Feb. 19, 1952 A. J. COBERT 2,586,205

MAGNETICALLY OPERATED THREAD FINGER DRIVE

Filed Jan. 20, 1950 2 SHEETS—SHEET 1

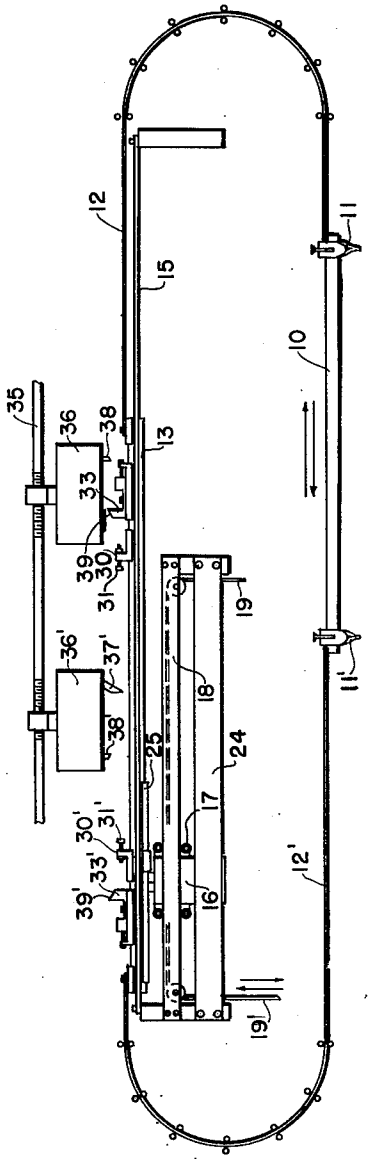

Fig. 1

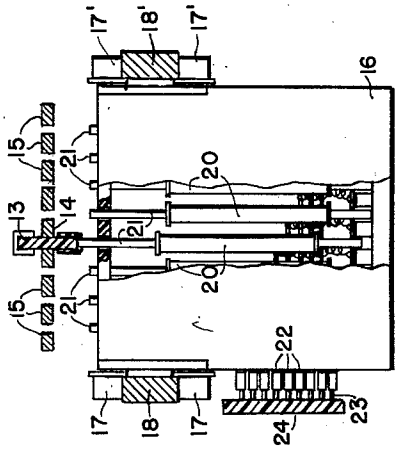

Fig. 3

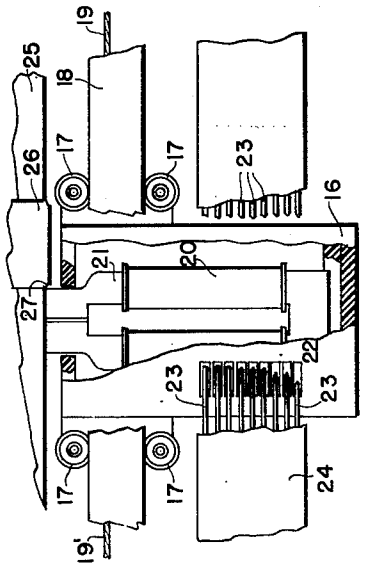

Fig. 2

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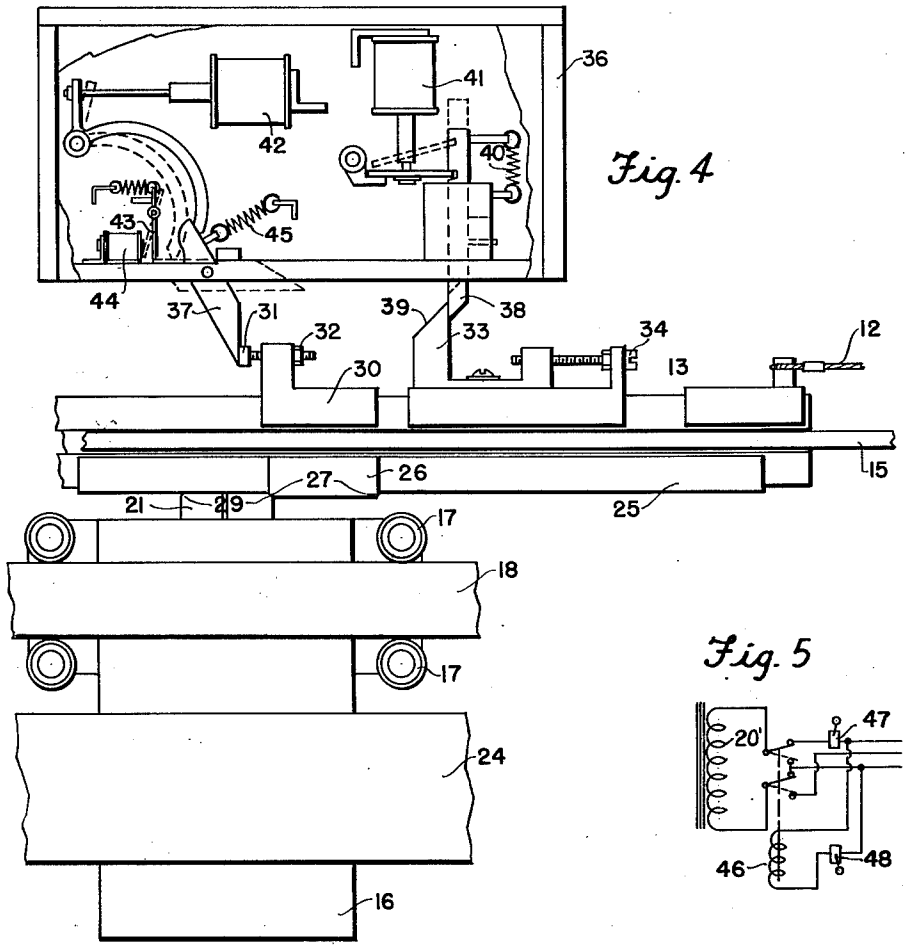

Fig. 4

Fig. 5

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MAGNETICALLY OPERATED THREAD FINGER DRIVE

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10 Claims. (Cl. 66—126)

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This invention relates to improvements in knitting machines, and more particularly to a magnetically operated thread finger drive.

The complicated designs, involving a multiplicity of mechanical movements, not only made ordinary knitting machines expensive to manufacture but also caused frequent breakdowns and seriously limited the operating speed. In certain types of prior art flat knitting machines, mechanical means such as releasable clamps are kicked out of operative position by narrowing nuts to cause the thread finger carriers to travel back and forth across the machine at varying portions of the entire traverse so as to narrow the fabric when desired, as in the knitting of full fashioned hosiery. Each time the thread finger carrier reaches the limit of its travel, such constructions cause the machine to suffer a mechanical jolt, and the severity of this jolt limits the operating speed of the machine. In other types of prior art structures, the thread finger carriers travel between limiting stops while the main movement of the machine goes on to travel the entire traverse of the knitting machine through the operation of a slip clutch; but of course extra power is required to drive the machine through the slip clutch while the thread finger carrier is held stationary; and, moreover, the machine suffers a severe mechanical jolt each time the thread finger carrier reaches the limit of its travel and the machine has to continue on through the action of the slip clutch.

An object of my invention is to provide a thread finger drive of relatively simple construction with a minimum of mechanically controlled and operated parts.

