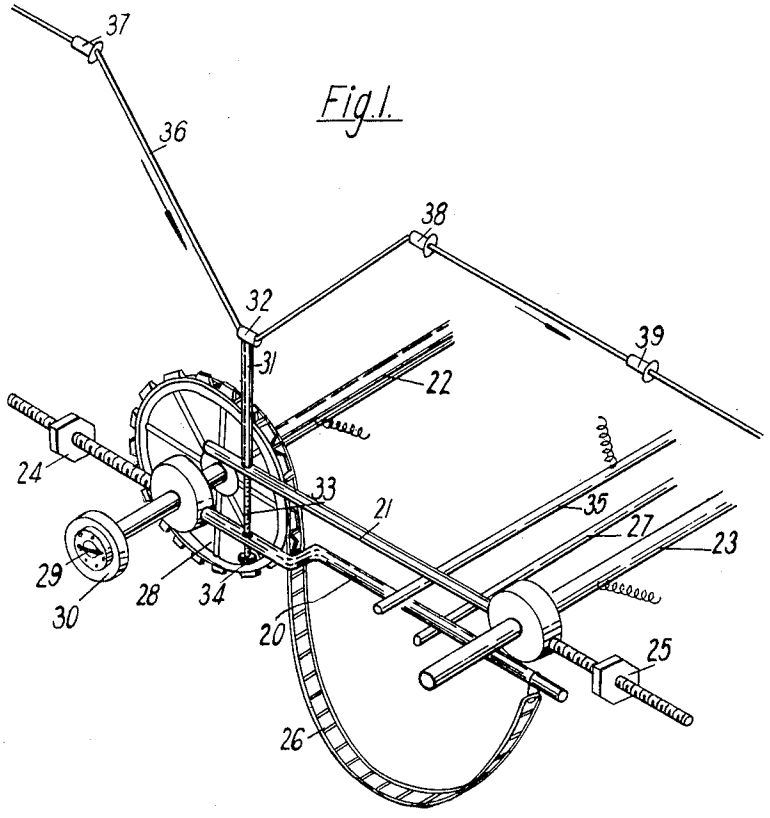
Jan. 4, 1966 S. DAVIES ETAL 3,227,833

ELECTRIC CIRCUIT CLOSING DEVICE OPERATED BY YARN TENSION

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Fig. 1.



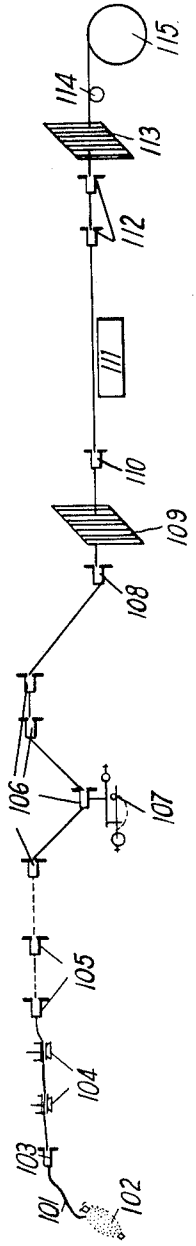
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Fig. 2



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ELECTRIC CIRCUIT CLOSING DEVICE OPERATED BY YARN TENSION

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8 Claims. (Cl. 200—61.13)

This invention relates to an improved device for actuating a stop motion, particularly suitable for use with textile warping or beaming machines, which operates when excessively high or low tensions obtain in the threadline. For some textile operations, for example warp knitting, it is sometimes desirable that yarns or threads be available on a form of package which allows a multiplicity of ends to be taken off simultaneously and in parallel. In order to obtain yarns on such a package the requisite number of bobbins are mounted on a support, for example on a creel, and the yarns are fed through guides and reeds to form a flat sheet which is wound upon a beam. This operation is commonly known as warping or beaming.

It occasionally happens during warping or beaming that the tension in a threadline increases to the point when the thread breaks, the break usually occurring at the front reed of the machine where the threadline tension reaches a maximum. This increase in tension may result from faulty supply packages, containers, caps, reeds or other damaged surfaces with which the yarn comes into contact, the faulty surface usually being at or near to the creel. Threadline breaks also appear owing to creel run-outs, i.e. all of the yarn on a package is used before the operative attending to the machine changes the package for a full one.

