Nov. 12, 1968 H. HOPF 3,410,314

CONTROL DEVICE FOR MOVABLE THREAD GUIDES

Filed Aug. 26, 1966

2 Sheets-Sheet 1

FIG. 1

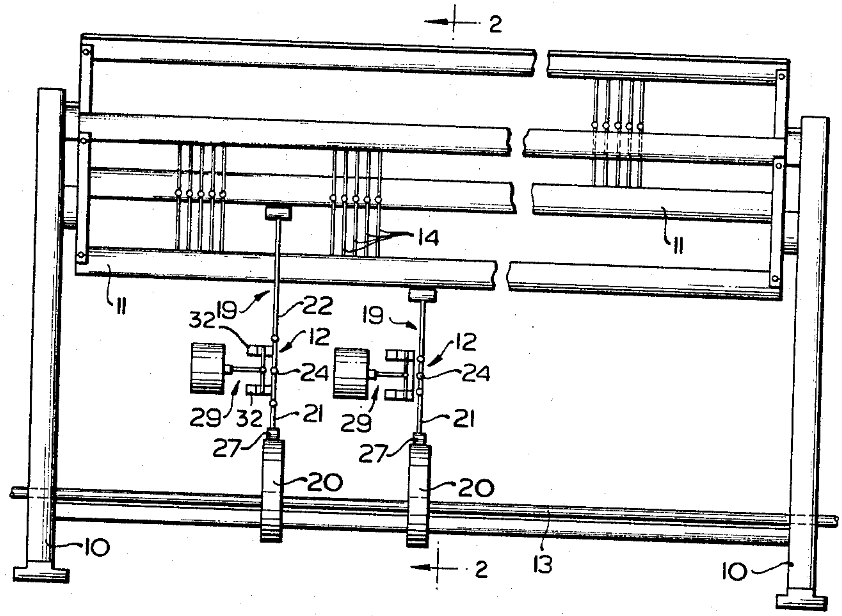
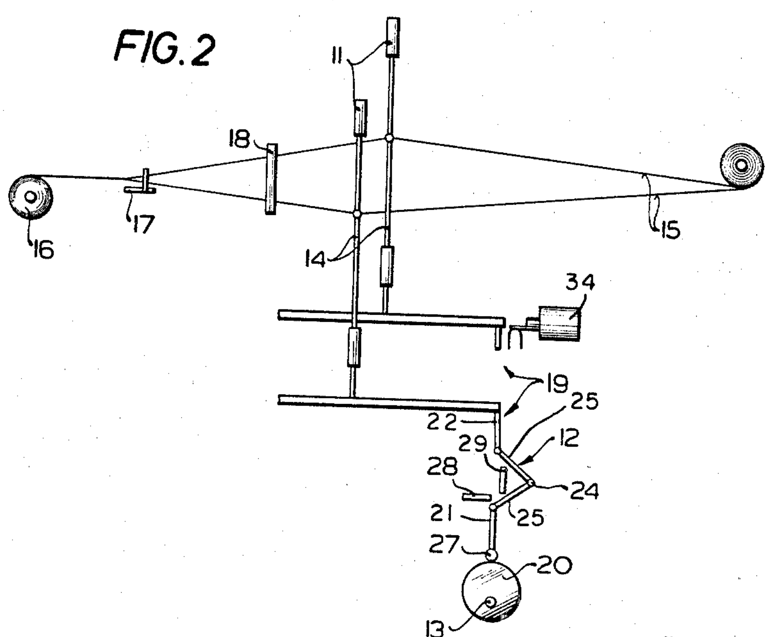


FIG. 2



INVENTOR
Hans HOPF

By

[signature]

