

[54] **CORE STRINGING APPARATUS**

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29/203 MW, 604, 603, 433

[56] **References Cited**

UNITED STATES PATENTS

2,958,126	11/1960	Shaw et al.	29/241 X
3,331,126	7/1967	Fielder et al.	29/203 MM

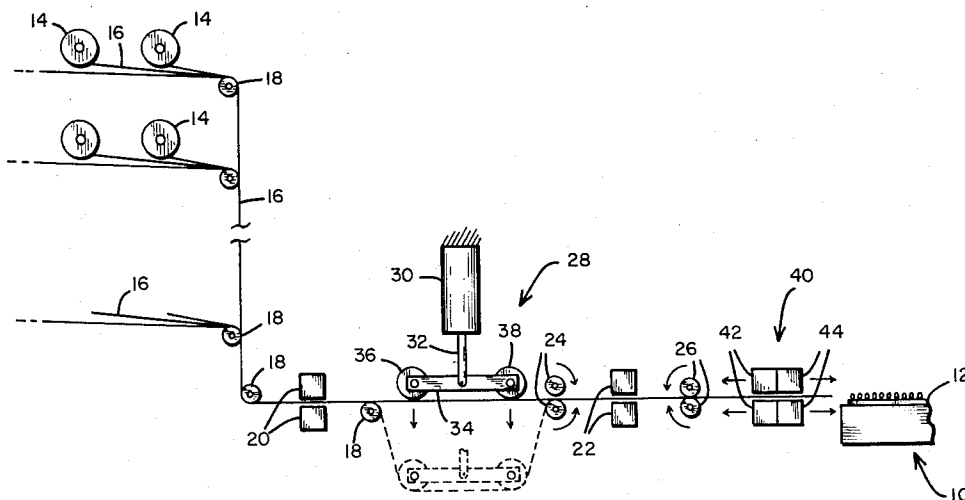
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[57] **ABSTRACT**

A machine for automatically threading a plurality of filaments through toroidal cores useful in manufacturing magnetic core memory arrays for use in digital data processing equipment. The cores are held on edge in a plurality of rows and columns with their apertures aligned and the filaments pass between a pair of drive rollers and are thereby advanced through the aligned apertures. Cooperating with the drive rollers are motor driven cams which impart a back-and-forth rotational motion about the axes of the filaments as well as a pulsating step-by-step forward motion into the core array.

