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Shorrock

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[45] **July 15, 1975**

[54] **PATTERN CONTROL SYSTEM**

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[22] Filed: **June 4, 1973**

[21] Appl. No.: **366,484**

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Mar. 7, 1973 United Kingdom..... 11056/73

[52] **U.S. Cl.**..... **340/172.5;** 112/79 A
[51] **Int. Cl.**..... **G06f 9/00;** D05c 15/00
[58] **Field of Search** . 340/172.5; 235/151.1, 151.11; 112/79 A

[56] **References Cited**

UNITED STATES PATENTS

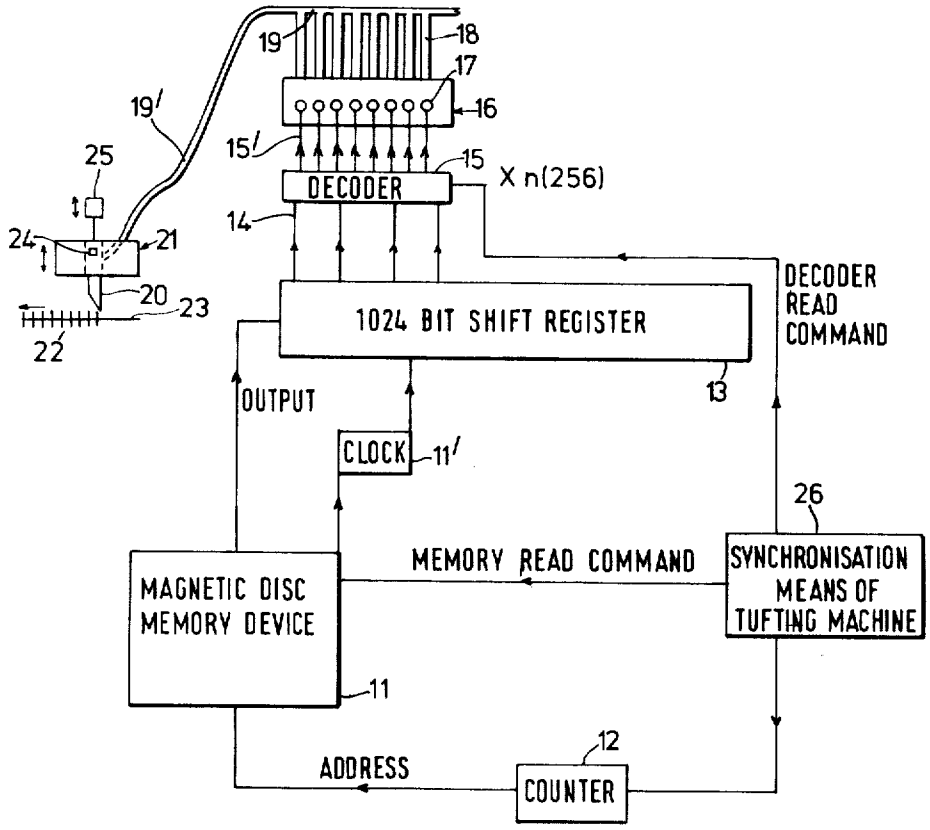
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Primary Examiner—Raulfe B. Zache
Attorney, Agent, or Firm—Steinberg & Blake

[57] **ABSTRACT**

The invention consists of a pattern control system for a textile machine such as one used to make tufted carpets, in which the colour or amount of yarn fed to each needle for each tuft insertion is to be individually controlled. Pattern information is recorded on a punched tape in binary form and fed to a magnetic disc memory such that each stitch in each pattern row, and the rows are recorded serially. During operation of the machine a start signal synchronised by the machine causes pattern information concerning a row of stitches determined by a counter to be fed serially from the disc to a temporary store which acts as a shift register, and on receipt of a command signal from the machine, delivers its information in parallel, if necessary via a decoder assembly, to the needles of the machine before their next tuft-inserting action. The control operation may determine either the colour of the tufts or their length, so that the carpet pattern finally produced may be either coloured or sculptured.