his ATTORNEY

CONTROL DEVICE FOR MOVABLE THREAD GUIDES

Filed Aug. 26, 1966 2 Sheets-Sheet 2

FIG. 3

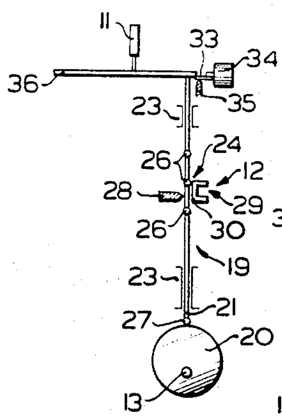


FIG. 4

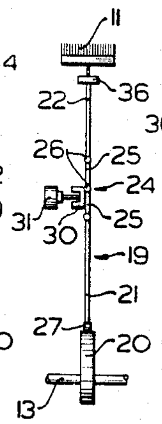


FIG. 5

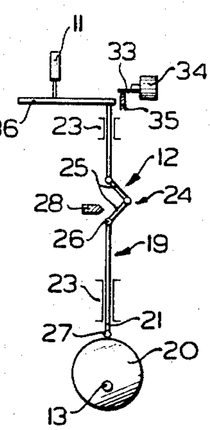
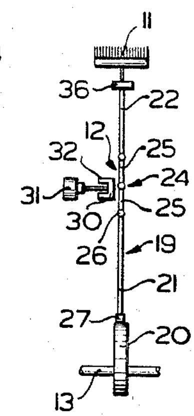


FIG. 6



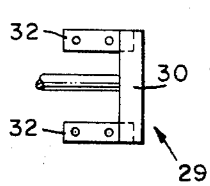


FIG. 2a

INVENTOR
Hans HOPF
By

his ATTORNEY

United States Patent Office

3,410,314

Patented Nov. 12, 1968

1

3,410,314
CONTROL DEVICE FOR MOVABLE THREAD GUIDES

Hans Hopf, Dorfanger, Germany, assignor to The Continental Elastic Corporation, New Bedford, Mass., a corporation of Delaware

Filed Aug. 26, 1966, Ser. No. 575,297
Claims priority, application Germany, Sept. 14, 1965
G 44,670
9 Claims. (Cl. 139—57)

ABSTRACT OF THE DISCLOSURE

The present invention relates to a control device for movable thread guide devices such as harnesses of looms which are moved by an associated rotating eccentric cam with the interposition of an associated transmission element, the effective length of which may selectively be changed as by means of associated stop members.

In looms having, for instance, harnesses as thread guiding devices in which the movement of the harnesses is effected by cams, it is necessary to provide a separate cam for each individual harness. Every weave pattern, furthermore, requires a separate cam arrangement. Accordingly, with each change of the weave pattern, the entire cam arrangement must be re-arranged, which is extremely time-consuming. Furthermore, in most cases when the pattern is changed, not only must the cams be re-arranged, but they must also be replaced by cams having different cam surfaces.

It is therefore necessary, in order to have the possibility of making different patterns, to keep in stock a large number of cams provided with different cam surfaces. Furthermore, it is to be noted that even if cams with various different cam surfaces are used, the number of designs available is limited to the cams in stock.

Looms are also known in which in order to form the weave pattern, the harnesses are moved by dobbies. In this way the disadvantage of the limited number of possible patterns is eliminated. In order to control the dobbies, cards are used which have punched holes, for example, to define a pattern and which are scanned by feeler pins. This use of dobbies to control the pattern is, however, relatively time-consuming and hence limits the operating speed of the loom so that its full capacity is not utilized.

The object of the present invention is to provide control devices for movable thread guide means of the type above described which will afford a very high degree of speed in the movement of the thread guide means or harness, according to any desired pattern with relatively simple and readily controllable mechanism.

This object is obtained, according to the invention, by controlling the effective length of the transmission elements arranged between the cam and the harness. Depending on the effective length of the transmission element, which is present at the time, the motion impulse caused by the rotating cam will not move the corresponding thread guide or harness at all, or will move it by a maximum amount, or by one or more intermediate amounts. In the case of a loom provided with harnesses, this means that the harnesses can be moved under the control of the transmission elements into a lower shed or an upper shed, or one or more intermediate sheds. In this way the transmission element itself is used to control the movement of the harnesses. It is to be noted that when changing the pattern, no cams need be changed or removed since the movement impulse coming therefrom is always governed by the effective length of the transmission element which determines whether the impulse results in a change of harness motion or not. In this way the cams can be simple circular harmonic cams and furthermore, it is possible to have the movement impulses for the various transmission elements produced by a common cam drive shaft. The direction of the transmission element can be as desired so that a raising or lowering or even a lateral displacement of the thread guide harness means can be effected.

2

The transmission element, according to the invention, is a pusher rod having a deformable portion and controlled in various manners so that the effective length of the rod may be adjusted in accordance with the desired position of the thread guide means or harness.