4 Claims, 2 Drawing Figures



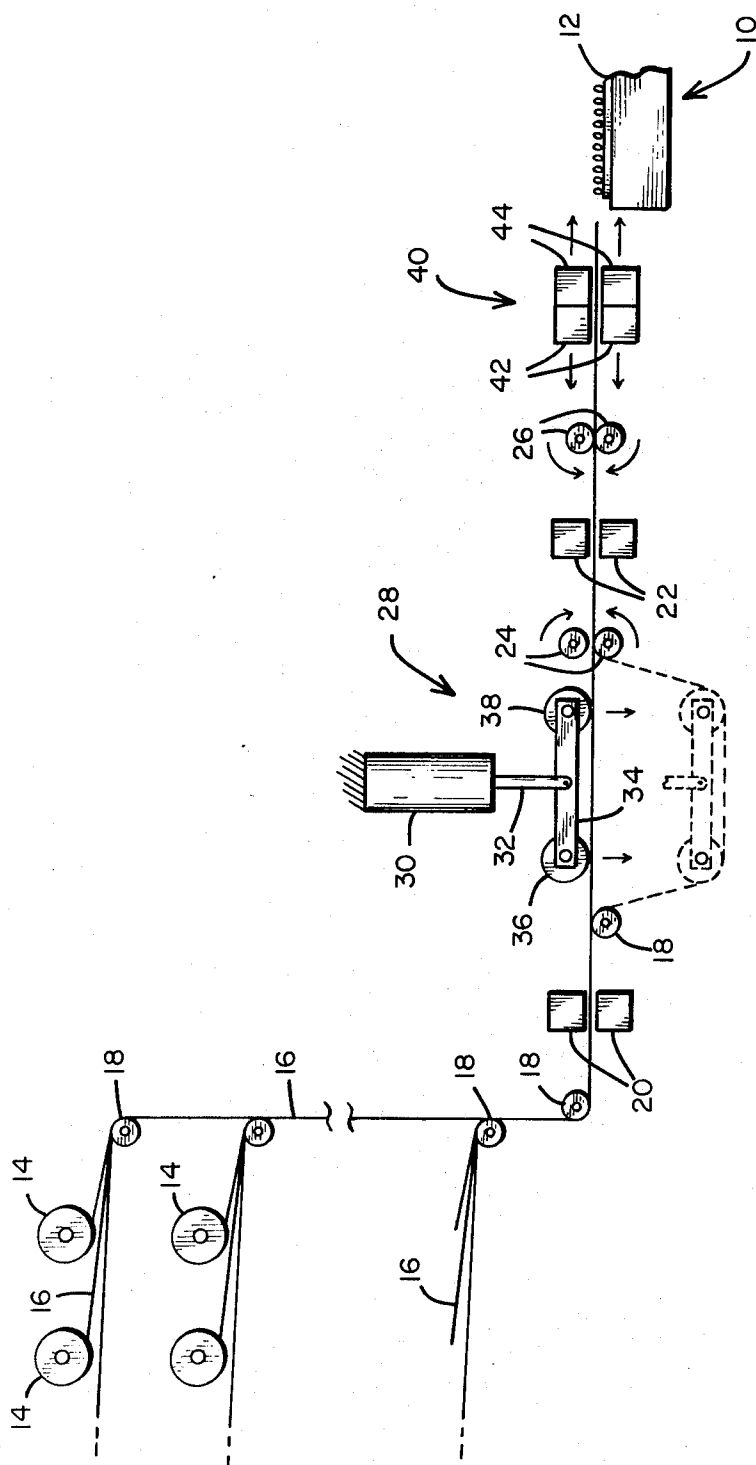


Fig. 1

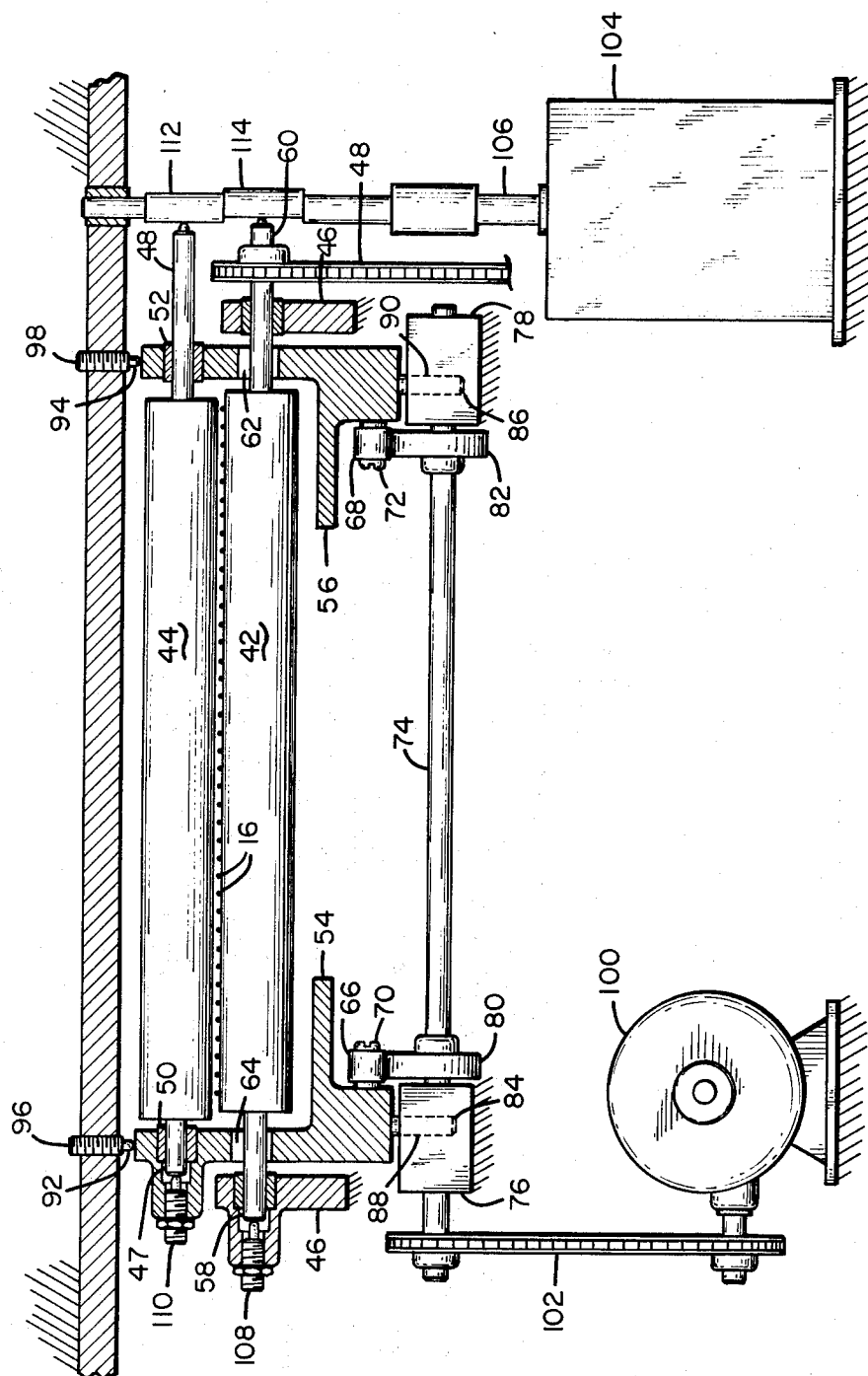


Fig. 2

CORE STRINGING APPARATUS

BACKGROUND OF THE INVENTION

This invention relates generally to apparatus for facilitating the manufacture of magnetic core memory arrays and more specifically to a machine for automatically threading the plural drive lines through the apertures in toroidal magnetic cores.

DISCUSSION OF THE PRIOR ART

The present invention is considered to be improvement over the invention described and claimed in the Fielder, et. al., Pat. No. 3,331,126 which is assigned to the assignee of the present application. In that patent there is described in considerable detail the construction and mode of operation of an automatic core stringing machine in which an array of tiny toroidal magnetic cores are held in predetermined coordinate locations such that the apertures therein are aligned along plural rows and columns. The filaments to be threaded through this array of aligned cores are contained on individual spools and are advanced through the core array by means of an arrangement of a drive and a driven roller between which the filaments pass. When the drive motor for the drive roller is energized, the filaments are pulled from the individual spools and advanced into the apertures of the aligned cores by means of suitable comb-like guides. In the Fielder, et.al., invention, it was found that the individual filaments tended to seek out and more readily pass through the apertures in the toroidal cores if a rotational motion was imparted to the filaments as they were advanced through the array. The present invention is considered to be a further improvement over the machine described and claimed in the Fielder et al. patent. It has been found that if, in addition to the rotational motion imparted to the filaments as they are advanced, a pulsating step-by-step motion is also imparted to the wires, that a marked degree of improvement is obtained in the way in which the ends of the wires seek out and pass through the tiny apertures in the aligned array of cores.

