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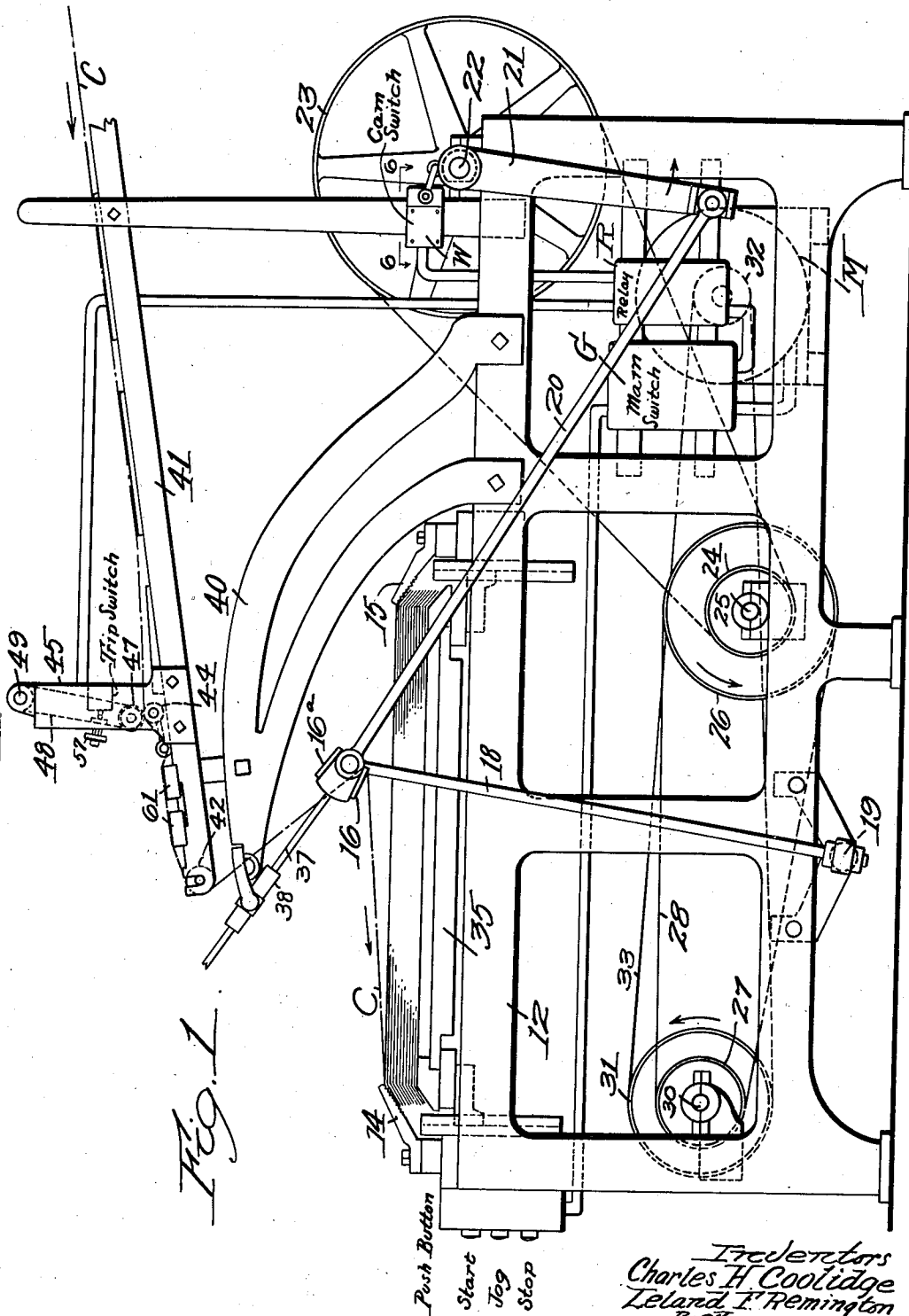
C. H. COOLIDGE ET AL

