# United States Patent

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[54] **DEVICE FOR FEEDING ELASTIC YARN INTO A STITCH-THROUGH TYPE MACHINE**
**7 Claims, 7 Drawing Figs.**


[52] **U.S. Cl.** ..... **66/84,** 66/86
[51] **Int. Cl.** ..... **D04b 23/06**
[50] **Field of Search** ..... 66/83—86



[56] **References Cited**
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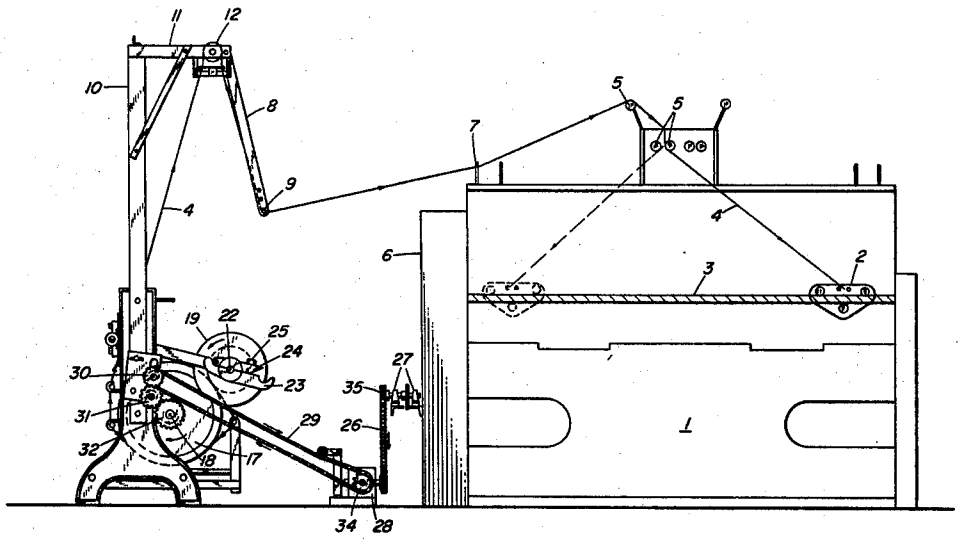
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**ABSTRACT:** A device, which can be in the form of an attachment to a stitch-through fabric-making machine, such as a Malimo machine. The attachment is particularly useful for laying in elastic weft threads to be stitched in by warp threads into the fabric and takes a drive from the main machine drive to turn a drum or drums which receive weft or filling threads, such as elastic threads, from a beam or creels they drive. The rotation of the drum, while continuously in one direction, is at varying rates so that the elastic filling threads are fed to the machine carriage at the rate the carriage moves, which prevents stretching of the filling threads and produces a smooth, uniform fabric. The device can be in the form of an attachment to an already existing machine or, of course, can be built into a new machine.