In addition, in the prior art machine described in the Fielder, et al., patent, an attempt was made to reduce the frictional drag on the filaments produced by the spool assembly by simultaneously vibrating the spool assembly and exuding air through holes provided in the axles on which the spools were mounted. While this approach did result in a substantial lessening of the frictional drag forces, they continued to create problems as far as a smooth, even advancement of the wires through the drive rollers was concerned.

The present invention obviates this problem by providing a means for forming a slack loop in the plural filaments at a point between the spools and the drive rollers such that frictional drag between the spools and their axles is no longer working in opposition to the driving forces applied to the plural filaments. More specifically, a device termed "drop bars" is disposed between the spool assembly and the filament drive rollers. When actuated by the human operator, a clamping means comes into play to grip the plural filaments at a point near where they enter between the drive and driven rollers and subsequently, the drop bar assembly moves downward for a predetermined distance to thereby withdraw a loop from each of the plural spools

used to store the filaments. Next, the drop bar assembly is raised, the clamping means released and the drive roller is rotated so that the drive rollers, in effect, remove the filaments from a slack loop rather than from the spools.

OBJECTS

It is accordingly a principle object of this invention to provide a new and improved machine for threading filaments through apertured elements.

Another object of this invention is to provide a novel motion to the ends of a plurality of filaments as they are fed into the apertures of an aligned array of toroidal elements.

Still another object of this invention is to provide in a magnetic core stringing machine a drive mechanism which will provide a pulsating, step-by-step feed to a plurality of filaments as they are threaded through an array of toroidal elements.

A still further object of the invention is to provide a mechanism in a filament stringing machine which obviates the problem of frictional drag which existed in prior art machines between the filament supply spools and the axles on which they are mounted.

This invention is pointed out with particularity in appended claims. An understanding of the above and further objects and advantages of this invention may be obtained by referring to the following description taken in conjunction with the drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic mechanical drawing used to explain the construction and mode of operation of the preferred embodiment; and;

FIG. 2 is a cross-sectional view taken through the drive roller assembly and illustrating the apparatus for achieving the pulsating, step-by-step motion for advancing the filaments.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENT

As is mentioned in the introductory portion of this specification, the present invention is considered to be an improvement over the filament threading machine described and claimed in the Fielder et al U.S. Pat. No. 3,331,126 which is hereby incorporated by reference. One reading that patent will be aware of the general organization, and the detail construction thereof. Accordingly, it is believed unnecessary for a full understanding of the present invention to include in the present specification a detail description of this general arrangement. Instead, only those portions of the Fielder et al machine which have been improved to incorporate the present invention will be described.

Referring now to FIG 1, there is shown a mechanical schematic diagram of the filament wiring machine incorporating the present invention. Indicated generally by numeral 10 is a vacuum table or platen on which is located a core patch 12. The core patch 12 has mounted thereon a plurality of tiny toroidal elements (magnetic cores) arranged in rows and columns with the apertures thereof aligned. The placing of the cores on the core patch is a separate operation and may take place at a work station remote from that at which the stringing is done. Located on spools 14 are lengths of continuous filaments or wires 16 which are routed by suitable guide rollers 18 and solenoid operated clamps

20 and 22 so as to pass between reverse drive rollers 24 and forward drive rollers 26 to a point in close proximity to the vacuum table 10 on which the array of cores to be strung is located. Disposed between the guide roller 18 and the reverse drive rollers 24 is a drop bar mechanism indicated generally by numeral 28.

The assembly 28 includes an actuatable piston 30 which may be electrical, pneumatic or hydraulic in nature. Affixed to the movable plunger 32 of the cylinder 30 is a drop bar 34 having a pair of rollers 36 and 38 rotatably mounted at each end thereof. The cylinder 30 is fixed to the frame at the position schematically indicated in FIG. 1 and the controls associated therewith are such that when the cylinder 30 is actuated to move the drop bar assembly downward, the clamping means 22 is closed while the feed limit clamp 20 is open.