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CLOTH FOLDING MACHINE

Filed Oct. 19, 1936

3 Sheets-Sheet 1



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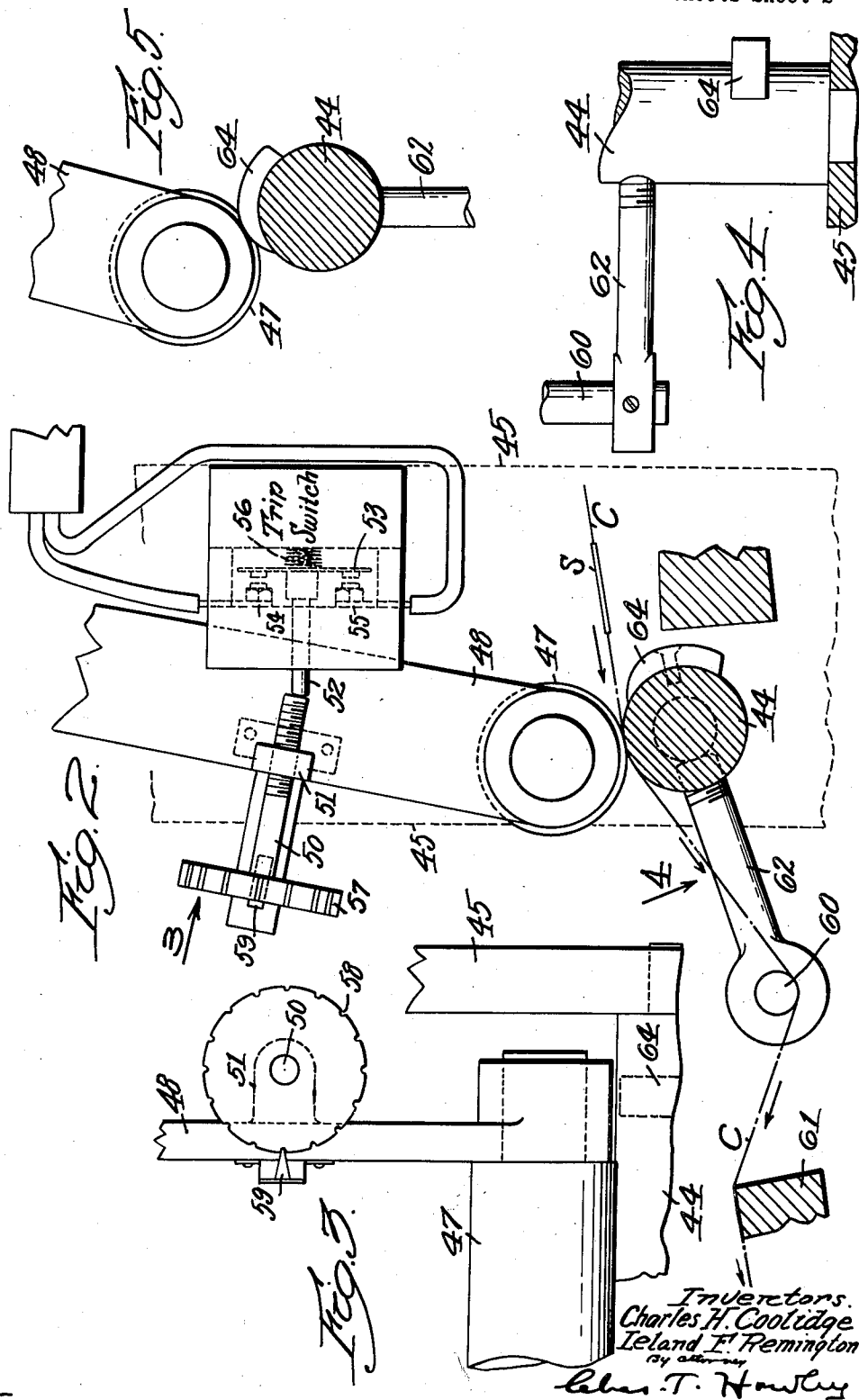