PATENTED MAR 23 1971

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SHEET 1 OF 7

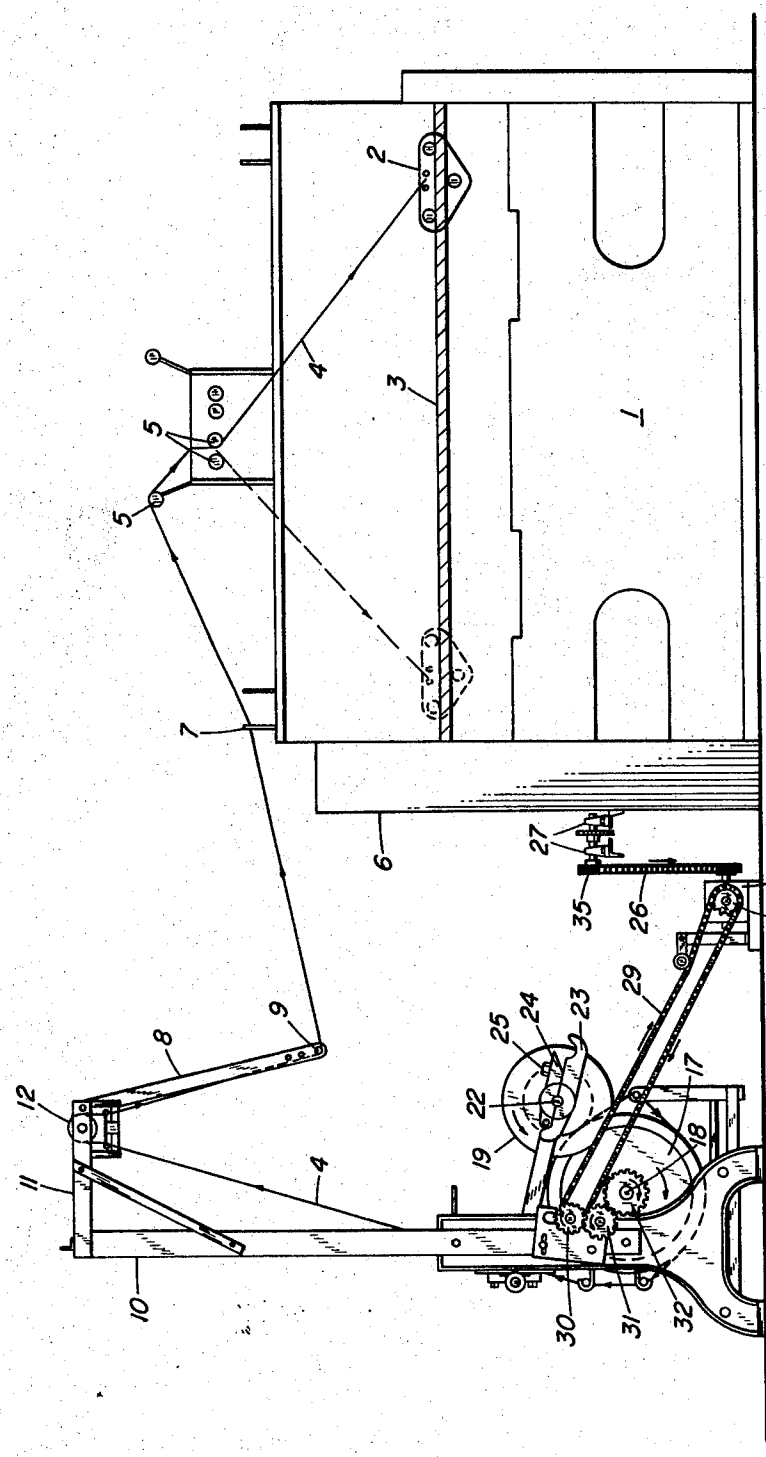



FIG. 1

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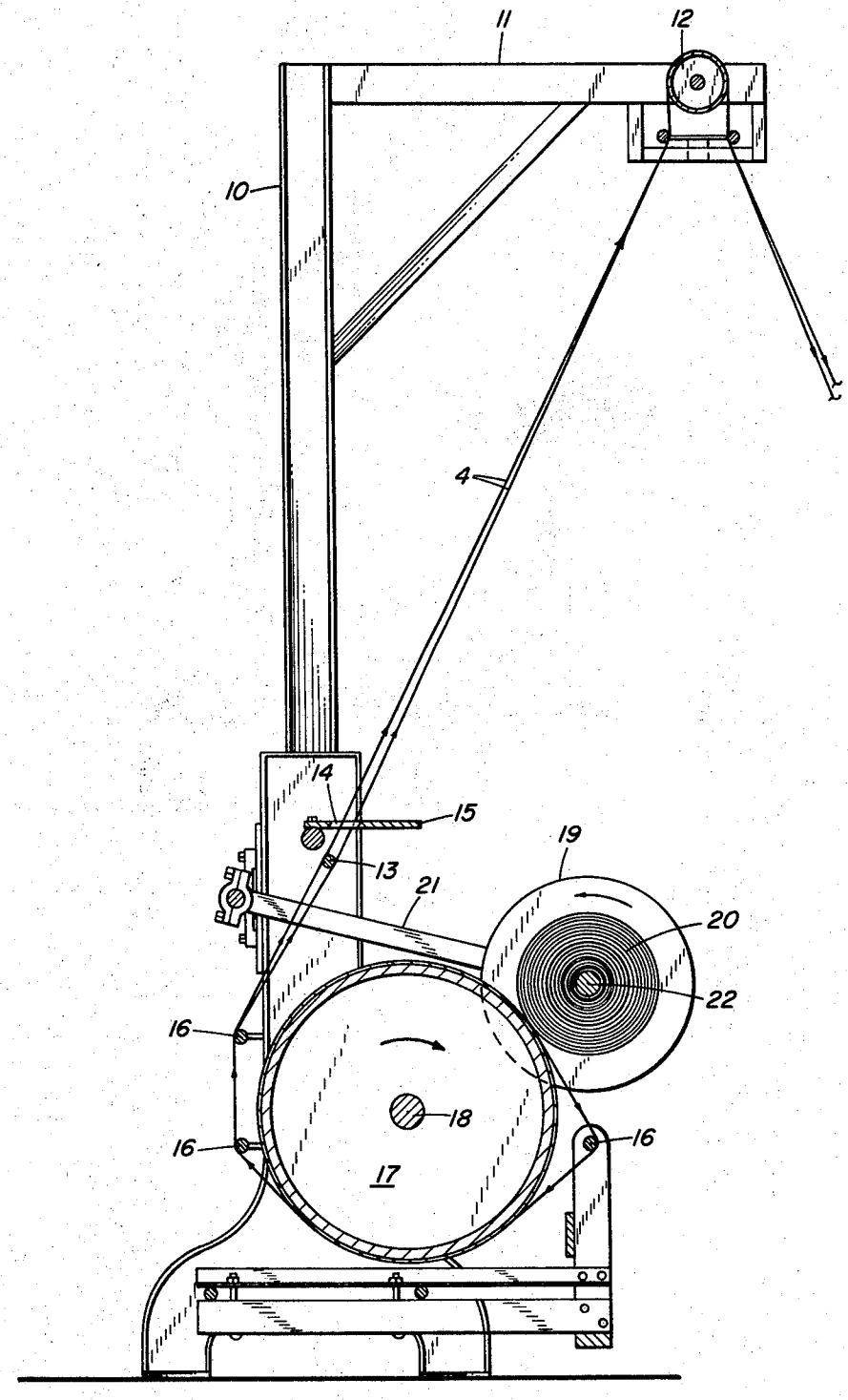