According to a preferred embodiment of the invention, the deformable portion is formed by pivoted arms or links which may be moved or bent laterally outward to change the effective length of the rod.

The extent of the lateral deflection of the pivoted elements determines the effective length of the pusher rod.

The mechanism to restrain movement of the deformable portion of the rod could be icnorporated into the pusher rod itself. However, it is preferred to use an arrangement in which the deformable portion will automatically bend due to the load acting on the pusher rod, produced between the driving cam and the thread guide means or harness and to restrain such bending by a movable stop. With this arrangement a control system is provided which in a simple manner either holds the thread guide device in position or moves it out of such position. The stops which restrains deformable portion from bending can be fully mechanical or an electric magnet can be employed to bring the stops into an active and/or an inactive position. The stops can be alternately moved by the electro-magnets into one direction or the other, for instance by means of reversing the polarity of the current applied to the magnet. However, it is also possible to move the magnets by electrical energization in one direction while the movement in the other direction is effected by gravity or a pre-tensioned spring.

The control device is also simplified if the deformable portion of the pusher rod is retained in its maximum effective length by a fixed stop slightly in front of its stretched position. In this way, there is introduced a slight bend of the deformable portion which permits further bending to be effected without special auxiliary means and without loss of time. The stop can also serve as the guide for the pusher rod.

The pusher rod itself may be of various type and may consist exclusively of a bendable member. However, it is preferable that the deformable portion be intermediate the ends of the rod so that the rigid portions can readily be guided in their longitudinal direction.

It has been assumed that each individual thread guide device or harness has associated with it, with the inter position of a pusher rod, only one cam. In order, however, to multiply the number of possible patterns, several, and preferably two cams are provided, staggered with respect to each other and both associated with a single thread guide device or harness through an associated pusher rod. In this way it is possible to lift the thread guide device or harness by one cam when the other cam is still in the low position. The cams are preferably arranged staggered apart with uniform spacing, for instance, in the case of two cams they may preferably be 180° apart from each other.

The number of patterns that can be formed can be further increased by holding the harness once it has been raised, by providing an insertable lock which holds the harness firmly. The raised position need not in this connection necessarily be a high position, it can, for instance also be a middle position or intermediate position when several sheds are to be formed. It is possible, in principle, to move the lock completely mechanically, but for a high speed of movement it is desired to use an electromagnet which actuates the lock. If the entire load of the thread guide device or harness is associated with the lock and thus with the electromagnet, the two must be made relatively large, which involves longer response and movement times. In order to prevent this delay, the lock is retained in its active position on a stationary bearing membed. The stationary bearing member takes over the load so that the lock and the electromagnet can be kept small and can be operated with small current and high speeds.

It is, of course, possible to control the lock both in its inactive position and in its active position. The control, however, is simplified by controlling the lock exclusively into its active position while the passage of the lock into its inactive position is made dependent on the movement of the thread guide device or harness.

The control command for providing a given active length of the transmission device can be effected by the known control devices for weaving machines. For example, the control command can be recorded on pattern cards, punch cards or the like. These control devices can be used in conventional manner to open and close electric circuits. Either sensing fingers can be used or photoelectric cells can be employed. The control command which in itself consists of a very short pulse can be further controlled by an adjustable multi-vibrator circuit in order to adjust the length of the pulse. Thus, it is possible for instance to convert the short control command into a lengthy stop pulse.

In the case of machines operating at particularly high speed, one may cause the locking device to be operated at a speed inversely proportional to the speed of rotation of the weaving machine. For this purpose, for instance, there can be used a tacho-generator which converts the speed into a measurable energy and utilizes the latter to govern the duration of the control. Thus, it is possible to utilize the voltage of the tacho-generator through a pre-magnetized choke to influence a multi-vibrator circuit in such a manner that the magnets of the control device have a stop time which is inversely proportional to the speed of rotation of the weaving machine.

In the accompanying drawings in which are shown various embodiments of the several features of the invention,

FIG. 1 is a view of a loom seen from the rear side,

FIG. 2 is a diagrammatic cross section through the loom taken along line 2—2 of FIG. 1,

FIG. 2*a* is an enlarged detailed view of the stop plate.