Another object of my invention is to provide a magnetically operated thread finger drive.

Another object of my invention is to provide a magnetically operated thread finger drive which eliminates or minimizes jolts when the thread finger reaches the limit of its travel.

Another object of my invention is to provide a magnetically operated thread finger drive which is light in weight and permits higher speeds of operation.

Other and further objects and advantages of my invention will be apparent from the following description taken in conjunction with the accompanying drawings in which like characters of reference designate corresponding parts throughout the several views, and wherein:

Fig. 1 is a schematic view showing an embodiment of my invention.

Fig. 2 is an enlarged front view, with parts broken away, showing a detail.

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Fig. 3 is a side view of the detail shown in Fig. 2.

Fig. 4 is an enlarged front view, with parts broken away, showing a further detail.

Fig. 5 is a wiring diagram for the magnetic pick-up.

In the drawings, an arrangement is shown suitable for double bed flat knitting machines, although I do not intend to limit the application of the present invention to machines of this type, it being contemplated that the same or similar principles of operation may be applied to other types of machines with suitable modifications. Fig. 1 shows a single thread finger carrier 10 having a pair of thread fingers 11, 11' for use, respectively, on the two sides of a double bed frame. Opposite ends of the thread finger carrier 10 are connected by flexible cables 12, 12', respectively, to the ends of an elongated slide rod 13. It is understood that a plurality of thread finger carriers would ordinarily be provided, the usual number being eight, and each such thread finger carrier would be connected to a separate slide rod similar to the slide rod 13 by flexible cables similar to the flexible cables 12, 12', but for simplicity of illustration only one thread finger carrier with associated cables and slide rod is shown.