It is necessary when a threadline-break occurs to stop the machine so that an operator can join the two broken ends of the thread together usually by knotting. Since it is not possible for the human eye to readily detect threadline breaks in a wrap sheet which may contain many hundreds of threads, devices designed to actuate stop motions are employed which cause the machine to be stopped rapidly after a threadline break has occurred. The devices in current use are commonly of the dropper-arm or tow tension type in which weighted arms are supported by the running threadline and when a break occurs in the threadline the weighted arm falls and makes connection with an electrical contact to close a circuit which operates a means for stopping the machine. Devices of this type, which are usually fitted at or near the creel, are not wholly effective in detecting threadline breaks which occur at or near the front reed, since a broken thread may become entangled with adjacent threadlines with the result that the tension in the yarn is maintained and therefore the dropper arm does not operate and the brake passes undetected. The dropper arms of these devices require good "frictionless" bearings for efficient operation and contamination often prevents them from operating, thus allowing breaks to pass undetected. Another important defect of this type of device concerns the delay which takes place on a break occurring and the stop motion device operating to bring the machine to a stop. As a result of this delay a considerable quantity of yarn may be wound on to the beam after a break occurs. In order to recover the broken end from the beam the excess yarn may be wound back off the beam on to an accumulator. However the accumulator has only a limited capacity, e.g. in the region of about 10 yards, and at high warping speeds too much yarn may be wound on to the beam for the broken end to be recovered;

this end then becomes known as a "lost end." The corresponding end from the creel has then to be marked, usually by tinting with a dye so that it can be recognised during knitting, and banded in by wrapping around the beam. Experience shows that about 10% of the threadline breaks which occur give rise to "lost ends."

The elimination of "lost ends" is of great importance in the textile trade since they are detrimental to beam quailty; each "lost end" resulting in two stoppages during knitting thereby causing a loss in production and in addition the dye used in tinting may cause staining if it is not completely fugitive.

There is, therefore, a need for a device to actuate a stop motion which will operate either at the front reed of the warping machine, in which case the braking by the stop motion would have to be almost instantaneous to prevent the broken end being wound on to the beam, or when conditions prevail which are likely to cause a threadline break.

It is known that, although the threadline break normally occurs at the front reed of the warping machine where the threadline tension is at a maximum, it is usually the result of an increase in tension at the creel owing to faulty supply packages, caps, containers or the like. Therefore if gross increases in tension of the threadline at the creel are detected and made to operate a means for stopping the machine, then the machine operator is able to take remedial action to relieve the tension and prevent a break occurring.

The object of the present invention is, therefore, to provide a device for actuating a stop motion to halt the feeding of threads to a beam, which operates the said stop motion when the tension in a threadline becomes either excessivley high, owing to the occurrence of a fault at the creel for example, or falls to nearly zero following a threadline break, and which thus largely overcomes the objections of the prior art devices.

Accordingly the present invention provides a device for actuating a stop motion connected with a thread feeding or winding mechanism comprising a pivotally mounted beam adapted to be moved into electrical contact with a contact bar when the tension of a thread falls below a predetermined limit and a second beam also adapted to be moved into electrical contact with a contact bar when the tension of a thread rises above a predetermined limit, characterised in that a member having a thread-engaging portion is both connected with said first mentioned beam normally to hold it out of electrical contact with said contact bar and carries means for moving said second mentioned beam into electrical contact with said contact bar, said second mentioned beam being supported by a fixed member and carrying an adjustable weight which normally holds it out of contact with said contact bar.

A preferred embodiment of the invention, hereinafter more fully described, comprises a combination of a chain and lightweight beams, one of which beams is arranged to be supported by a thread. Upon an increase in tension in the threadline to a predetermined value the beams are raised and make a connection with a contact bar which closes an electric circuit operating a relay which in turn actuates a means for stopping the machine. The threadline tension at which the beam closes the electric circuit is determined by the weight of the chain which is suspended by one end from one of the beams. The other end of the chain is attached to a sprocket mounted on a shaft one end of which terminates in a pointer knob. By turning the knob, and hence also the shaft and sprocket, the amount of chain suspended from the beam can be varied. The shaft on which the sprocket is mounted is designed to carry a plurality of such sprockets so that an equivalent

number of stop motion devices can be simultaneously adjusted by turning the one knob, for example thirty such stop motion devices can be mounted so as to be adjustable by the knob.

Should the tension in the threadline increase so rapidly that a break occurs before the machine can be brought to a complete halt, the recovery of the broken end from the beam is an easy task since only a relatively small amount of yarn would have been wound on to the beam after the break occurred.