FIG. 3 shows a raised harness of the loom seen in the longitudinal direction of the harness,

FIG. 4 shows a raised harness of the loom, but seen in the transverse direction of the harness,

FIG. 5 shows a harness in the lowered position seen in the longitudinal direction of the harness, and

FIG. 6 shows a harness in the lowered position seen from the transverse side of the harness.

It should first be noted that the drawings merely show sufficient mechanism necessary for a clear understanding of the invention. The type of loom in which the invention can be incorporated could utilize a shuttle or be a shuttleless loom and the filling could be introduced by a filling needle or by compressed air. Furthermore, for the sake of simplicity, only two harnesses have been shown, on basis of which the control of the loom will be explained. The number of harnesses can be multiplied within given limits.

The machine frame has two side standards or columns **10** in which conventional harness frames **11** are slidably mounted for up and down movement in suitable guides in manner well known to those skilled in the art. The harness frames **11** are reciprocated by a harness control designated generally as **12** by means of cams **20** mounted on cam shaft **13**.

Each harness frame **11** has a plurality of heddles **14**, through the holes or eyes of which extend warp threads **15**.

Referring to FIG. 2, the loom also includes a take-up roller **16** which takes up the finished web formed from the warp threads **15**. On the side of the warp threads **15** there is arranged a disc **17** which is rotatably supported on a vertical shaft. The disc **17** serves in known manner, together with other generally eccentrically arranged supports to effect movement of a filling needle (not shown) which carries the filling threads. A reed **18** associated with the warp threads operates in conventional manner.

The harness control **12** is shown in detail in FIG. 3 to FIG. 6. In general, it may be stated that the pusher or lifting rod **19**, as illustratively shown, can be adjusted in length to at least two different sizes by the deformation or kinking of linked parts. These sizes result in the corresponding harness positions, for instance, a low position and a high position. The length of the pushers **19** is adjustable. As will hereinafter be described in detail, the control can be effected in such a manner that all known types and patterns of weave can be created. The pushers **19** are moved by cams **20**.

Assuming that circular cams **20** are used, they are eccentrically mounted so that a substantially uniform raising and lowering of the harnesses **11** is assured. For simple patterns, it is sufficient if each harness **11** is moved by only a single cam **20** with the interposition of an associated pusher **19**. If, however, a large number of pattern possibilities is desired, one can proceed in such a manner that two cams **20** act on one harness **11** with the interposition of one pusher **19** for each cam, the cams **20** being, however, 180° apart. It may also be pointed out that the invention is not limited exclusively to deformable pushers **19** of the type shown in FIGS. 3–6. For the sake of simplicity, this form of pusher **19** has been selected in the illustrative embodiment shown. Instead of a deformable region defined by pivoted links, the pusher can have an elastic region, for instance one with springs which bend under load, in which connection, however, the bending can be prevented by holding means such as holding plates or the like and the lifting of the harness **11** is thus made possible.

As illustratively shown, each of the pushers **19** has four arms, i.e., a lower upright arm **21** and an upper upright arm **22**. The two arms **21** and **22** are restrained by guides **23** from moving out laterally and can be moved only in their longitudinal direction. Between the two upright arms **21** and **22** there is interposed a deformable or bendable region **24**, which consists of two links or arms **25** of substantially the same length. All the arms **21**, **22** and the two arms **25** are connected to each other by pivots **26**. This arrangement makes it possible for the arms **25** to move outwardly to one side. In order to reduce the frictional forces between the lower upright arm **21** and the cam **20**, the arm **21** is provided with a roller **27** at its lower end, which cooperates with a cam **20**.

The deformable region **24** has two stops on the two sides lying in the plane of deformation. On the side opposed to the deformable region a fixed stop **28** (FIGS. 3 and 5) is provided. This stop is mounted on the machine frame. Its apex or nose end against which arm **25** abuts is so designed that the two arms **25** forming the deformable or kinkable region **24** cannot assume a completely longitudinally aligned position, but are held by contact against the stop **28** in a slightly bent position at an angle that is slightly less than 180°. This pre-bent position of the arms **25** makes possible a dependable and rapid bending to desired position. Movable auxiliary means can thus be entirely dispensed with. On the other side of the deformable region **24** opposed to the stop **28**, another stop, as already mentioned, is provided. It is designated generally as **29** and is a movable stop. In the active position, i.e., in the blocked position, the stop **29** with its associated stop plate **30** lies within the bent path. Accordingly, bending at the deformable region **24** is prevented by holding the arms **25** between the stops **28, 29.**