FIG. 2

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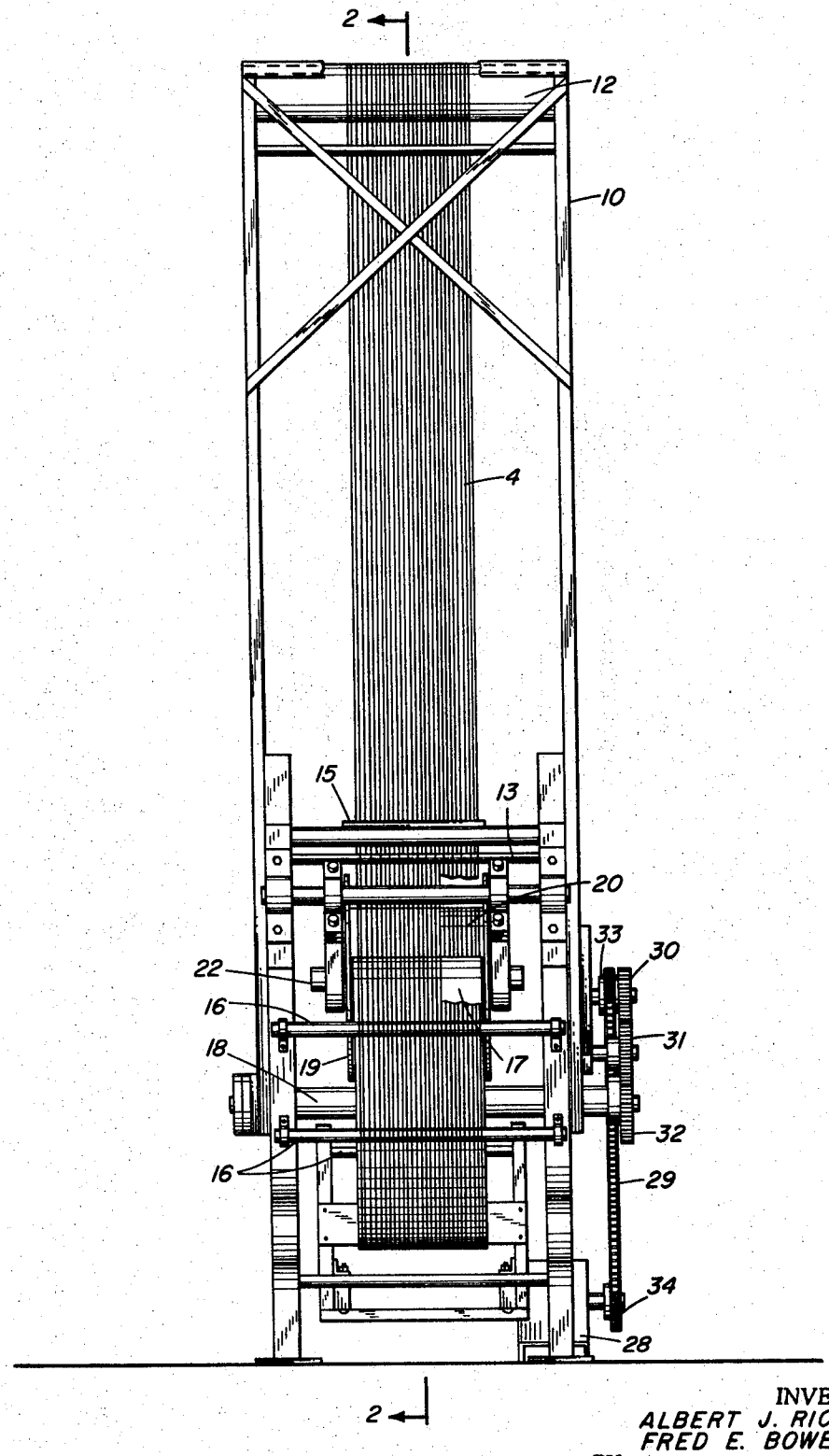



FIG. 3

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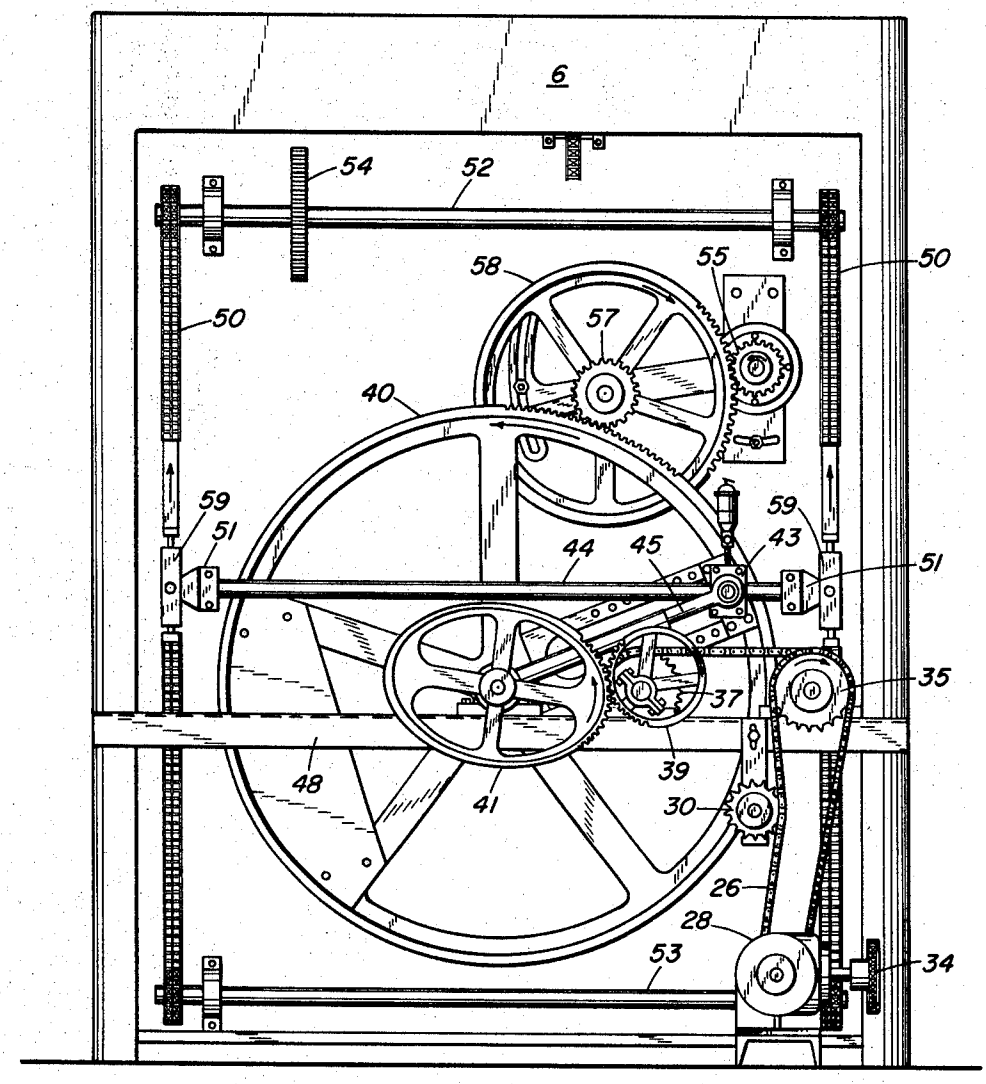