17 Claims, 4 Drawing Figures



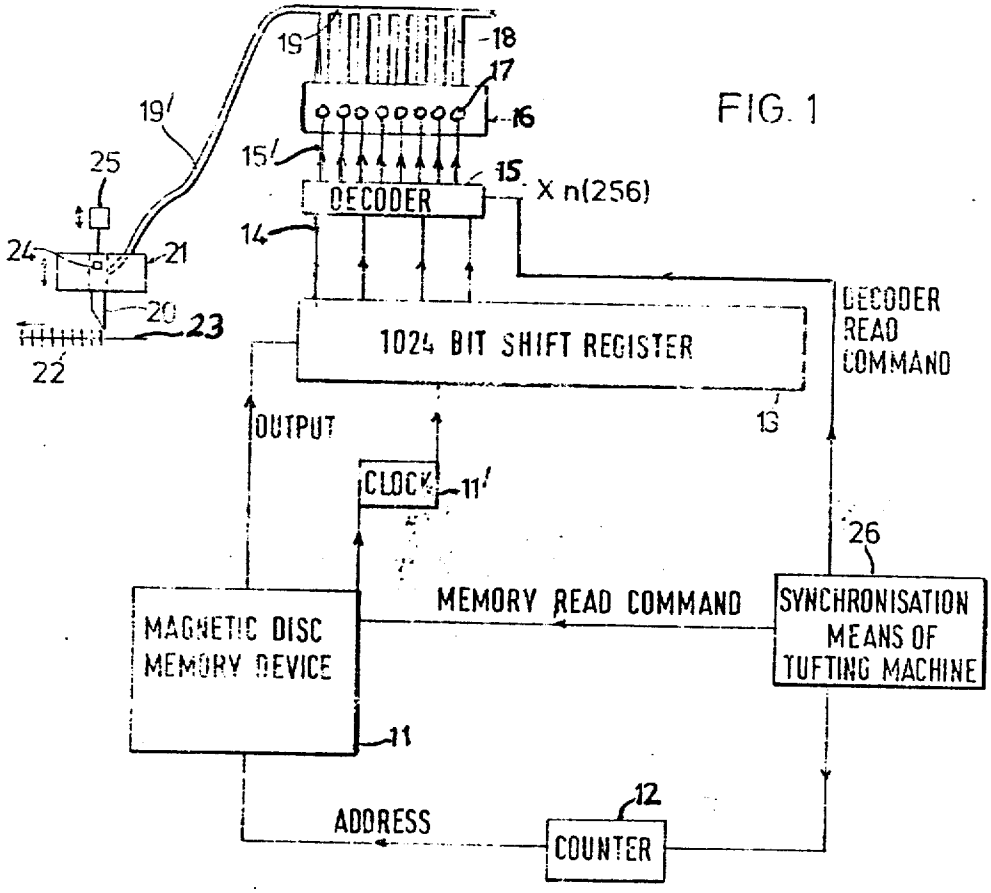

19
18
17
19'
16
15'
15
25
DECODER
X n(256)
14
24
21
20
23
22
1024 BIT SHIFT REGISTER
DECODER READ COMMAND
13
OUTPUT
CLOCK
11'
26
MEMORY READ COMMAND
SYNCHRONISATION MEANS OF TUFTING MACHINE
MAGNETIC DISC MEMORY DEVICE
11
ADDRESS
12
COUNTER

FIG. 1

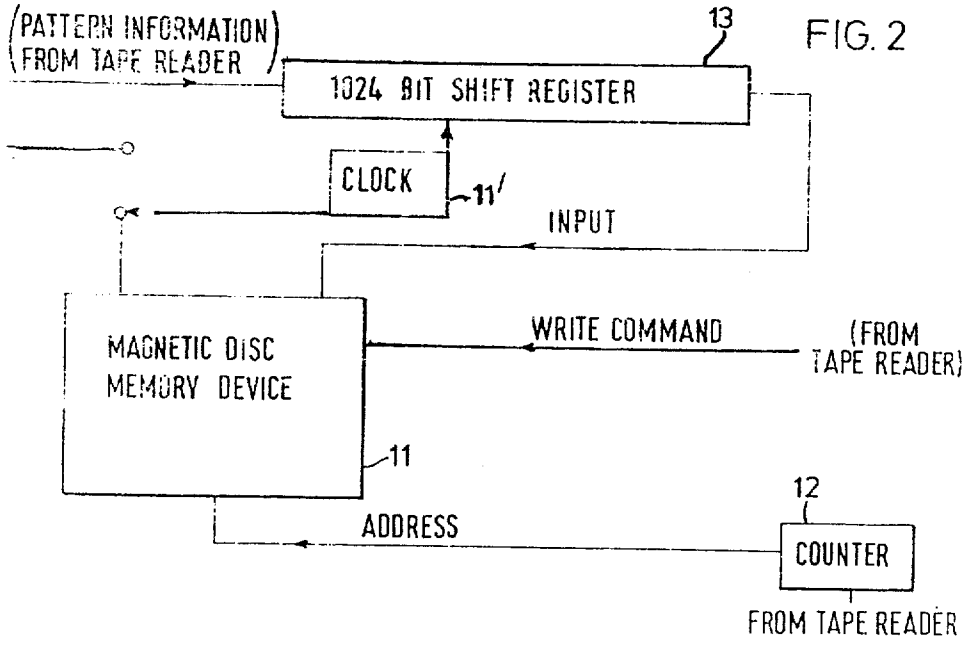

(PATTERN INFORMATION FROM TAPE READER)
13
1024 BIT SHIFT REGISTER
CLOCK
11'
INPUT
MAGNETIC DISC MEMORY DEVICE
WRITE COMMAND
(FROM TAPE READER)
11
12
ADDRESS
COUNTER
FROM TAPE READER