The slide rod 13 may be made of fiber or plastic of light weight, and it is provided with a narrow central neck portion 14 which is slidably mounted between a pair of slide rod guides 15, which may be made of steel or other suitable material, nine such slide rod guides 15 being shown in Fig. 3 to provide for the customary number of slide rods 13.

Beneath the slide rod 13 is a movable carriage 16 which is provided with rollers 17, 17' for reciprocating motion along the transverse tracks 18, 18', respectively, reciprocating motion corresponding to the complete traverse of the machine is imparted to the carriage 16 by means of flexible cables 19, 19'. Within the carriage 16 are a plurality of electromagnet coils 20, each of which is provided, respectively, with a movable core 21, one such magnet and movable core being provided for each slide rod 13 and positioned directly beneath it, as shown in Fig. 3.

For excitation of the magnets within the movable carriage 16, the carriage is provided on one side thereof with a plurality of contact shoes 22, one such shoe being provided for each magnet 20 plus one additional common return shoe. A similar number of stationary electric rails 23 are mounted on insulating material 24 for cooperation with the shoes 22 to complete the electric

circuit through the magnets 20 from a suitable source of direct current (not shown).

A substantially U-shaped pick-up guide 25, of steel or other suitable material, is fixed respectively to the lower portion of each slide rod 13, and the pick-up guide 25 carries a pick-up lug 26 which depends slightly below the pick-up guide and is provided with beveled corners 27 which cooperate with matching beveled corners 29 on the core 21, as best seen in Fig. 4. Stop lugs 30, 30' are fixed, respectively, near the ends of each slide rod 13, and these lugs have an upstanding portion extending above the respective slide rod and being screw threaded for the reception of an adjustable stop finger 31, 31' which is held in adjusted position by stop nut 32. Still nearer the respective ends of each slide rod is an adjustable rebound lug 33, 33' which extends above the respective slide rod and is held in adjusted position by the screw threaded adjusting means 34, as best seen in Fig. 4.

Mounted above the slide rods 13 on a right-hand and left-hand threaded narrowing screw 35, as seen in Fig. 1, are the width adjusting boxes 36, 36'. Each of these width adjusting boxes carries, respectively, a stop pawl 37, 37', and a rebound pawl 38, 38' directly over each slide rod 13 for cooperation with the stop fingers 31, 31' and the rebound lugs 33, 33'. The rebound lugs 33, 33' have beveled top faces 39, 39', respectively, for cooperation with the complementary beveled lower faces on the rebound pawls 38, 38' so that the rebound lugs, when moving toward the associated stop lugs, will slide beneath the rebound pawls by lifting the rebound pawls against the tension in a rebound pawl retaining spring 40, and the rebound pawl will be spring pressed downward behind the rebound pawl momentarily before the slide rod rebounds after the stop finger strikes the stop pawl. After the rebound has been checked, the rebound pawl can be lifted, by energization of the rebound pawl lift solenoid 41, to the inoperative position shown in broken lines in Fig. 4. The stop pawls can be raised to the inoperative position, shown in broken lines in Fig. 4, by energization of the stop pawl lift solenoid 42 and they will be held in this position by the latches 43 until released individually by energization of the stop pawl release solenoid 44, when they will be pulled into operative position by tension in a stop pawl spring 45, one such latch, spring and release solenoid being provided for each stop pawl.

In the operation of the apparatus according to my invention, when power is applied to the knitting machine reciprocating motion is imparted to the carriage 16 by means of the cables 19, 19' to cause the carriage to ride back and forth along the tracks 18, 18' for the full traverse of the machine. Then when it is desired to start the knitting operation, the appropriate electromagnet 20 is energized to cause the movable core 21 of the selected electromagnet to be raised by electromagnetic force to bring the upper end of the magnet into contact with the pick-up guide 25 on the slide rod 13 immediately above the selected magnet. When this contact is made, the carriage 16 will then drive the slide rod with it on its next traverse. By positive engagement with the beveled corners 27 of the pick-up lug 26 a positive drive is assured. It is not necessary, however, that the magnet 20 be energized at the exact instant to cause the core 21 to come immediately into driving contact with the beveled corner of the driving lug because the core may be allowed to slide along the pick-up guide 25 until it gains positive driving contact with the pick-up lug 26. My construction does not depend upon the horizontal or sliding pull across the magnet to carry the slide rod, but utilizes the direct or vertical pull of the magnet which is many times greater than the sliding or cross-magnet pull. Since the pick-up lug 26 projects approximately .045" beneath the pick-up guide 25, when a magnet core is in engagement with the pick-up lug, it would be necessary for the magnet to be pulled away from the pick-up slide vertically or at right angles to the slide. Sliding movement is arrested by the pick-up lug, and while the magnet is excited it cannot be dropped from the pick-up slide except by being broken away at right angles to the pick-up guide.