There will now be described with reference to the accompanying drawings the aforementioned embodiment, which description is by way of illustration and not limitative of the invention.

In the drawings FIGURE 1 is a diagrammatic view of a preferred embodiment of this invention, FIGURE 2 is a diagrammatic representation of a single threadline path from a package to the beam during warping.

In FIGURE 1, **20** is a lightweight beam pivotally mounted on a transverse shaft **22** which is rotatable about its axis and **21** is a lightweight beam spaced vertically above beam **20** and pivotally mounted on a fixed shaft **23**. Counter-balancing weights **24** and **25** are provided at one end of each of beams **20** and **21** respectively. A chain **26** is suspended from the free end of the lower beam **20**, which is supported by the transverse rod **27** and the other end attached to a toothed wheel **28** which is firmly mounted on shaft **22**. One end of the said shaft **22** terminates in a knurled pointer knob **29** that co-operates with a fixed dial **30**. The free end of beam **21** carries an upwardly extending fixed rod **31** having thereon an eyelet **32**. An extension **33** of rod **31** extends downwardly from beam **21** passing through beam **20** and terminating in a stop **34**. A fixed transverse electrical contact bar **35** is positioned between the beams **20** and **21**. A threadline **36** passing from a package to a beaming machine is led through the fixed eyelet **37** to the eyelet **32** mounted on rod **31** and thence through fixed eyelets **38** and **39**.

The normal threadline tension encountered during warping is sufficient to support the beam **21**, the weight of which causes the threadline **36** to flex downwardly to some extent. An increase in threadline tension occasioned, for example, by a fault at the creel causes the beam **21** to be raised thus drawing the downwardly extending rod **33** through beam **20** until the stop **34** meets the said beam **20**. A further increase in threadline tension to a predetermined level then causes beam **20** to be raised together with beam **21** until the former makes contact with the contact bar **35** thus closing an electric circuit which actuates a relay and operates a stop motion to prevent further feeding of the threadline to the warping beam. The threadline tension required to raise beam **20** and thus close the electric circuit is determined by the weight of chain **26** suspended from the said beam, which weight of chain can be varied by rotating the shaft **22** by means of the knurled knob **29** and thus causing the toothed wheel **28** to deliver or take up chain as required. The dial **30** is calibrated in terms of threadline tension and thus the threadline tension required to cause beam **20** to close the electric circuit can be selected by turning the knob **29** to correspond with the appropriate point of the dial.

In this embodiment of the invention beam **21** is designed to operate as a dropper arm in the normal manner. In the event of the threadline tension falling to zero or nearly to zero as a result of a threadline break occurring which may not have been preceded by an increase in threadline tension, e.g. a creel run-out, the beam **21** falls and makes contact with contact bar **35** thus closing an electrical circuit and operating a stop motion as previously described.

In FIGURE 2 a thread **101** is taken from a package **102** mounted on a creel, passed through eyelet **103** to tensioning devices **104** and thence through more eyelets **105** to eyelets **106** of the stop motion actuating device **107** of this invention, the foregoing all being mounted on a creel (not shown). From the stop motion actuating device the threadline is passed through eyelet **108** and front reed **109** of a warping machine, through eyelet **110**, over a warp sheet inspection device **111**, through eyelets **112**, back reed **113**, over gumming-out bar **114** and is then wound up on beam **115**.

In operation the threadline tension at which the device is required to actuate the means for stopping the machine, hereinafter referred to as the operating tension, is pre-set by adjusting the amount of chain **26** extending between the beam **20** and the sprocket **28** by the rotation of the knob **29** thus determining the amount of resistance to the upward movement of the free end of the beam **20**. The weight of the beam **20** is so arranged that rod **31** will flex the threadline downwardly between the guides under normal threadline tension so that when the tension in the threadline increases owing to a fault occuring at the creel, for example, the beams are raised. If the operating tension is reached beam **20** makes a connection with the contact **35**, and an electric circuit operating a relay is closed, the relay in turn then actuates a means for stopping the machine. A light on the creel (not shown) indicates the position of the faulty threadline and an operator can then take corrective action without a break having occurred. Since the connection between the beam **20** and the contact **35** may be of only a short duration, owing to "snatching" of the threadline for example, the relay must be sensitive and must be arranged to remain closed even after the circuit has been broken again. For this purpose a silicon controlled rectifier, wired into the electrical circuit as described hereinafter, has been found to be effective and reliable.

