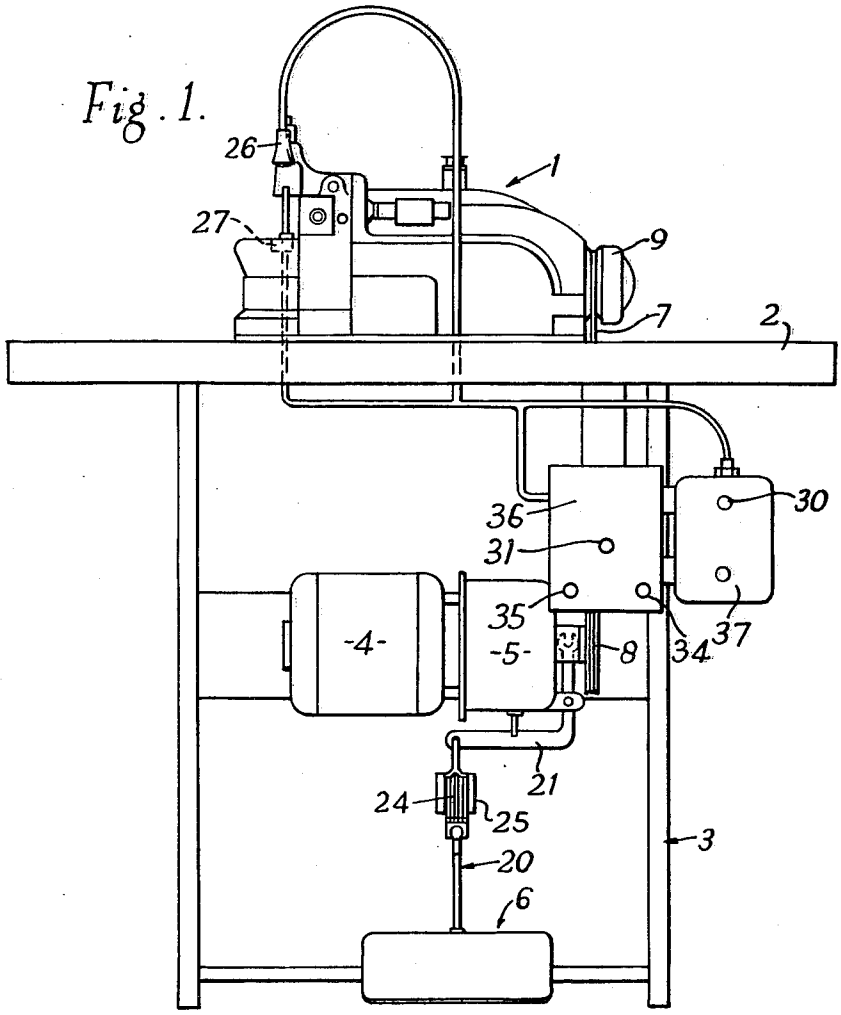
June 8, 1965 E. W. FREEMAN ETAL 3,187,702

SEWING MACHINES

Filed May 1, 1963 4 Sheets-Sheet 1

Fig. 1.



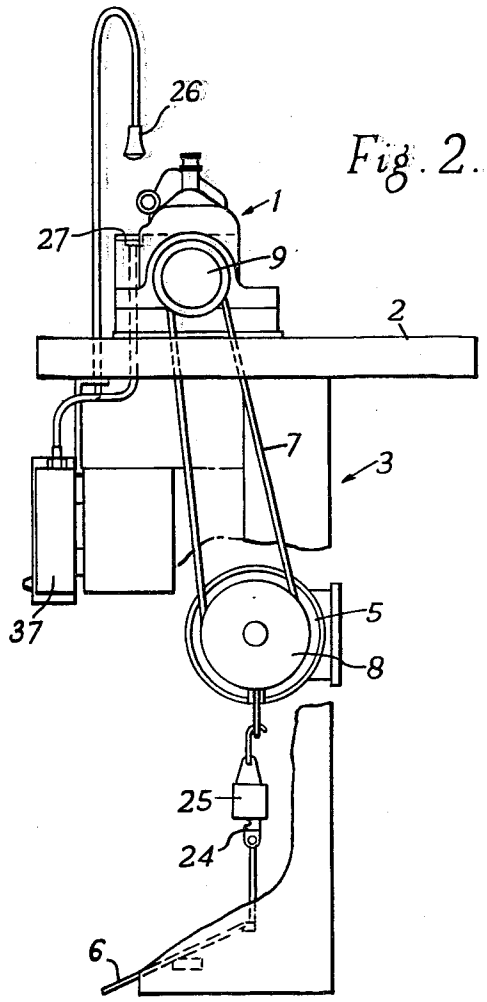


Fig. 2.

