or does not receive light from said light beam creating source.

12. In apparatus as set forth in claim 1, a sewing machine mounted on said means providing a work supporting surface, said sewing machine having means for forming a line of stitching in pieces of material supplied thereto, and light responsive means in advance of the stitch forming means of said sewing machine for controlling the operation of said sewing machine and said means for advancing successive pieces of said material toward said edge.

13. In apparatus as set forth in claim 12, means manually operable by the operator for initiating the operation of said sewing machine, and means for continuing the operation of said sewing machine so long as one or more of said workpieces successively supplied by the operator conceals said light responsive means.

16

14. In apparatus as set forth in claim 12, means for delaying the stopping of the operation of said sewing machine for a predetermined selected number of operations of said sewing machine after said light responsive means is uncovered and exposed to light.

15. In apparatus as set forth in claim 12, said means for advancing successive pieces of material comprising a feed roller driven by said sewing machine positioned just beyond the stitch forming region of said sewing machine, said feed roller being disposed in alinement with the line of stitching formed by said sewing machine and serving to mash and weaken the thread chain between the trailing end of one piece and the forward end of the next piece.

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