The stop plate **30** is so designed with respect to its length and position that the arms **25** when restrained by the stop plate **30** are retained in substantially longitudinal alignment with arms **21, 22** during the entire stroke of the pusher **19.** It can be seen that when the pusher **19** is held locked by the stop plate **30,** as above described, the left movement coming from the cam **20** is also transmitted to the upper end of the harness **11.** If, on the other hand, the stop plate **30** is brought out of the path of movement of the deformable region **24,** the two arms **25** will bend. As a result, the lift which is transmitted from the cam **20** to the lower upright arm **21** of the pusher **19** will be taken up by the deformable region **24** so that the upper upright arm **22** will not move.

In the illustrative embodiment above described, the stop plate **30** is moved by electro-magnet **31.** The plunger (not shown) of magnet **31** has its path of movement perpendicular to the plane of the deformable region **24.** In this manner, the pressure from the elements of deformable region **24** do not act directly on the magnet **31.** Rather, the magnet **31** serves merely to move the stop plate **30.** It is therefore, immaterial whether the magnet **31** acts by reverse polarity in both directions or else only in one direction while the movement in the other direction is effected by mechanical load such as a pre-tensioned spring or a weight. The stop plate **30** is held in the active position against the action of the oncoming pressure of the bendable region **24** by two fixed stops **32.** Accordingly, the magnet **31** only requires little force for energization since it only moves the stop plate **30.** The stops **32** are arranged in such manner that they serve as counter-supports for the stop plate **30** and take up the forces of the bending.

From the foregoing it is clear that by reason of the control of plate **30** by magnet **31,** the harnesses **11** can be alternately raised and lowered. Furthermore, different weave designs may be formed solely by controlling the magnet **31.** This is, however, only a partial utilization of the possibility of control if each harness **11** must be raised or lowered for each cam rotation. However, the harness **11** can be maintained in its lowered position as long as desired by merely retaining the magnet **31** deenergized. In order to raise the harness **11,** the magnet **31** must be energized. In order, however, to be able in a simple manner to obtain all known possibilities of patterns, it is necessary to be able to hold the harness **11,** also as long as desired, in its raised position. For this purpose the harness is retained in its raised position by a control pawl **33.** As can be seen in FIG. 3 and FIG. 5, an electro-magnet **34** is used to move the pawl **33** into its active and inactive positions respectively. In the active position of the pawl **33** the harness **11** is retained in its upper position. In the inactive position, the harness **11** is not held and can move unimpeded into its lower position. The pawl **33** and the stroke length of the plunger (not shown) of magnet **34** and pawl **33** are both kept relatively small in order to obtain short actuating times and motion times. In order however, to be able dependably to hold large and heavy harnesses **11,** the pawl **33** is arranged to be supported by fixed stop **35** mounted on the frame of the loom.

It is clear that by reason of the movable pawl **33,** the harness **11** can be held as long as desired in raised position, and by the actuation of the magnets **31** and **34** any pattern may be provided. Thus, the harnesses **11** can remain in their low position or be moved to a high position as desired.

As shown in FIGS. 2 to 6 of the drawings, the pusher **19** is not placed directly below the corresponding harness **11,** but rather a harness yoke **36** is interposed. This is necessary since all the cams **20** are arranged on a single shaft and the individual harnesses **11** are located one behind the other in conventional manner. Furthermore, a harness yoke **36** is desirable since two cams **20** each having a separate pusher **19** can act on a single harness **11.**

For purpose of illustration, it is assumed that a harness motion of one high, three low, is desired. To this end, for the first lifting action by cam **20,** the magnet **31** is actuated. As a result, the deformable region **24** is blocked in the manner described and the harness **11** is raised by the pusher **19** by the interposed harness yoke **36.** The magnet **34,** which holds the harness in the raised position, is not actuated. Accordingly, the harness **11** is lowered upon further rotation of the cam. Upon the second rotation of the cam **20** the magnet **31** is not actuated. The deformable region **24** is accordingly not supported and the arms **25** will bend outwardly so that the upper arm **22** of pusher **19** will not be lifted and accordingly the harness **11** will remain in its low position during the entire rotation of the cam.