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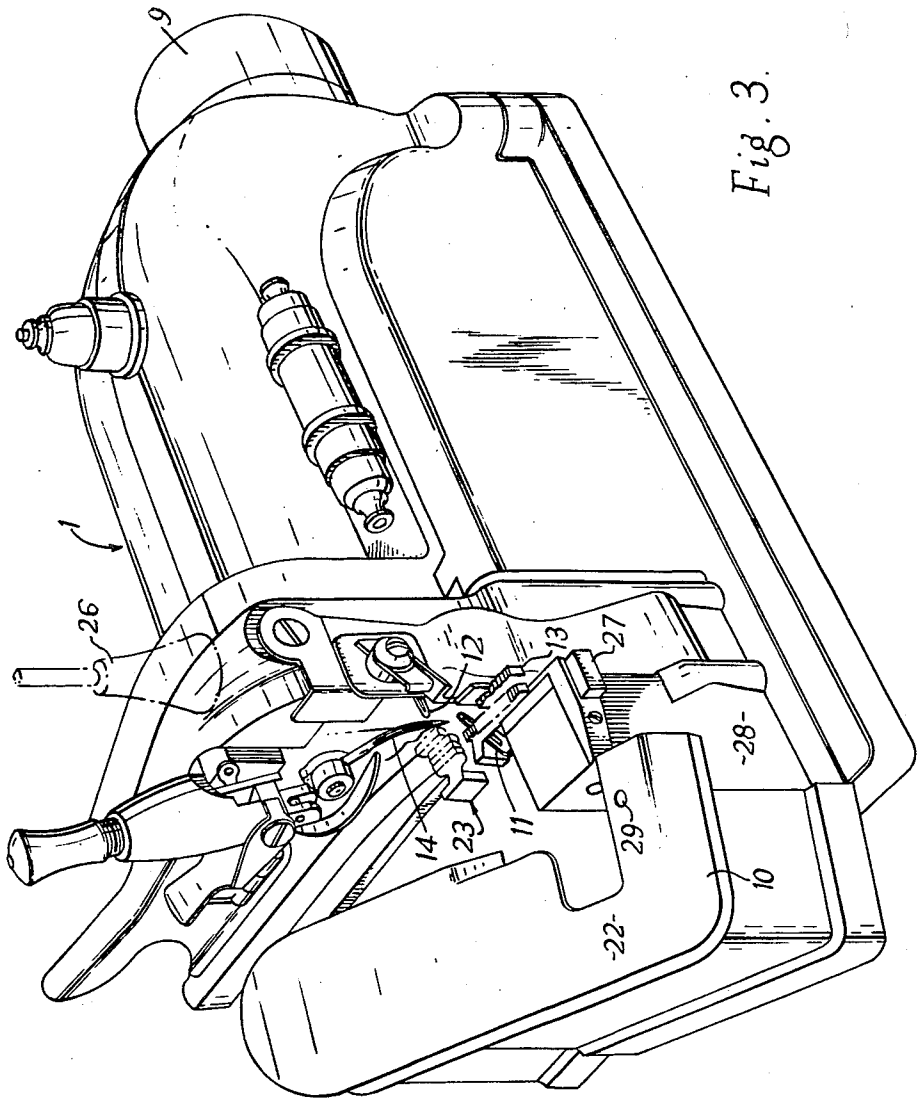


Fig. 3.