With the stop pawls properly adjusted by the narrowing screw, the portion of the complete traverse to be traveled by the selected slide rod, and consequently its associated thread guide carrier directly connected thereto by the cables 12, 12', will be determined. As the stop finger on the slide rod approaches the stop pawl, the electromagnet 20 then in use is de-energized, but due to residual magnetism the core 21 will not immediately be released from the pick-up guide. Then as the rebound lug slides under the rebound pawl, the rebound pawl drops into locking position behind the rebound lug an instant before the stop finger strikes the stop pawl. This action can be accurately and minutely adjusted by the means provided.

When the stop finger strikes the stop pawl, the slide rod will stop instantaneously and the magnet core 21 will be kicked from engagement with the pick-up lug 26 with but very little effort, the beveled corner of the magnet sliding easily downward and away from the complementarily beveled corner of the lug inasmuch as the magnet was at that moment only lightly held in place against the pick-up guide by residual magnetism, and the machine suffers almost no appreciable shock from the stopping and dropping of the light weight moving parts. If it is desired to minimize still further the effort required to release the magnet from driving engagement with the slide rod, the polarity of the direct current applied to the coil 20' of the electromagnet 20 may be reversed, as shown in Fig. 5, by the use of solenoid operated switch 46. With the switch 46 in normal position shown in full lines in Fig. 5, direct current at approximately 45 volts can be applied to the coil 20' by cam operated micro-switch 47, of ordinary design. Then, an instant before the stop finger strikes the stop pawl, cam operated micro-switch 48, of ordinary design, can be used to energize solenoid switch 46 to cause it to operate to the broken line position shown in Fig. 5 to put direct current at approximately 5 volts, reversed polarity, on the coil 20' to kill the residual magnetism, at which time the magnet core will drop out of contact with the pick-up guide by its own weight and the machine will suffer substantially no jolt by reason of stopping the light moving parts to which driving force is being imparted only by the momentum of the parts themselves.

After the slide rod has been brought to rest, the carriage 16 continues on through the first half of the full traverse of the machine, and then reverses its direction of travel to pass through a similar sequence of operations during the second half of the cycle of operation, the rebound pawl being lifted out of operative position by

means of the rebound pawl lift solenoid to permit the slide rod to pass beneath it on the opposite stroke.

It will be obvious that while I have illustrated and described my invention in a very practical embodiment thereof without attempting to illustrate and describe other embodiments and adaptations which I contemplate, various changes and modifications can be made without departing from the scope of my invention as described in the following claims.

I claim:

1. In apparatus of the class described, a movably mounted thread guide carrier, slide means connected to said carrier to drive the same, a movably mounted carriage, means for imparting movement to said carriage, electromagnetic means carried by said carriage, driving means on said slide means, means for exciting said electromagnetic means to cause said electromagnetic means to engage said driving means to drive said slide means, said electromagnetic means being slidable along said slide means to positive driving engagement with said driving means, stop means on said slide means, and means adjacent said slide means for engagement with said stop means to control the movement of said thread guide carrier driven by said slide means.

2. In apparatus of the class described, a movably mounted thread guide carrier, a slide rod connected to said carrier to drive the same, a movably mounted carriage, means for imparting movement to said carriage, electromagnetic means carried by said carriage, a driving lug on said slide rod, means for exciting said electromagnetic means to cause said electromagnetic means to engage said driving lug to drive said slide rod, said electromagnetic means being slidable along said slide means to positive driving engagement with said driving lug, stop means on said slide rod, and means adjacent said slide rod for engagement with said stop means to control the movement of said thread guide carrier driven by said slide rod.

3. In apparatus of the class described, a movably mounted thread guide carrier, a slide rod connected to said carrier to drive the same, a movably mounted carriage, means for imparting movement to said carriage, electromagnetic means carried by said carriage, a driving lug on said slide rod, means for exciting said electromagnetic means to cause said electromagnetic means to engage said driving lug to drive said slide rod, stop means on said slide rod, rebound means on said slide rod, and narrowing means adjacent said slide rod for engagement with said stop means and said rebound means to control the movement of said thread guide carrier driven by said slide rod.