FIG. 4

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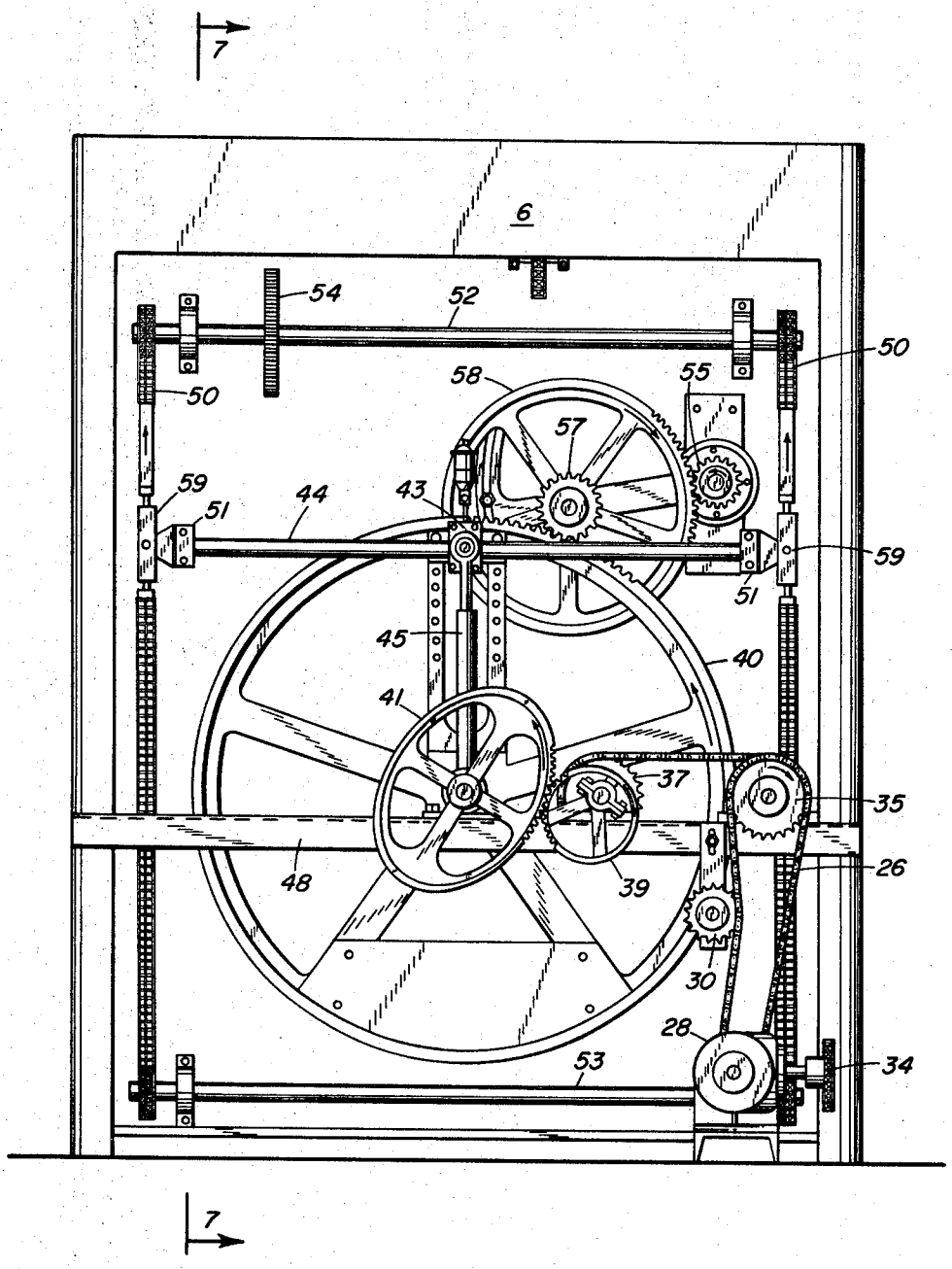