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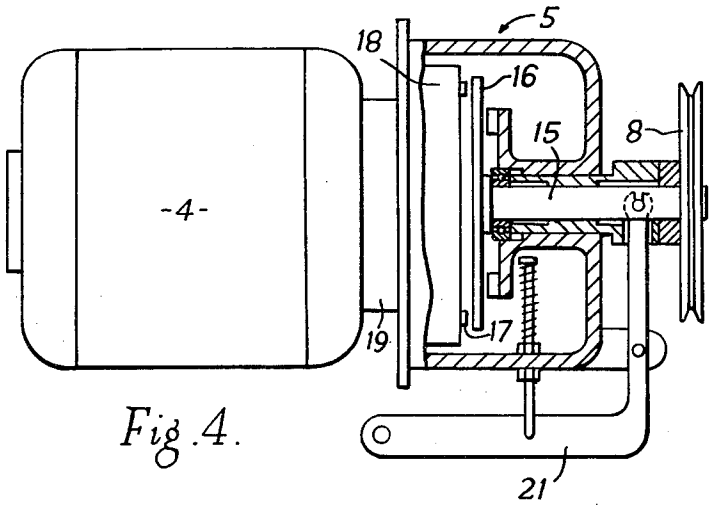


Fig. 4.

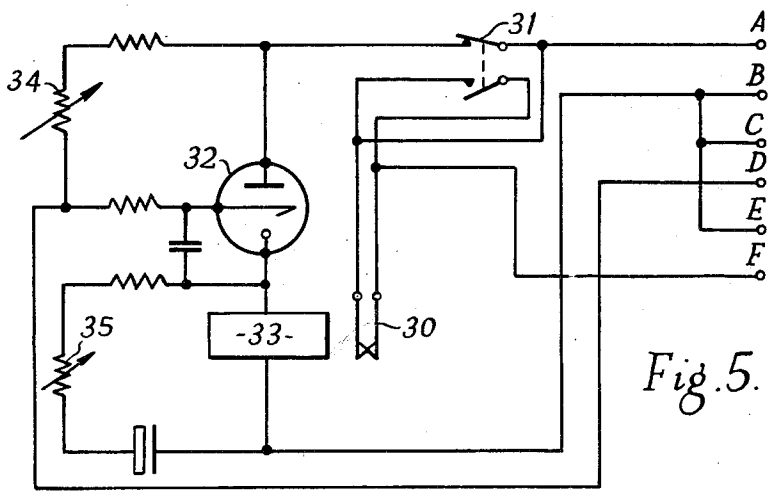


Fig. 5.

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SEWING MACHINES

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Claims priority, application Great Britain, Oct. 2, 1962, 37,232/62; Nov. 22, 1962, 44,129/62
5 Claims. (Cl. 112—219)

This invention relates to industrial sewing machines, being applicable to most of the many and various types of these machines with a degree of benefit which must vary with the situation and task to which a particular machine is dedicated.

Although its potential has not been exhaustively investigated it is clear that the sewing machines used in the garment industry, such as overlock seaming and welting machines, flatlock machines, and the like are particularly good subjects for the application of the present invention. Indeed it has been developed practically in connection with an overlock sewing machine so that it will be convenient, and appropriate, to concentrate on this particular application in the ensuing exposition of the invention. This will, of course, be subject to the qualification that its details and features, the problems it is designed to meet, and the advantages it can bring about will be applicable to a greater or lesser degree to other types of industrial sewing machine, which are therefore to be regarded as within the purview of the present invention.

Overlock sewing machines, then, are equipped with a feeding and stitching mechanism comprising means to feed the fabric through the stitching zone of the machine and means to form a line of running chain stitches in the fabric during its passage through this zone. The feeding and stitching mechanism is driven from an electric motor and its starting and stopping are controlled by the user of the machine by a manual or foot interruption of the drive for this mechanism. This is implemented in various ways, for example by operation of a motor switch, by engagement and disengagement of a clutch in the drive from the motor, and so on.

Now experience has overwhelmingly proven that in industrial use the length of "chain" (i.e. line of chain stitching) invariably overruns the part of the garment or fabric (hereinafter referred to as the "work") to be stitched by a substantial amount, due to such factors as inertia in the machine, inattention or tiredness of the operator, and so on. The machines are in fact usually equipped with a handy knife edge on which the excess thread is cut off and discarded.