In operation, a free-loop of filament is drawn from each of the plurality of spools 14 by releasing the filament break 20, closing the clamps 22 and dropping the rollers 36 and 38 from the position illustrated in solid line to that shown in dotted line to thereby form a slack loop in the filaments when the rollers 36 and 38 are again retracted by the cylinder 30.

Next, the feed limit break 20 is closed to maintain the established withdrawn wire length and the clamp 22 is released to allow the drive rollers 26 to drive the wires forward towards the cores on patch 12. The reverse drive rollers 24 are included as a convenience if it is desired to back the filaments off from the core array.

Once the plural filaments are threaded through the array of toroidal elements, a wire severing mechanism 40 is operated to break the wires and at a same time to produce a bullet-nose end thereon. Specifically, the severing device includes a first clamp 42 and a second clamp 44 which are both first operated to grip the wires passing between the halves thereof and subsequently, the clamps 42 and 44 are laterally displaced from one another so as to impart a straight line tensile break in the filaments. The resulting bullet-nose on the filament ends facilitates the insertion of the filaments into the array when it is rotated 90 degrees, all as described in the aforementioned Fielder patent.

Thus, it can be seen that the operation of the drop bar mechanism serves to withdraw a predetermined length of filaments from the supply spools and form a slack loop therein so that when the drive rollers 26 are operated, they do not have the frictional resistance of the spools opposing the driving force.

Referring now to FIG. 2, there is shown a cross-sectional view which corresponds to FIG. 3 of the aforereferenced Fielder et al patent, but which is modified to incorporate the novel drive motion producing device of the present invention. As shown in FIG. 2, there is a drive roller 42 and a driven roller 44. The drive roller 42 is suitably journaled through bearings mounted in the frame member 46 and is adapted to be rotated by a chain drive 48 which is coupled to a drive motor (not shown) either directly or through a suitable transmission.

The driven roller 44 is disposed above the drive roller 42 and is adapted to be rotated by the drive roller 42 when it is lowered into contact with the filaments 16 passing therebetween. The ends 47 and 48 of the driven roller 44 are journaled by means of bearings 50 and 52 in cam follower arms 54 and 56 respectively. The ends 58 and 60 of the drive roller 42 pass through clearance holes 62 and 64 drilled through the cam follower arms

54 and 56 and are supported by the bearings in the frame member 46.

Secured to the arms 54 and 56 are a pair of cam followers 66 and 68. The cam followers may comprise steel ball bearings or rollers formed from a suitable plastic material such as Nylon which are rotatably mounted by means of screws 70 and 72 which pass therethrough and serve as an axle.

Cooperating with the cam followers 66 and 68 is a motor driven cam shaft 74 which is journaled in bearings 76 and 78 attached to the frame. Affixed to the cam shaft 74 are a pair of cams 80 and 82 which abut the cam followers 66 and 68. The cams 80 and 82 are designed to have an eccentricity such that as they rotate, the upper driven roller 44 periodically comes into contact with the filament 16.

Formed in the bearing members 76 and 78 are cylindrical bores 84 and 86 which receive a pair of guide pins 88 and 90 which are attached to the cam follower arms 54 and 56 respectively. These pins serve to constrain the motion of the cam follower arms and the driven roller in a vertical direction. Opposing this motion are a pair of spring biased ball-bearings 92 and 94 which abut the cam follower arms 54 and 56 and which are secured to the frame by a threaded fitting 96 and 98. The spring biased ball-bearings serve to hold the cam followers 66 and 68 in contact with the eccentric cams 80 and 82 in a conventional fashion as well as to offer some adjustment of wire driving frictional force. In operation, then, when the motor 100 is energized by a suitable control manipulated by the human operator, the cam shaft 74 is rotated via the chain drive 102 to periodically raise and lower the driven roller 44. When the roller 44 is in its raised position, no driving force will be imparted to the filament 16 to cause them to advance into the core array. However, when the cam follower arm assembly is in its lowered position, the driven roller 44 forces the filament 16 into contact with the drive roller 42 allowing them to advance. Because of the intermittent raising and lowering of the driven roller 44, a periodic, step-by-step advance motion is imparted to the filament 16.