FIG. 5

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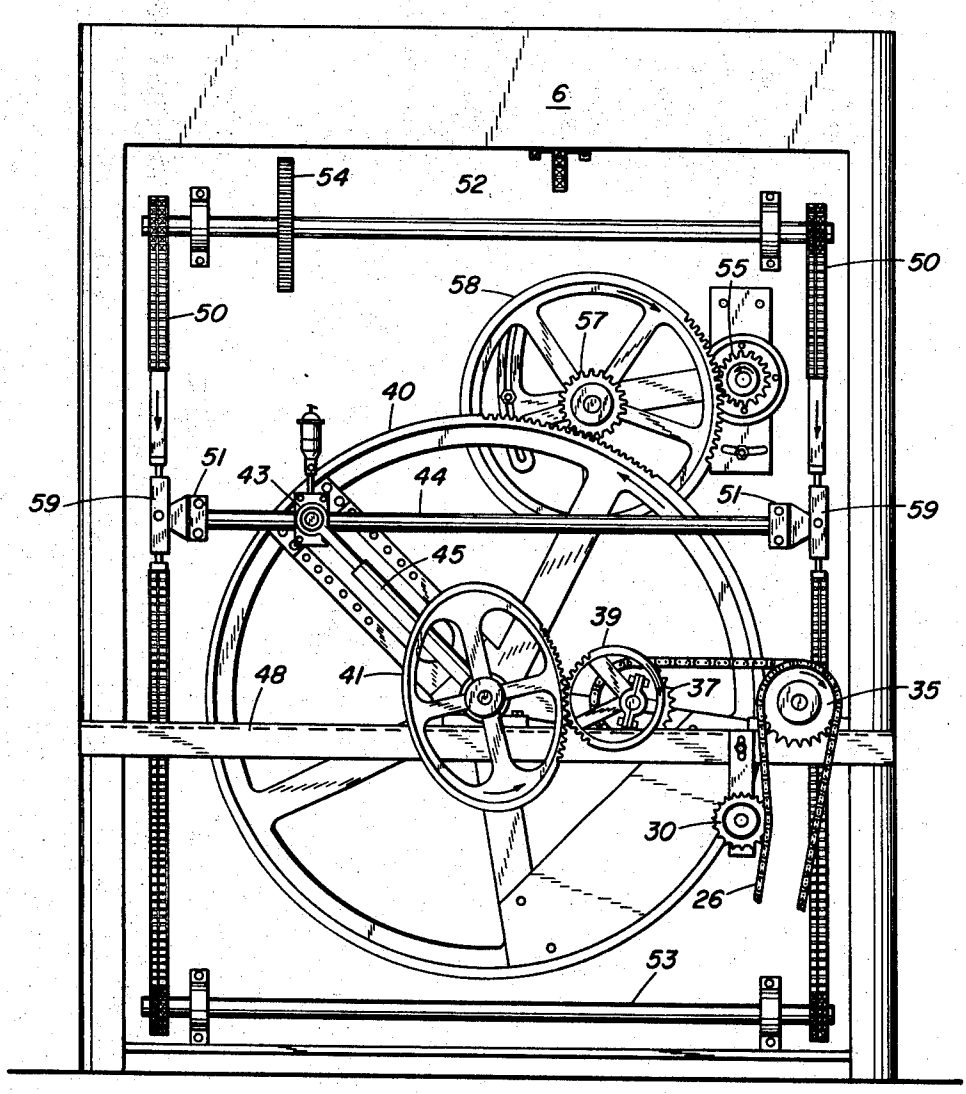



FIG. 6

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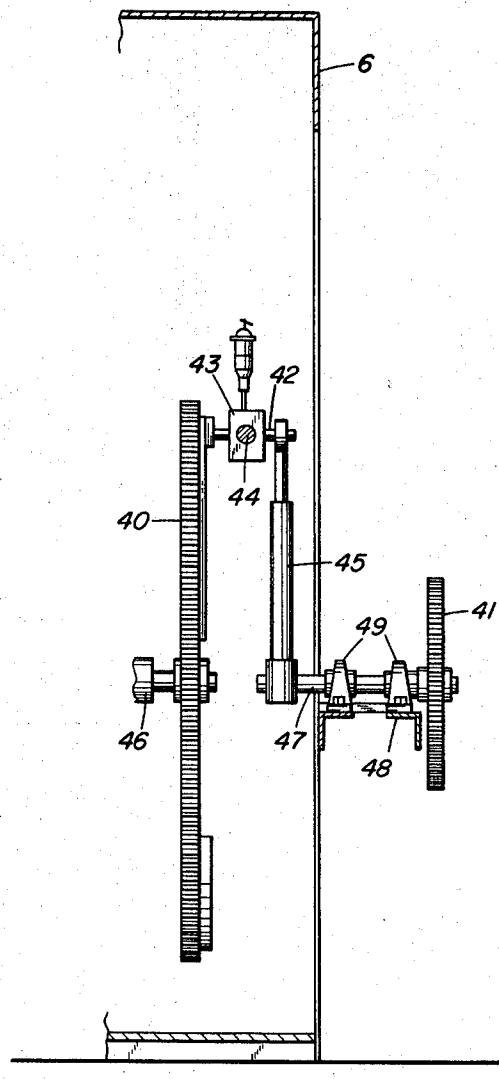



FIG. 7

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# DEVICE FOR FEEDING ELASTIC YARN INTO A STITCH-THROUGH TYPE MACHINE

## BACKGROUND OF THE INVENTION

In recent years a method of producing fabrics and machinery for producing the fabric have been developed in which either loose weft threads are laid in between a warp or nonwoven material, such as felts, mats and the like, and are stitched by the warp threads, which can be stitched with various stitching mechanisms. The resulting fabrics have adequate strength, and the operation of the machine can be much faster than conventional machines. Among the machines, particularly for stitching together a large number of weft threads that are laid across the warp threads, have been those referred to as "Malimo" stitch-through-type machines. In these machines the stitching is usually by chain or tricot stitch and can also be effected by a modified knitting mechanism. In each case a stitched warp fabric is produced, and the mechanisms are generally referred to as "stitch-through machines," of which the Malimo represents one type which has been very successful.