With some kinds of work it is found that as much thread goes to waste as is used in the garment, and it will therefore be clear that, with an operator dealing with many pieces of work per shift and a large number of machines being operated at a time, the sheer loss in thread can be a substantial factor in the cost of the product, especially where expensive thread is used, apart from the extra provision which has to be made for clearance of the waste thread from the stitching zone to avoid hindrance of the work, the collection and disposal of this thread in bulk, the more frequent replenishment of the machines with fresh spools of thread, and the extra wear and tear of the machine parts in making the superfluous stitches.

The subject of this invention is a means which meets this problem (and analogous problems in other forms of sewing machine) and lies in the installation in a sewing machine provided with a thread feeding and stitching mechanism and manually- or foot-operated means dictating the starting and stopping of this mechanism, control equipment comprising a detector at the stitching zone of the machine to detect the presence of work in this zone and responsive to absence of such work to operate a control device for arresting said mechanism irrespective of the status of said manually- or foot-operated means.

The benefit flowing from this simple exposition of the arrangement will be manifest. In brief it means that when work is introduced into the stitching zone it will affect the detector to allow the feeding and stitching mechanism to be operated in the normal way but, as soon as the work has cleared this zone, the overriding control now imposed will immediately terminate the feed, and in particular the "stitching," in such way as to prohibit any unnecessary utilisation of thread.

The invention includes the provision, in an industrial sewing machine having a clutch-controlled driving transmission to a thread feeding and stitching mechanism, of control equipment comprising a control device adapted to intervene and interrupt said transmission, and a detector sensing the presence of work at a control point in or adjacent the stitching zone in the machine and operating said control device.

A standard form of treadle-controlled drive to an overlocking machine includes a prime mover in the form of an electric motor the shaft of which is coupled through a friction clutch to a pulley which, through a belt, drives a pulley fixed to an input spindle of the feeding and stitching mechanism of the machine. This form of drive has the useful feature that the operator can vary the slipping of the clutch and thus the speed at which the work is fed through the stitching zone, this assisting the positioning of the work during its feed (and hence the location of the stitches in the finished product) and, for example, enabling the feed to be stopped altogether for the incorporation at some stage of an extra piece of fabric, or the pleating of this fabric, and so on.

In applying this invention to such constructions the control device will be used to override the action of the clutch, thus terminating the stitching action automatically at required times, irrespective of the user's manipulation of this clutch. This can be accomplished in various ways, for example the control equipment may include a relay adapted to emit electrical signals in response to the operation of said detector, and a control device operable by said electrical signals for uncoupling the drive from said motor to the work guiding and stitching mechanism.

The work detector may also assume various forms. A light-responsive detector is particularly suited and effective results have been obtained by the use of a light sensitive device or photoelectric assembly immediately at the entrance of the stitching zone of the machine, this assembly comprising a light source positioned immediately above the threshold of the worktable and directed towards a photocell unit arranged vertically beneath it, e.g. let into the margin of the table itself. A light sensitive device of this character can be arranged to react instantaneously to the cessation of work at the threshold of the stitching zone.

Again, it is very convenient to utilise electromagnetic means for transmitting the signal from the detector to the control device. Thus, the signal emitted by the photocell unit or equivalent can be used to control an electric supply to the winding of a solenoid link in the clutch assembly between the work feeding and stitching mechanism and a driving motor.

To cater for potential changes in ambient light conditions the assembly may include provision for variation of

the intensity of the light source, or a sensitivity control in the photo cell circuit.

In practice, moreover, it is found of advantage to provide for control of the delay in cessation of stitching when work has cleared the threshold of the stitching zone. This is the case, for example, where, to avoid any chance of unravelling of the thread in a sewn garment, it is advantageous for the ends of a line of stitching (particularly overlock chain) to be turned back and trapped in the garment by a superposed piece of fabric (so-called "bartacking"). On the other hand, it is still desirable, keeping the aims of the invention in mind, to control the length of surplus stitching which is allowed for this purpose, and which may vary for different classes of work. To cater for this, where using an electro-magnetic arrangement as described above the relay circuit referred to will advantageously be connected to one, two or more capacitances which can be incorporated selectively and at will into the circuit, to provide for a variable time delay in the operation of the electromagnetic link.