As is described in the Fielder et al application, it is also desirable to impart a rotating motion to the filaments 16 as they are advanced in straight lines through the core array. For this purpose there is provided a gear reduction type transmission 104 which is coupled to the same motor (not shown) which operates the driven roller 42 through the chain drive 48. The transmission 104 causes the cam shaft 106 to rotate and thereby cause the drive roller 42 and the driven roller 44 to move laterally against the force applied to the shaft ends 47 and 58 by the spring biased bearing assemblies 108 and 110. Because of the manner in which the cams 112 and 114 are formed on the cam 106, the lateral movement of the driven roller 44 will be 180 degrees out of phase with respect to the lateral movement of the drive roller 42.

Thus it can be seen that a momentary or "pulsed" wire drive force may be exerted on the wires by causing a pair of motor/camcontrolled rollers to make-then-break physical contact with the wires. In the embodiment illustrated, this is achieved by lowering the driven roller against a motor driven drive roller. Because both the speed (frequency of contact) of lowering the upper roller and the rotational speed (RPM) of the drive roller are adjustable, an infinite range of sensitive wire

drive options exists from continuous drive to micro-incremental drive pulses. Finally, it is to be noted that this pulsed wire drive is used simultaneously with the previously developed method disclosed in the Fielder et al. patent of "rolling" the wire axially while propelling it forward. The combined pulse-and-roll action has been found to greatly improve the "homing" ability of a filament to enter a core aperture, especially when the filament may be slightly bent or when the cores are tipped on the core patches.

While there has been described a preferred embodiment of the present invention, many variations will be suggested to those skilled in the art and certain of these variations have already been discussed. Still further modifications will be apparent, however, and the foregoing description is therefore meant to be illustrative only and should not be considered limitative to the invention. All such modifications as are in accord with the principles described are meant to fall within the scope of the appended claims.

What is claimed is:

1. In a machine for threading filaments simultaneously through a plurality of apertured elements of the type including means for holding said elements in at least one row with their apertures aligned, means for supplying a continuous filament for said row; and a pair of drive rollers adapted to frictionally engage said filaments for advancing said filaments into said aligned apertures, the improvement comprising: means cooperating with said rollers for imparting a pulsating step motion to said filaments as they are advanced into said apertures.

2. In a machine for threading filaments simultaneously through a plurality of apertured elements of the type including means for holding said elements in at least one row with their apertures aligned, means for supplying a plurality of continuous filaments for the el-

ements in said row, a drive roller and a driven roller adapted to frictionally engage said plurality of filaments for advancing said filaments into said aligned apertures, and means for imparting a rotational motion to said filaments about their direction of advancement as they are advanced into said apertures, the improvement comprising: means cooperating with said driven roller for imparting a pulsating step motion to said filaments as they are advanced into said apertures.

3. Apparatus as in claim 2 wherein said last mentioned means comprises:

a. a motor driven cam shaft; and

b. a cam follower located on said driven roller adapted to cooperate with said cam shaft to periodically lift said driven roller out of contact with said drive roller.

4. Apparatus for threading a plurality of continuous filaments through an array of apertured elements of the type including means for holding said array in predetermined coordinate locations of rows and columns with the aperture of each element being aligned with all of the apertures of the elements in at least one row and one column, a plurality of spools for supplying continuous filaments for said elements in a row, and a drive roller and a driven roller mounted on separate shafts adapted to frictionally engage said filaments therebetween to advance said filaments through said array, the improvement comprising:

a. means for withdrawing a predetermined length of filaments from said plurality of spools to form a slack loop therein; and

b. means cooperating with said driven roller to periodically cause it to engage and disengage said drive roller to thereby advance said filaments through said array in pulsating steps.

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