In spite of the success of the stitch-through machines, and particularly the Malimo machines, problems have arisen when it is desired to produce fabrics with a large number of elastic weft threads that are stitched together. Such fabrics, of course, have a one-way stretch in the weft direction, but if the standard carriages which lay a number of weft threads across the warp by a reciprocating motion pull the weft threads from packages, beams, and the like, this results in a varying tension under which the weft threads are pulled because the reciprocating motion of the carriage which lays the groups of weft threads does not proceed at uniform speed. At the two extremes of carriage travel the carriage moves very slowly, reaching a maximum in the middle of its stroke and then slowing down again. In other words, the carriage travel represents a form of simple harmonic motion. When the weft threads are substantially inelastic, no problems have arisen. However, when it is attempted to produce fabrics with elastic weft threads on the standard type of machine, such as Malimo machines, the tension on the weft threads, and therefore their degree of stretch, varies during the carriage travel, being of course a maximum in the middle of the stroke when the carriage is moving most rapidly. This has resulted in uneven elastic fabric, which is accentuated when the machines operate at maximum speed. For this reason the stitch-through machines have not been successful for producing fabrics with elastic weft threads and which, therefore, have a high degree of stretch in the weft direction. This has seriously restricted the field and has made it impractical to produce elastic stitched filling fabrics of highest quality and at economically desirable high rates of speed.

## SUMMARY OF THE INVENTION

The present invention overcomes some of the problems of a stitch-through machine of the type laying weft threads across the warp and more particularly elastic weft threads. By reason of the improvement represented by the present invention, fabrics of highest quality and particularly elastic fabrics can be produced at high rates of speed. The present invention is particularly useful where the weft threads which are laid across the warp threads are actually elastic threads, that is to say, threads, covered or uncovered, of an elastomer, such as rubber, spandex, and the like. However, the problem is still presented when the weft threads are stretchable even though they are not formed of elastomers. Thus, for example, stretch nylon threads, which have a considerable amount of stretch due to the nature of the thread itself, can be used in the present invention, with the elimination of the problems which have been described. In order to simplify the description in the specification, it will deal with elastic weft threads, it being understood that the invention is not limited thereto and includes any type of thread which stretches sufficiently so that poor results are obtained in the ordinary type of stitch-through fabric-making machine. The preferred embodiments, of course, will be described in connection with elastic threads as typical example of the invention.



Stitch-through fabric-making machines have also been used to form fabrics where a nonwoven batt or blanket is stitched. The nonwoven batt is ordinarily fed longitudinally in the same manner as the warp threads or stitching threads, and so when there is only a nonwoven batt, the present invention is not particularly applicable. However, it is also sometimes of importance to produce fabrics with stitched nonwoven batts which are also stretchable in one direction. In such a case, elastic weft thread may be laid across the batt and the warp threads by a carriage in the same manner as has been described in connection with fabrics in which there is no batt but only a large number of weft threads laid across the warp threads. Because of the nature of the batt, it is often sufficient to have a smaller number of elastic threads laid across than would be necessary or desirable if they were the only material forming the bulk of the fabric, and therefore, it should be understood that the present invention is not limited to a particular number of threads laid across or a particular spacing. The problems to be solved are, of course, the same. The present invention is particularly useful with Malimo machines, and while this exact construction of machine is not the only one for which the present invention is useful, throughout the remainder of the specification the description will deal with a machine of the Malimo type, representing a typical illustration with devices for which the present invention is useful. However, it is equally useful with any stitch-through type of machine in which a carriage lays weft threads across warp threads, and particularly a fairly large number of weft threads at a time, by means of a reciprocating carriage or carriages.

The actual stitching mechanism, whether by sewing for example in chain or tricot stitch form, a modification of a knitting operation or the like, is not changed by the present invention, nor is the general operation of the carriage which lays weft threads across the warp threads. Accordingly, the present invention will be described as an improvement which can be an attachment if desired to existing machines. The fact that existing machines can be operated by the present invention to produce improved fabrics, and particularly improved elastic fabrics, is an advantage, because it becomes possible to design the present invention as a removable or disconnectable attachment to such machines. However, the advantages of the present invention are quite marked even when the machine is not producing an elastic fabric, so that new machines often can be economically built with the present invention permanently incorporated in the machine. Either type of device is, of course, equally included in the present invention. As the stitching and even the carriage motion is not changed by the present invention, the operation will not be described in detail nor the mechanism illustrated in detail in the drawings and in the description of the preferred embodiments. Only so much of the operation of the machine will be described or shown as is needed to show where the improved mechanism of the present invention connects into the operation of the machine.

Malimo machines are provided with a continuous drive and means for producing a reciprocating simple harmonic motion of the weft thread-carrying carriage from the drive. The present invention modifies this part of the mechanism and can be designed as a detachable attachment, although, as has been pointed out above, in many cases with a new machine it may be desirable to incorporate the mechanism in more permanent form.

In general a drive from the main machine drive is taken off which operates continuously in the same direction but at a varying rate exactly corresponding to the rate at which the carriage moves. This unidirectional motion at varying speeds turns a drum or similar mechanism which pulls off weft thread or threads from a beam and feeds them onto the carriage through the conventional thread leads or guides. As the drum feeds off the weft threads at the same rate as the movement of the carriage lays them across the warp threads, they are not

under tension, or rather they have only a very minimum tension which does not change with the wide variations of speed of the carriage at various points of its stroke. As a result, weft threads are laid perfectly uniformly, and particularly in the preferred embodiment, which involves elastic weft threads, these threads are not stretched to any significant degree. Therefore, fabrics are produced which are smooth, uniform, and attractive, and the machines, such as Malimo machines, may operate even the elastic weft threads at maximum speeds and hence in the most economical manner. Another advantage is when a relatively large number of weft threads are laid by a carriage at one time, all of the threads are under exactly the same tension, or rather substantial lack of tension, and so there is no nonuniformity between weft threads in the finished fabric. This is another advantage which produces a fabric of maximum smoothness and uniformity. At the same time all of the advantages of the high speed possible with a Malimo machine are retained.