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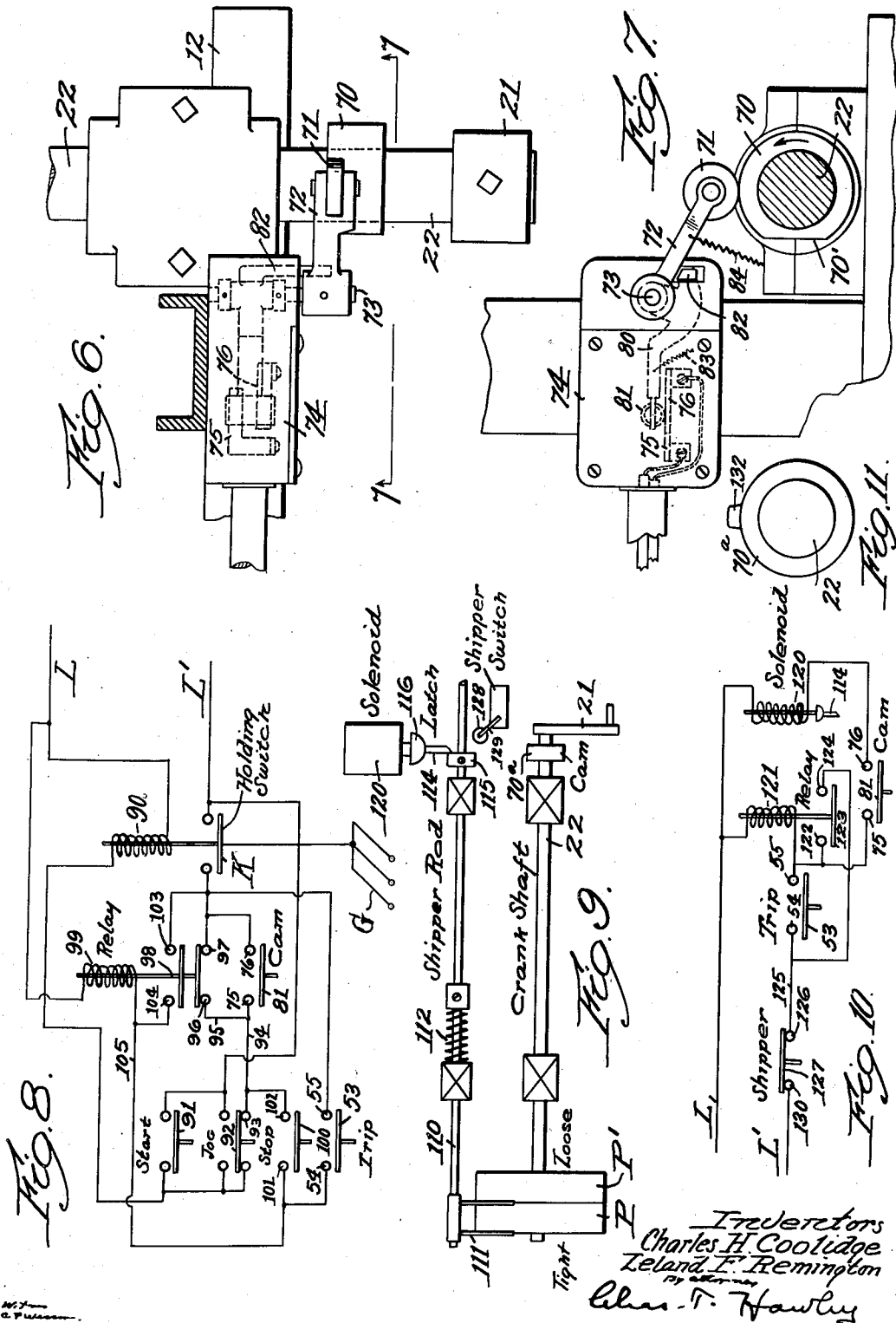
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CLOTH FOLDING MACHINE