In the electrical circuit a 12 volts A.C. current derived from the secondary winding of a transformer is fed to a fullwave rectifier through a relay. The relay is designed to operate on a wide range of currents and when energized, by the closing of a contact on the device of this invention, actuates a means for stopping the machine.

The output D.C. voltage from the aforementioned fullwave rectifier is smoothed by a resistance and condenser and applied to a silicon controlled rectifier in series with a 12 volt indicating lamp with a shunt resistor. A third electrode from the silicon controlled rectifier, called the trigger electrode is connected to the electrical contacts at each threadline position. Any contact closing at a threadline position causes the silicon rectifier to pass current causing the lamp to light and the relay to operate. The silicon controlled rectifier continues to pass current until a reset button is pressed after the fault which caused the contact to close has been removed, hence a momentary tension snatch is enough to cause the machine stop motion to be actuated.

In the event of a threadline breaking without the tension first rising to the operating value beam **21** falls under its own weight and makes a connection with contact **35**, the stop motion then being actuated as before.

Since devices of this type are frequently employed under conditions of high humidity, care should be taken to ensure that their component parts, particularly the bearings and electrical contacts, are formed of materials which do not corrode under such conditions. Thus it may be found to be advantageous to form the beams and toothed wheel of a rigid plastic, metal strips being attached to the beams to provide means for making electrical contact with the contact bar. The aforementioned metal strips and the contact bar may be gold plated to prevent corrosion. The bearings may conveniently be formed of polytetrafluoroethylene, which gives a good "frictionless" surface under conditions of high humidity.

This embodiment may also be adapted by suitable adjustment of the operating tension to prevent the occurrence of "tight ends," that is one threadline being wound on to the beam at a considerably higher tension than other threadlines, which are also known to cause difficulties during knitting.

What we claim is:

1. A device for actuating a stop motion device associated with a thread handling mechanism comprising: a first pivotally mounted beam movable toward and away from a position in which said first beam actuates a stop motion device when the tension of a thread falls below a predetermined limit; a second pivotally mounted beam movable toward a position in which said second beam actuates the stop motion when the tension of the thread rises above a predetermined limit; thread-engaging means carried by said first beam for normally holding said first beam away from its actuating position; means carried by said first beam and engaging said second beam and moving said second beam toward its actuating position upon a predetermined amount of movement of said first beam away from its actuating position; and an adjustable weight carried by said second beam for normally holding said second beam out of its actuating position.

2. A device as in claim 1 including an electrical contact bar which said beams engage in their actuating positions.

3. A device according to claim 1 wherein the weight acting on said second beam is varied to vary the threadline tension at which that beam will be moved to the position in which it actuates a stop motion device.

4. A device according to claim 3 wherein the weight is in the form of a chain one end of which acts on the free end portion of said second beam and the other end is attached to a toothed wheel mounted on a rotatable shaft, the weight of chain acting on the beam being varied by winding portions of the chain on or off the toothed wheel by suitable rotation of the shaft.

5. A device according to claim 4 wherein the toothed wheel and said second beam are mounted on a common shaft.

6. A device according to claim 4 wherein the weight acting on said second beam bears a direct relationship to the tension in the yarn required to cause that beam to move to the position in which it actuates a stop motion device.

7. In a thread-handling mechanism a device for actuating a stop motion device upon excessively high or excesssively low tension in the threadline comprising: a

first beam pivotally mounted for downward and upward movement toward and away from a lower position in which said first beam actuates a stop motion, said first beam being urged by gravity toward said lower position; thread-engaging means normally holding said first beam away from its lower position and responsive to an excessive increase in thread tension for moving said first beam still further away from said lower position; a second beam pivotally mounted below said first beam for upward and downward movement between an upper position in which said second beam actuates a stop motion and a lower position engaging a support member; an adjustable weight carried by said second beam for normally holding said second beam in engagement with said support member; means carried by said first beam for engaging said second beam and moving said second beam toward its upper position upon a predetermined amount of movement of said first beam away from its lower position, whereby excessively low tension in the threadline effects movement of said first beam to its lower, actuating position and whereby excessively high tension in the threadline effects movement of said second beam to its upper, actuating position.

8. A device is in claim 7 including an electrical contact member located to be engaged by said first beam in its lower position and by said second beam in its upper position.

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