A specific form of the present invention will now be described in more detail with reference to the accompanying drawings, in which:

FIGURE 1 is a front view of an overlock sewing machine installation incorporating control equipment according to this invention.

FIGURE 2 is a side view of the installation seen in FIGURE 1.

FIGURE 3 is an enlarged perspective illustration of the overlocking machine per se.

FIGURE 4 illustrates the motor and clutch assembly operating the machine, with the clutch seen partly in vertical cross section, and

FIGURE 5 is a diagram of the electrical arrangement controlling the equipment according to this invention.

The invention is assumed, in the accompanying drawings, to be applied to an overlocking machine of a standard type manufactured by the Singer Manufacturing Company under the designation 246K. This machine is generally denoted **1** in the drawings where it is shown mounted on a table **2** supported by a frame **3**. It is driven by a motor **4**, also supported on this frame, through a friction clutch **5** which is operator-controlled through a treadle **6** and drives the machine through a belt and pulley transmission **7**, **8**, **9**.

The overlocking machine itself is shown on a larger scale in FIGURE 3 which, however, only depicts the main components of the machine which, in itself, forms no part of the present invention. Thus FIGURE 3 illustrates the body of the machine with the left hand section **10** of the casing swung aside to expose part of the work feeding and stitching mechanism. FIGURE 3, in fact, shows a first looper **11**, a second looper **12**, toothed work-advancing bars **13**, and a needle **14**, all of conventional construction and designed to feed fabric or other work through the machine and at the same time sew it with a line of chain stitching.

The end pulley **9**, which is mounted on the main shaft (not shown) of the machine driving the feeding and stitching mechanism, is, as indicated above, driven from the pulley **8**. This latter is disposed on the axially-movable shaft **15** of the clutch **5**, the shaft **15** carrying a friction plate **16** cooperating with friction rings **17** on a plate **18** coupled to the output shaft **19** of the electric motor **4**. Shaft **15** is normally movable between its clutch engaging and disengaging positions by depression and release of the treadle **6**, this acting on the shaft through a coupling **20** incorporating a pivoted bellcrank lever **21**.

Hence, under normal conditions, an operator seated in front of the machine places the fabric to be stitched on the stitch plate **22**, formed by the upper face of the machine casing section **10**, at the stitching zone **23** at which the loopers **11** and **12** and the needle **14** act in cooperation. The feeding and stitching mechanism is set into

motion by depression of treadle **6** and this continues so long as the operator's foot remains on the treadle. In practice it is found that, due to the human factor, the clutch will not be released and the feeding and stitching mechanisms not arrested until well after the fabric has cleared the stitching zone of the machine—leaving a substantial tail of waste chain stitch which has subsequently to be cut off. As has been indicated, the primary purpose of the equipment of the present invention is to render the cessation of the thread feed automatic when the fabric or work has passed out of the stitching zone and thus avoid the waste of thread and operator's time.

To accomplish this we provide for the clutch to be automatically disengaged, to which end the coupling **20** incorporates a solenoid link **24**, **25** comprising an armature core **24** connected to treadle **6** and a winding in a surrounding housing **25** connected to the clutch-operating means. The armature winding **25** is energised only so long as work is present at the critical part of the stitching zone **23** of the machine. At all other times the solenoid winding is automatically de-energized to allow the clutch to uncouple the driving motor **4**.

In implementation of this overriding, automatic operation of the clutch, a photo-electric assembly is provided at the stitching zone, this including a light source housing **26** mounted vertically above the critical entry point into the stitching zone, and a cooperating photo-cell unit **27** disposed directly therebelow. In FIGURE 3 the unit **27** is shown mounted on the post **28** of the machine; it is normally covered by the stitching plate **22** of the machine which, however, is provided with an exposure window **29** at the appropriate part.

The arrangement is that, so long as the light beam between **26** and **27** is obscured by the presence of work (fabric) in the stitching zone, then the drive to the motor can be operated normally through the treadle **6** but, as soon as the work has cleared the window **29**, the solenoid **24** will be operated to disengage the clutch, irrespective of the action of the operator's foot on treadle **6**.