4. In apparatus of the class described, a movably mounted thread guide carrier, a slide rod connected to said carrier to drive the same, a movably mounted carriage, means for imparting movement to said carriage, electromagnetic means carried by said carriage, a driving lug on said slide rod, means for exciting said electromagnetic means to cause said electromagnetic means to engage said driving lug to drive said slide rod, a stop lug on said slide rod, a rebound lug on said slide rod, and means adjacent said slide rod for engagement with said stop lug and said rebound lug to control the movement of said thread guide carrier driven by said slide rod.

5. In apparatus of the class described, a movably mounted thread guide carrier, a slide rod connected to said carrier to drive the same, a movably mounted carriage, means for imparting movement to said carriage, electromagnetic means carried by said carriage, a driving lug on said slide rod, means for exciting said electromagnetic means to cause said electromagnetic means to engage said driving lug to drive said slide rod, a plurality of spaced stop lugs on said slide rod, a plurality of spaced rebound lugs on said slide rod, and narrowing means adjacent said slide rod for engagement with said stop lugs and said rebound lugs to control the movement of said thread guide carrier driven by said slide rod.

6. In apparatus of the class described, a thread guide carrier mounted for reciprocating movement, an elongated slide rod connected to said carrier to drive the same, guides supporting said slide rod for reciprocating movement, a carriage mounted for movement adjacent said slide rod, means for imparting reciprocating movement to said carriage, an electromagnet carried by said carriage, said electromagnet having a movable core, a driving lug on said slide rod, means for exciting said electromagnet to cause said electromagnet to engage said driving lug to drive said slide rod, a plurality of spaced stop lugs on said slide rod, a plurality of spaced rebound lugs on said slide rod, and narrowing means adjacent said slide rod for engagement with said stop lugs and said rebound lugs to control the reciprocating movement of said thread guide carrier driven by said slide rod.

7. In apparatus of the class described, a thread guide carrier mounted for reciprocating movement, an elongated slide rod connected to said carrier to drive the same, guides supporting said slide rod for reciprocating movement, tracks adjacent said slide rod, a carriage mounted for movement along said tracks, means for imparting reciprocating movement to said carriage, an electromagnet carried by said carriage, said electromagnet having a movable core, a driving lug on said slide rod, means for exciting said electromagnet to cause said electromagnet to engage said driving lug to drive said slide rod, a plurality of spaced stop lugs on said slide rod, a plurality of spaced rebound lugs on said slide rod, and narrowing means adjacent said slide rod for engagement with said stop lugs and said rebound lugs to control the reciprocating movement of said thread guide carrier driven by said slide rod.

8. In apparatus of the class described, a thread guide carrier mounted for reciprocating movement, an elongated slide rod connected to said carrier to drive the same, guides supporting said slide rod for reciprocating movement of said slide rod on said guides, tracks beneath said slide rod, a carriage mounted for movement along said tracks, means for imparting reciprocating movement to said carriage, an electromagnet in said carriage, said electromagnet having a movable core, a driving lug on said slide rod, means for exciting said electromagnet to cause said electromagnet to engage said driving lug to drive said slide rod, a plurality of spaced stop lugs on said slide rod, a plurality of spaced rebound lugs on said slide rod, and narrowing means above said slide rod for engagement with said stop lugs and said rebound lugs to control the reciprocating movement of said thread guide carrier driven by said slide rod.

9. In apparatus of the class described, a movably mounted thread guide carrier, slide means

connected to said carrier to drive the same, a movably mounted carriage, means for imparting movement to said carriage, electromagnetic means carried by said carriage, driving means on said slide means, means for energizing said electromagnetic means to cause said electromagnetic means to engage said driving means to drive said slide means, stop means on said slide means, control means adjacent said slide means for engagement with said stop means to control the movement of said thread guide carrier driven by said slide means, and means for de-energizing said electromagnetic means before said control means engages said stop means.

10. In apparatus of the class described, a movably mounted thread guide carrier, slide means connected to said carrier to drive the same, a movably mounted carriage, means for imparting movement to said carriage, electromagnetic means carried by said carriage, driving means on said slide means, means for energizing said electromagnetic means to cause said electromagnetic means to engage said driving means to drive said slide means, stop means on said slide means, control means adjacent said slide means for engagement with said stop means to control the movement of said thread guide carrier driven by said slide means, and means for reversing the polarity of said electromagnetic means an instant before said control means engages said stop means.

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