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3 Sheets-Sheet 3



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CLOTH FOLDING MACHINE

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This invention relates to machines for folding pieces of cloth in textile finishing plants. The cloth to be folded is commonly placed in the machine in the form of a large roll containing several hundred yards of cloth, each roll comprising several separate pieces of cloth stitched together end to end. During the folding operation, it is customary to stop the machine, cut the seam, and remove each piece of cloth separately after it has been folded.

It is the general object of our invention to provide improved automatic mechanism which will act to stop the machine whenever a seam appears at a given point. We also provide for similarly stopping the machine when the end of a roll of cloth is reached.

A further object of our invention is to provide automatic mechanism which will stop the machine with the folding blades in a predetermined position, regardless of the point in the folding cycle at which the stopping indication is given.

Our invention further relates to arrangements and combinations of parts which will be hereinafter described and more particularly pointed out in the appended claims.

Preferred forms of the invention are shown in the drawings, in which

Fig. 1 is a side elevation of a folding machine having our improvements applied thereto;

Fig. 2 is an enlarged side elevation, partly in section, of the seam-detecting and indicating mechanism and associated parts;

Fig. 3 is a partial front view, looking in the direction of the arrow 3 in Fig. 2;

Fig. 4 is a partial plan view of certain parts, looking in the direction of the arrow 4 in Fig. 2;

Fig. 5 is a front view, partly in section, of certain parts appearing in Fig. 2 but in a different position;

Fig. 6 is a detail plan view, taken along the line 6—6 in Fig. 1;

Fig. 7 is a sectional front elevation, taken along the line 7—7 in Fig. 6;

Fig. 8 is a diagrammatic view of the electrical circuits and connections used in the form of our invention shown in Figs. 1 to 7;

Fig. 9 is a diagrammatic view illustrating the application of our invention to a belt driven cloth folder;

Fig. 10 is a diagram of the electrical connections used with the modified construction shown in Fig. 9; and

Fig. 11 is a view of a detail part to be described.

Referring to Figs. 1 to 7, we have shown a folding machine comprising a frame 12 on which

cross bars or stationary jaws 14 and 15 are securely mounted. The cloth C is threaded between a pair of front and rear folding blades 16 and 16^a, pivotally mounted at the upper ends of a pair of swinging arms 18 which oscillate about fixed pivots 19.

The upper ends of the arms 18 are connected by links 20 to crank arms 21 on the opposite ends of a crank shaft 22, supported in fixed bearings on the frame 12. The shaft 22 is preferably provided with a large pulley 23, belt-connected to a pulley 24 on a countershaft 25. The shaft 25 is connected by pulleys 26 and 27 and a second belt 28 to a second countershaft 30. The shaft 30 is in turn connected through pulleys 31 and 32 and a third belt 33 to a driving motor M. Through the connections described the crank shaft 22 is driven at substantially reduced speed from the motor M.

A cloth table 35 is yieldingly pressed upward against the jaws 14 and 15. Suitable mechanism, not shown, is provided for normally pressing the table upward against the jaws and for alternately relieving the upward pressure at one end or the other of the table as the cloth is folded.

In starting the folding operation it is customary to thread the cloth between the blades 16 and 16^a when the blades have moved part way rearward and are substantially in the position shown in Fig. 1. The end of the cloth is then brought forward and inserted between the front end of the table 35 and the front holding jaw 14.

The machine is then started, causing the blade 16 to insert a fold of cloth between the rear end of the table 35 and the rear jaw 15, which fold is immediately clamped against the jaw 15 by the yielding upward pressure of the table.

A fold is then inserted under the front jaw 14 by the folding blade 16^a, these blades being rocked as the arms 18 are oscillated by a guide rod 37 slidable in a bearing 38 having a swivel support on a fixed upper frame member 40.

The cloth from the previously mentioned cloth roll is drawn into the machine over an upper platform or supporting structure 41 and passes around a guide roll 42 rotatably mounted at the front end thereof.

The parts thus far described are of the usual construction and operate in the usual manner and in themselves form no part of our present invention, which relates particularly to mechanism for automatically stopping the folding blades 16 and 16^a, in a predetermined position whenever a seam or end of cloth approaches the folding mechanism.