The electrical connections to achieve this end are illustrated in FIGURE 5. This shows circuits ending in terminals marked A . . . F. Of these terminals A and B are connected to AC mains, C and D to the photo-cell unit **27**, and E and F to the winding of solenoid unit **24**, **25**. It will be noted that the circuits illustrated include a start and stop switch **30** for the solenoid **24**, **25** being connected to the latter through the terminals E, F; a double arm switch **31** by means of which the photo-electric assembly can be brought into use or cut out when not required, and a cold cathode tube **32** which, when operated by the photo-electric assembly, will trigger the supply to the solenoid winding through terminals E, F and through a relay coil indicated at **33**.

It will also be noted that the electrical arrangement includes an adjustable rheostat **34** which regulates the sensitivity of the equipment to cater for variant light conditions under which the machine may be used. It will be appreciated that where, for example, the machine is in use in a factory relying on daylight or daylight and artificial lighting, the light intensity may be liable at times to vary to a degree sufficient to affect the photo-cell unit **37**.

The circuits also include a rheostat **35** which is adjustable for the purpose of applying a variable time delay to the operation of the solenoid even after the work has passed the critical point in the stitching zone. It may, in fact, be of advantage when the machine is used for certain types of work, to set it up to stitch a specific length of chain beyond the edge of the fabric, for example in connection with bartacking.

The various switches and resistances referred to are grouped together in boxes **36** and **37** mounted on the frame **3** and having readily-accessible manual buttons and knobs, as indicated in FIGURE 1.

The arrangements described above are not exhaustive

of the possibilities within this invention. Thus, for example, the control of the work feeding and stitching mechanism may be exercised by the arrangement of fast and loose pulleys on the main input spindle of the feeding and stitching mechanism of the machine, one or other of these pulleys being driven, at any time, by a belt which itself is driven from the main motor of the machine, for instance through the friction clutch referred to above, and the belt being shifted from the fast to the loose pulley under the dictation of the detector.

We claim:

1. In a sewing machine provided with a work feeding and stitching mechanism which acts at a stitching zone of the machine and is driven from a motor through a driving transmission including a clutch which is coupled through a linkage to a foot-operated means dictating the starting and stopping of the said mechanism, control equipment comprising an electro-magnetic device incorporated directly in said linkage so as to form part of the latter, a photo-electric detector device arranged at said stitching zone to detect the presence of work in said stitching zone, an electrical circuit incorporating said detector device and said electro-magnetic device, and an adjustable time delay device connected into said electrical circuit, whereby, when the detector device detects the absence of work in the stitching zone, the electro-magnetic device is operated through the electrical circuit and under the action of the time delay device so that the clutch is disengaged and the work feeding and stitching mechanism is arrested independent of the position of the foot-operated means.

2. Sewing machine control equipment according to claim 1, in which the time delay device comprises a rheostat connected in the electrical circuit.

3. In a sewing machine provided with a work feeding and stitching mechanism which acts at a stitching zone of the machine and is driven from a motor through a driving transmission including a clutch which is coupled through a linkage to a foot-operated means dictating the starting and stopping of the said mechanism, control

equipment comprising a photo-electric detector device which is arranged at the stitching zone of the machine to detect the presence of work in this zone and is operable in the absence of such work, an electrical circuit incorporating said detector device, a relay in said circuit adapted to emit electrical signals in response to the operation of the detector device, an electro-magnetic device which is incorporated directly in the said linkage so as to form part of the latter and is connected into said electrical circuit, this electro-magnetic device being operable by the aforesaid electrical signals to interrupt the linkage and thereby disengage the clutch and arrest the work feeding and stitching mechanism independently of the foot-operated means, and an adjustable time delay device in the electrical circuit adapted to impose a variable time delay on operation of the electro-magnetic device after the emission of electrical signals by the said relay.

4. Sewing machine control equipment according to claim 3, in which the said electrical circuit incorporates a rheostat for varying the light sensitivity of the photo-electric detector device.

5. Sewing machine control equipment according to claim 3, in which the electro-magnetic device comprises a solenoid link having an armature core and a winding which are connected through links of the linkage to the foot-operated means and the clutch respectively.

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