While the present invention is particularly important with elastic stitch-through fabrics, which cannot be produced uniformly and rapidly at all in the ordinary Malimo machine, it is perfectly possible to use the invention even with weft threads which are not elastic. In other words, the machine can be operated to produce ordinary stitched warp fabrics without change. As a matter of fact, even when the weft threads are substantially nonelastic, the invention has some advantage as the uniformly of the weft threads is at a maximum and it is possible to take them off from beams without any risk of any difference from one thread to another. In other words, even with nonelastic weft threads the very maximum of uniformity of fabric is obtainable at maximum speed, and although it is possible to operate a machine, such as a Malimo machine, with nonelastic weft threads without using the principles of the present invention, they produce even in this case an advantageous result.

An essential feature of the present invention is that the drum which takes the weft threads from a beam, which it drives, is turned in a single direction but at varying speeds to correspond with the speeds of carriage travel. This requires a varying ratio drive from the uniform rate main machine drive, but there is no limitation to any particular design of varying ratio drive. There will be described a very suitable form of drive, namely an elliptical gear, and this is a preferred form, but the invention is not limited thereto.

The preferred form of the present invention takes off the threads that are laid across the warp threads from a beam, and this is the preferred embodiment which will be described in more detail below. The elimination of tension is effected because the drum, turning continuously but at varying rates to correspond to the speed of carriage travel, drives the beam by friction and so may be considered to overfeed somewhat to the carriage so that there is no tension on the warp threads. A beam, and often a single drum, presents a number of advantages and a very large number of weft threads, for example about 140, as is common in Malimo machines, are readily accommodated. However, it is known with nonelastic weft threads that they can be taken from a corresponding number of cones or packages which are mounted on a framework or creel to rotate freely. Usually the packages or cones are vertical, but even so their spacing may be, and often is, considerably greater than is desired for spacement of the weft threads laid across the warp threads. It is, of course, an easy matter to direct the threads through suitable guides so that when they reach the carriage they are closer together and have the spacing which is desired in the final fabric. The present invention can also be used with a similar form of thread supply but, of course, with the cones or packages lying horizontally so that they can be turned by friction from the drum or, in some cases, a number of drums. The spacing of the threads coming off the cones is, of course, quite large, and as has been pointed out above, they can be guided closer together where they finally reach the carriage. However, the drum or drums, all of which turn at the same rate if more than one drum is used, overfeed in the same manner and prevent any tension of the stretchable threads. Such a modification is included in the broader aspects of the present invention.

In the more detailed description of the invention below, it will be described as a unitary operating machine. The mechanisms are, of course, cooperating, but a portion of the mechanism, including the drum, can be disconnected from the main machine and can be used as an attachment for other Malimo machines. The invention is, therefore, not limited to a single unitary machine structure.

## BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side elevation of the varying speed drum drive and a purely diagrammatic representation of the outside of a Malimo machine;

FIG. 2 is an enlarged section through the drum drive taken along the line 2–2 of FIG. 3;

FIG. 3 is an end elevation, partly broken away, of the drum and beam drive;

FIGS. 4, 5 and 6 are three end views of the Malimo machine with modifications and with the cover removed in three different positions of the machine drive through a single half turn, and

FIG. 7 is a section along the line 7–7 of FIG. 5.

## DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIG. 1 shows purely diagrammatically an elevation of a Malimo machines 1 with an end cover 6. In the machine there is shown diagrammatically a track 3 on which a carriage 2 is reciprocated by standard Malimo mechanism (not shown). The carriage 2 carries a series of weft threads 4 which are guided by a series of rollers or pins 5 through an eye 7, and more pins 9 on an arm 8, which is pivoted in a horizontal arm 11 of a framework 10 which carries a drum and weft beam, as will be described.

The threads 4, and there usually are a number of them, are on a beam 19, shown wound in layers 20. This portion of the device is best seen in FIGS. 2 and 3. The threads from the beam 19 are wound partially onto a drum 17 which drives the beam. Guide pins 16 are used and the threads are then separated by the rod 13 passed through an opening 14 in a shelf 15 and extending on up to a roller 12 journaled in the arm 11, which has been described. The beam rotates in a bearing provided with a clamp with jaws 23 and 24 and a holddown bolt 25. This is best shown in FIG. 1. The axle 22 of the beam is journaled in a swinging arm 21 which at its other end is journaled on a stub shaft attached to the framework 10. This is best seen in FIGS. 1 and 2. As the drum unwinds threads from the beam, the beam center moves closer to the drum, which is permitted by the arm 21. FIGS. 1 and 2 show a single thread in FIG. 1 which is really a double thread, as is shown in FIG. 2. However, the beam carries a large number of threads, which are seen best in FIG. 3.

The drum 17 is turned continuously in one direction but at varying speeds corresponding to the simple harmonic motion of the carriage 2. This drive will be described below. Actual connections to the drum are by means of a set of three gears 30, 31 and 32, which can be seen in FIGS. 1 and 3, the gear 30 being turned on its shaft by the sprocket 33, which is connected by chain 29 to a sprocket 34. The latter is turned by a shaft extending into a right-angle drive 28 of known design. The other end of the drive is driven by a chain 26 from a sprocket 35 journaled onto a bracket 27 on the end of the machine. The drive is shown clearly in FIGS. 1 and 3, and the varying ratio drive of the chain 26 will be described below.