For the purpose of detecting the approach of a seam or of the end of the roll, we provide a cloth-supporting roll 44 mounted in bearing brackets 45 secured to the upper supporting structure 41. We also provide a detector roll 47 mounted in arms 48 pivoted at 49 to the upper ends of the brackets 45. As the cloth C is drawn over the supporting roll 44, it is lightly engaged by the roll 47 as clearly indicated in Fig. 2, and on the approach of a seam S the detector roll 47 will be swung easily to the left in said figure.

A screw 50 is threaded in a block 51 mounted on one of the arms 48, and the end of the screw 50 engages a plunger 52 which supports a trip switch member 53 adapted to close a circuit between terminals 54 and 55 for a purpose to be described. A spring 56 is provided for closing the switch, and the switch is normally held open by the weight of the detector roll 47 and associated parts.

When the roll 47 is engaged by a seam S and is swung to the left in Fig. 2, the pressure on the plunger 52 is momentarily relieved and the spring 56 will move the trip switch member 53 to complete the circuit between the terminals 54 and 55.

In order to adapt the detector apparatus to different thicknesses of cloth, the screw 50 is provided with an enlarged head 57 having notches 58 to receive a holding catch 59 mounted on the swinging arm 48. By use of the head 57, the screw 50 may be adjusted as desired and may be firmly retained in adjusted position.

As the cloth C leaves the detector rolls, it passes under a cross rod 60 and over one or more fixed supporting drop bars 61. The drop rod 60 is mounted in arms 62 threaded radially into the supporting roll 44 previously described. A cam plate 64 is also fixed in position on the supporting roll 44.

As long as cloth is passing through the machine, the drop rod 60 is supported in the position shown in Fig. 2 and the cam plate 64 is maintained in the inoperative position also shown in Fig. 2.

When the end of the roll of cloth is reached, however, the drop rod 60 is released and swings downward by gravity, turning the roll 44 to the position shown in Fig. 5, in which position the cam plate 64 engages the detector roll 47 and swings the roll 47 and arms 48 to the left, thus permitting the trip switch 53 to close as previously described.

The electrical equipment for controlling the operation of the motor M includes, in addition to the trip switch 53, a main starting switch G (Fig. 1), a relay mechanism R and a cam controlled switch mechanism W.

The construction of the latter switch mechanism is shown in Figs. 6 and 7. A cam 70 is mounted on the crank shaft 22 and is engaged by a cam roll 71 mounted on the end of an arm 72, which arm is fixed on a stud 73 pivoted in fixed bearings in a switch box 74 in which terminal plates 75 and 76 are mounted. The cam 70 has a short low portion 70'. A second arm 80 is loosely pivoted on the stud 73 and is preferably formed of insulating material but supports a roll 81 of conducting material. The arm 80 is provided with an offset abutment 82 positioned to normally engage the under side of the arm 72.

A light spring 83 acts to move the arm 80 and conducting roll 81 toward the terminal plates 75 and 76, and a heavier spring 84 acts to hold the roll 71 against the cam 70. The relation of the abutment 82 to the arm 72 is such that when

the roll 71 is on the high part of the cam 70, the arm 72 will be clear from the abutment 82 and the spring 83 will be free to close the circuit between the terminals 75 and 76.

The connections and operation of the various parts of the electrical equipment which control the starting and stopping of our improved folding machine are indicated diagrammatically in Fig. 8.

One line wire L is connected through a holding coil or solenoid 90 to one side of a starting switch or button 91 and to upper and lower contacts at one side of a manual-control or "jog" button 92. The opposite side of the starting switch 91 and the upper contact of the jog switch 92 are directly connected to the second line wire L'.

When the starting switch is closed, a circuit is thus completed through the holding coil 90, so that the coil is energized and the main switch G is closed, thus starting the motor M. At the same time the solenoid 90 closes a holding switch K.

The manual-control or jog switch 92 is double-acting and normally closes the circuit between the lower contacts of said switch. The second lower contact 93 is connected through a wire 94 and branch wire 95 to contacts 75 and 76.