In the case of a harness motion of three high, one low, with the harness **11** in its high position, it will be kept in this position. The retention of the harness **11** in the high position is ecected by the actuation of magnet **34** which moves the pawl **33** into locking position beneath the harness yoke **36.** Upon a further second rotation of the cam, the harness yoke **36** is raised slightly so that the pawl **33** is no longer under load. As a result, the magnet **34** can thus readily withdraw the pawl **33** with a minimum of power since the heavy load of the harness **11** and the harness yoke **36** has been removed.

The two examples above described can operate with only a single cam per harness and are sufficient to form repeats of even numbers. For weaving repeats of uneven numbers, i.e., if an uneven number of picks is to be effected by the filling needle, it is necessary to use two cams, each displaced 180° away from the other and each acting with the interposition of a separate pusher **19** on the harness yoke **36.** It is obvious that each of the pushers **19** has its own control means. The harness **11** can also be held in its raised position.

For controlling the two magnets **31** and **34,** various possibilities exist. In this connection, one may proceed from the known possibilities, namely, the use of dobby pattern cards, or cardboad cards or punched paper cards. Mechanical feeler devices are provided which effect the energization and de-energization of the magnets to mechanically block or release the pushers **19** or hold the harness **11** in raised position. When using a punched card, photo diodes or transistors, excited for instance by a light pulse, may be used to control the magnets. It is also possible in the case of the last mentioned control to use dobby pattern cards or cardboard cards. In the following, a few of these possibilities will be discussed in further detail.

The dobby pattern cards have projections which can be used on the one hand to actuate the magnet **31** directly by way of an electrical contact and, therefore, to bring the harness **11** into raised position and, on the other hand, to actuate the holding magnet **34** and, therefore, to hold the harness **11** in its raised position. It is, therefore, necessary to provide two rows of dobby cards when a cam **20** and a pusher **19** are associated with the harness **11.**

As many changes could be made in the above equipment, and many apparently widely different embodiments of this invention could be made without departing from the scope of the claims, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrated and not in a limiting sense.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent of the United States is:

1. A control device for a machine having movable thread guide means, comprising a cam, means to rotate said cam, a transmission element interposed between the cam and the thread guide means and operatively connected thereto, to raise and lower said thread guide means, said transmission element comprising a pusher

rod having a deformable portion between its ends, said deformable portion being movable laterally outwardly in one direction to change the effective length of said rod, by the force produced between the cam and the thread guide means and a stop associated with said deformable portion and movable into alignment therewith to restrain lateral movement thereof.

2. A control device according to claim **1** in which said pusher rod has two end portions and two intermediate portions each pivoted to each other and to an associated end portion, said intermediate portions defining the deformable portion.

3. A control device according to claim **1** in which an electromagnet is operatively connected to said stop to move the latter.

4. A control device according to claim **1** in which a fixed stop is aligned with said deformable portion to limit its movement in the opposite direction.

5. A control device according to claim **1** in which a movable locking member is associated with said thread guide means to retain the latter in raised position.

6. A control device according to claim **5** in which an electromagnet is operatively connected to said locking means to move the latter.

7. A control device according to claim **5** in which a fixed stop is provided to support said locking means when it is in position to retain the thread guide means in raised position.

8. A control device according to claim **1** in which an electromagnet is operatively connected to said stop to control its position to determine the effective length of the transmission rod, a pattern control element, and means controlled by the pattern control element selectively to energize said electromagnet.

9. A control device according to claim **8** in which the pattern control element has control indicia thereon, and mechanical sensing means are provided to scan said control indicia.

References Cited

UNITED STATES PATENTS

1,904,006	4/1933	Means	139—55
2,354,843	8/1944	Tandler et al.	139—319
2,693,828	11/1954	Nims	139—57
2,980,145	4/1961	Herard et al.	139—80
3,080,894	3/1963	Morrison	139—80
3,265,096	8/1966	Zangerle et al.	139—55 X

FOREIGN PATENTS

925,279	3/1955	Germany.
825,221	12/1959	Great Britain.
323,522	12/1934	Italy.
246,963	11/1947	Switzerland.

MERVIN STEIN, *Primary Examiner.*

J. KEE CHI, *Assistant Examiner.*