Turning to FIGS. 4, 5 and 6, the main machine drive turns a gear 55 which meshes with a larger gear 58, and this in turn drives a smaller gear 57 meshing with the teeth on a still larger gear 40. This gear drives an elliptical gear 41 which meshes with an eccentric gear 39, the eccentrically located shaft of which drives a sprocket 37, which in turn drives the sprocket 35 through its shaft. An idler gear 30 maintains tension on the chain 26 from the sprocket 35 to the right-angle drive 28.

FIG. 7 shows the drive of the elliptical gear 41 from the gear 40, which turns on its shaft 46. Near the periphery of this large gear is a pin which slides through a block 43, which in turn slides along a movable rod 44 which provides the drive to the carriage, as will be described below. The pin 42 is also fastened to a crank arm 45 which turns the shaft 47 on which the elliptical gear 41 is mounted. Bearings 49 on a bracket 48 maintain proper alignment. The eccentricity of the elliptic gear 41 and of the circular eccentric gear 39 is such that the chain 26 turns the drum 17 continuously in the same direction with a simple harmonic rate through the drives which have been described above.

As the large wheel 40 turns, block 43 slides on the rod 44 and causes the latter to be moved up and down in simple harmonic motion. The ends 51 of this rod attach to chains 50, which in turn drive a lower shaft 53 and an upper shaft 52. The latter drives a gear 54, which, through conventional machine drive, drives the carriage 2. As this drive is not changed by the present invention, it is not shown, as has been mentioned above. FIGS. 4 to 6 show three positions in a little less than half a rotation of the big gear 40. In FIG. 4 the crank arm is near to the right side; it is directly vertical in FIG. 5, and is over at 45° in FIG. 6. The drive shown in FIG. 7 corresponds to the position in FIG. 5 as it is a section taken through section lines 7–7 of FIG. 5. As the large gear 40 continues to turn, the rod 4 moves on down through a position 180° from that of FIG. 5 and back up again until it reaches the position in FIG. 4, and the cycle is then repeated.

It will be noted that the chains 50, and through them the gear 54, move the carriage 2 in simple harmonic motion, as is required in Malimo machines. The eccentricity of the elliptical gear 41 and the eccentric circular gear 39 is such that the drum turns at a rate such that the circumference of the drum 17 moves at a rate corresponding to the movement of the carriage 2. As the threads 4 are being fed off the drum 17 at this rate, there is no significant tension on the threads as the carriage 2 moves back and forth, and hence even with elastic weft threads there is no significant stretch. The threads are laid across the warp threads uniformly, and as the warp threads are stitched in the conventional manner in Malimo machines, a fabric is produced which is smooth and uniform regardless of whether the weft threads are elastic or nonelastic, that is to say, are not stretchable. The stitching is not affected by the present invention and is, therefore, not shown as it is part of standard Malimo machines. The travel of the carriage can be varied for different widths of fabric. This is effected by varying the length of the crank arm 45 as shown in FIGS. 4 to 7. In the first three of these figures guide rails are shown with various openings to permit this adjustment. The length of the crank arm 45 determines how much the rod 44 moves during a single turn of the gear 40.

It will be noted that the driving mechanism for the drum which takes the weft threads off from the beam need not be built permanently into a machine. The elliptical gear 41 and the eccentric circular gear 39 and the drives through chains 26 and 29 are all external to the machine itself and so they can be formed as an attachment, it being only necessary to connect onto the shaft 47 of another machine. It is thus possible for the present invention to be an attachment so that it can be used with several machines, and it is not necessary to have the whole drive reproduced in each individual machine. However, as has been pointed out above, for many purposes there are advantages in new machines to build in the drive from the start as the drive improves operation even with nonelastic weft threads even though it is possible to operate without it where the weft threads are not elastic.

We claim:

1. In a stitch-through-type fabric-making machine having a drive, weft-laying carriage, and means for moving the carriage in simple harmonic oscillatory motion from the drive, the improvement which comprises:
   a. means for driving a drive system synchronously from the drive at the rate of one revolution per carriage reciprocation cycle;
   b. means for driving the drive system comprising varying ratio drive elements and an output shaft, the ratio variation being such that said shaft turns at a varying rate proportional to speed of carriage movement at various portions of its oscillation;
   c. at least one weft thread supply and at least one drum in driving contact therewith to receive weft threads therefrom;
   d. said drum being driven from the output shaft of the varying ratio drive at a rate so the drum periphery moves at a speed corresponding to that of the carriage at all portions of its reciprocation; and
   e. means for feeding weft threads from drum periphery to the carriage.

2. A machine according to claim 1 in which the weft thread supply is a beam carrying the weft threads wound thereon side by side.

3. A machine according to claim 1 in which the varying ratio drive consists of an elliptical gear and an eccentric circular gear in mesh, the latter driving the output shaft.

4. A machine according to claim 2 in which the varying ratio drive consists of an elliptical gear and an eccentric circular gear in mesh, the latter driving the output shaft.

5. A machine according to claim 3 in which the carriage motion is effected by a large gear synchronously driven by main drive, near the periphery of the large gear a block pinned thereto and slidable on a movable rod whereby as the gear rotates the block slides and the rod moves up and down in simple harmonic motion, and drive means connecting the rod to the carriage.

6. A machine according to claim 5 in which the output shaft from the varying ratio drives drives sprockets and chains in a plane parallel to the drum axis and the drum drive includes a right angled drive.

7. A machine according to claim 5 in which the block is connected by a rigid arm to a shaft which turns the elliptical gear.

# UNITED STATES PATENT OFFICE

# CERTIFICATE OF CORRECTION

Patent No. 3,572,058 Dated March 23, 1971

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It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Page 1

/73/ Assignee J. P. Stevens & Co., Inc.

New York, New York

A corporation of the State of Delaware

Signed and sealed this 29th day of February 1972.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

ROBERT GOTTSCHALK
Commissioner of Patents