The contact 75 is in the cam switch mechanism W previously described and is closed by the contact member 81 when the cam switch is in the position shown in Fig. 7, but is open as indicated in Fig. 8 when the roll 71 (Fig. 7) engages the low part 70' of the cam 70.

The contact 96 and its associated contact 97 are normally connected by a double-acting switch 98 controlled by a relay coil or solenoid 99. The contacts 76 and 97 are both connected through the holding switch K to the second line wire L'.

After the holding switch K has been closed by momentarily closing the starting switch 91 as previously described, the circuit through the holding coil or solenoid 90 will be maintained through the lower contacts of the jog switch 92 and through the contacts 96 and 97 and lower member of switch 98, even after the starting switch 91 has been released.

During a portion of the time, the holding circuit is also completed through the contacts 75 and 76 and cam switch member 81, which parts form a circuit in parallel with that through the parts 96, 97 and relay switch 98.

As long as either one of these parallel circuits is closed, the holding coil 90 will be energized and the main switch G will remain closed, so that the motor M will continue operating.

The relay coil 99 is in a branch circuit which includes a stop switch or button 100 with contacts 101 and 102 and also includes in a parallel branch the trip switch 53 with contacts 54 and 55 previously described.

The contact 102 of the stop switch is connected to the wire 94 previously described, and the contact 55 of the trip switch is connected to one side of the holding switch K and to an upper contact 103 of the double-acting switch 92, the second upper contact 104 of which is connected to the wire 105 which connects the relay coil 99 to the stop and trip switches.

Assuming that the motor M is in operation as previously described and assuming that the trip switch is closed by approach of a seam or the end of the cloth, the stopping of the machine at a predetermined point will be effected as follows:

When the trip switch 53 closes, the relay coil circuit is completed through the holding switch

K to the second line wire L' and the relay coil 99 is energized to raise the double-acting relay switch 98, breaking the circuits between the contacts 96 and 97 and completing a holding circuit through the contacts 103 and 104.

The motor M will still continue to operate as long as the cam switch 81 holds the circuit between the contacts 75 and 76 closed. When the low point 70' of the cam 70 permits the cam switch 81 to open, however, the holding circuit through the solenoid 90 is broken and the main switch G opens, thus stopping the machine in a position determined solely by the setting of the cam 70 relative to the crank arms 21.

If it is desired to stop the machine manually at any time, the stop button is pushed to close the stop switch 100, thus completing the relay coil circuit through the contacts 101 and 102, wires 94 and 95 and switches 98 and 81 which are normally closed in parallel branch circuits.

The relay coil 99 is thus energized as previously described to shift the switch 98, and the machine is thereafter stopped in predetermined position by the opening of the cam switch 81.

The so-called "jog" switch 92 is used for momentarily energizing the motor M to move the folding blades by short steps to a desired position for threading or cloth removal. The jog switch 92 is normally in lowered position as indicated in Fig. 8 but when raised by pressing the jog button, it completes a circuit through the upper contacts of the jog switch which corresponds to the circuit initially established by closing the starting switch 91.

So long, however, as the switch 92 is in raised position, no holding circuit will be maintained, as the connection to the terminal 93 is broken. Consequently the main switch G will open as soon as the circuit through the upper contacts of the switch 92 is broken and the motor will stop.

We have thus provided control mechanism such that the machine can be placed in continued operation by momentarily closing the starting switch 91, can be stopped in predetermined position by the stop switch 100 or by the trip switch 53, and can be intermittently operated by the jog or manual-control switch 92.

By the use of the parallel circuits for the cam switch 81 and the lower contacts of the double-acting relay switch 98, the stop or trip switches may be actuated at any point in the folding cycle but the machine will stop only when the cam switch 81 is thereafter opened by operation of the cam 70 on the crank shaft 22. By angularly adjusting the cam 70 on the crank shaft 22, the machine may be stopped in any desired position, the motor M being preferably of the "brake" type.

Figs. 9 and 10 illustrate the application of our invention to a belt-driven machine. In Fig. 9 we have shown the crank arm 21, crank shaft 22, and cam 70^a, all substantially as previously described, and have also shown the crank shaft 22 as provided with tight and loose pulleys P and P' to receive a belt controlled in position by a shipper rod 110 and shipper fingers 111. The shipper rod is moved to inoperative position by a spring 112 and is maintained in operative position by a latch 114 which engages a collar 115 on the shipper rod. The latch 114 may be mounted on the plunger 116 of a solenoid 120.

When the solenoid is energized, the latch is raised and the shipper rod will be released to move the belt to the loose pulley P'.

The electrical control circuit for this modified construction is shown in Fig. 10 and comprises a line wire L connected by branch circuits to a solenoid 120 and to a relay coil 121.

The solenoid 120 is connected to one of the contacts 76 of a cam-operated switch corresponding in all respects to the switch previously described and including a switch member 81 and second contact 75. The contact 75 is connected to one terminal 122 of a relay switch 123 controlled by the relay coil 121.

The second contact 124 of the relay switch is connected to a wire 125 which in turn connects one contact 54 of a trip switch 53 with one contact 126 of a shipper switch 127. The latter switch is closed so long as the shipper rod is in the position shown in Fig. 9 but is opened when the shipper rod moves to the right in Fig. 9, causing the collar 115 to engage and depress a roll 128 mounted on an arm 129 forming a part of the shipper switch. The second contact 130 of the shipper switch is connected to the second line wire L'.

The operation of these switches and circuits is as follows: The shipper switch 127 is closed on the starting of the machine but no through circuit is completed. When the trip switch is thereafter closed on the approach of a seam or of the end of the cloth, a circuit is completed through the relay coil 121 which in turn effects closing of the relay switch 123, thus completing a holding circuit for the coil 121 through the switch 123 and around the trip switch 53.

The circuit is now completed through the solenoid 120 except at the cam switch 81. The cam 70^a operates the same as the cam 70 shown in Figs. 7 and 8, except that the cam 70^a has a very short raised portion 132 as shown in Fig. 11, so that the cam is normally open but is closed momentarily at a selected point in each revolution of the crank shaft 22.

After the closing of the trip switch 53, the solenoid 120 will accordingly not be energized until the high point 132 of the cam 70^a closes the switch 81, which closing will thus be in timed relation to the rotation of the crank shaft 22.

As soon as the circuit through the cam switch 81 is closed, the solenoid 120 will be energized, raising the latch 114 and releasing the shipper rod, thus stopping the machine. As soon as the shipper rod is released, the roll 128 is engaged by the collar 115 and is depressed to open the shipper switch 127, thus breaking the holding circuit and again releasing the latch 114.

With both forms of our apparatus, it will be seen that the machine is automatically controlled and that the stopping of the machine takes place with the crank arms and folding blades in a predetermined position, regardless of the point in the cycle of operations at which the stopping indication is given.

Any desired stopping position may be attained by varying the setting of the cam 70 or 70^a on the crank shaft 22, but it is usually preferred to stop the parts somewhat beyond the middle of the backward stroke and substantially in the position shown in Fig. 1. This position is most convenient for threading up the machine and also for removal of the folded cloth, and is also a safety position. In case of accidental starting of the machine the folding blades will move from the stopping position in a direction away from rather than toward the operator.

With our stopping mechanism in use, it is un-

necessary for the operator to watch for seams or cloth ends.

Having thus described our invention and the advantages thereof, we do not wish to be limited to the details herein disclosed, otherwise than as set forth in the claims, but what we claim is:

1. In a machine for transversely folding an elongated strip of cloth in superposed layers and having folding blades, means to oscillate said blades, and a seam-detector and stopping mechanism, the combination with said seam-detector and stopping mechanism of means to effect operation of said stopping mechanism to stop the machine at a single predetermined point only in the folding cycle on indication of a seam by said detector.

2. In a machine for transversely folding an elongated strip of cloth in superposed layers and having folding blades, means to oscillate said blades, and a seam-detector and stopping mechanism, the combination with said seam-detector and stopping mechanism of means to effect operation of said stopping mechanism to stop the machine with the blades at an intermediate point in their rearward travel only, on indication of a seam by said detector.

3. In a machine for transversely folding an elongated strip of cloth in superposed layers and having folding blades, means to oscillate said blades, and a seam-detector and stopping mechanism, the combination with said seam-detector and stopping mechanism of additional means effective to detect a cloth end and means to effect operation of said stopping mechanism to stop the machine at a predetermined point only in the folding cycle on indication of a seam by said detector or a cloth end by said additional means.

4. A machine for transversely folding an elongated strip of cloth in superposed layers comprising folding and driving mechanism, manually controlled starting mechanism therefor, means to detect the presence of either a seam or a cloth end in said machine, and an automatically controlled device effective to stop said machine in a predetermined position only, on indication by said detecting means of either a seam or a cloth end in said machine.

5. In a machine for transversely folding an elongated strip of cloth in superposed layers and having folding blades, means to oscillate said blades, and a seam-detector and stopping mechanism, the combination with said seam-detector and stopping mechanism of means to effect operation of said stopping mechanism to stop the machine at a single predetermined point only in the folding cycle after said detector has been engaged by a seam at any point in said folding cycle.

6. A machine for transversely folding an elongated strip of cloth in superposed layers comprising folding mechanism, driving mechanism therefor, a seam-detecting device, means to initiate stopping of said machine on indication of seam appearance in said machine by said detecting device, and additional means to complete stopping of said machine after such indication and at a predetermined point only in the cloth folding cycle.

7. A machine for transversely folding an elongated strip of cloth in superposed layers comprising folding mechanism, driving mechanism therefor, manual means to initiate stopping of said machine, and automatic means effective to

thereafter complete stopping of said machine at a predetermined point only in the cloth folding cycle.

8. A machine for transversely folding an elongated strip of cloth in superposed layers comprising folding mechanism, driving mechanism therefor, a seam detector, and stopping mechanism controlled thereby and effective to stop the machine after indication and at a predetermined point only in the folding cycle, said latter mechanism including two parallel branch electric control circuits, one of which circuits is opened on seam detection and the other of which is periodically opened at a predetermined point in the folding cycle, and said machine being stopped only when both of said parallel circuits are simultaneously open.

9. A machine for transversely folding an elongated strip of cloth in superposed layers comprising folding mechanism, driving mechanism therefor, a seam detector, and stopping mechanism controlled thereby and effective to stop the machine after indication and at a predetermined point only in the folding cycle, said latter mechanism including a solenoid and two parallel branch electric control circuits, one of which circuits is opened on seam detection and thereafter held open by said solenoid and the other of which is periodically opened at a predetermined point in the folding cycle, and said machine being stopped only when both of said parallel circuits are simultaneously open.

10. A machine for transversely folding an elongated strip of cloth in superposed layers comprising folding mechanism, driving mechanism therefor, a seam detector, a movable member controlling said driving mechanism, a latch for said member, and means to release said latch at a predetermined point only in the folding cycle on indication of a seam in said machine by said detector at any point in said cycle.

11. A machine for transversely folding an elongated strip of cloth in superposed layers comprising folding mechanism, driving mechanism therefor, a seam detector, a movable member controlling said driving mechanism, a latch for said member, and means to release said latch at a predetermined point only in the folding cycle on indication of a seam in said machine by said detector at any point in said cycle, said latter means including a latch-releasing solenoid and two electric switches in series, said solenoid being operative only when said switches are simultaneously in closed position.

12. A machine for transversely folding an elongated strip of cloth in superposed layers comprising folding mechanism, driving mechanism therefor, a seam detector, a movable member controlling said driving mechanism, a latch for said member, and means to release said latch at a predetermined point only in the folding cycle on indication of a seam in said machine by said detector at any point in said cycle, said latter means including a latch-releasing solenoid and two electric switches in series, said solenoid being operative only when said switches are simultaneously in closed position, one of said switches being controlled by said seam detector and the other switch being automatically closed at a predetermined point in each folding cycle.

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