FIG. 2

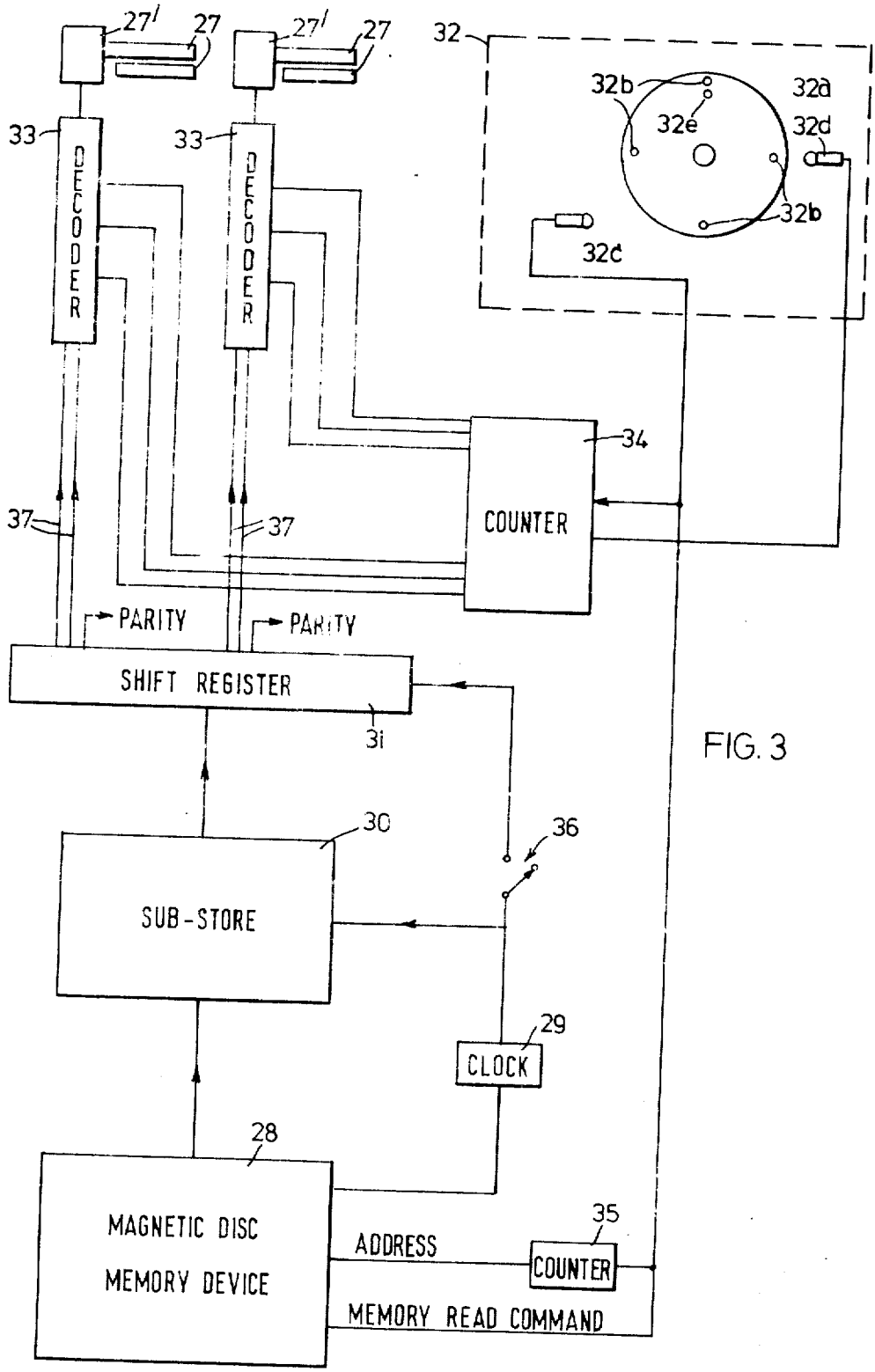

27'
27
27'
27
32
32b
32a
32e
32d
32b
32c
33
33
DECODER
DECODER
34
COUNTER
37
37
PARITY
PARITY
SHIFT REGISTER
31
30
36
SUB-STORE
29
CLOCK
28
MAGNETIC DISC
MEMORY DEVICE
35
ADDRESS
COUNTER
MEMORY READ COMMAND

FIG. 3

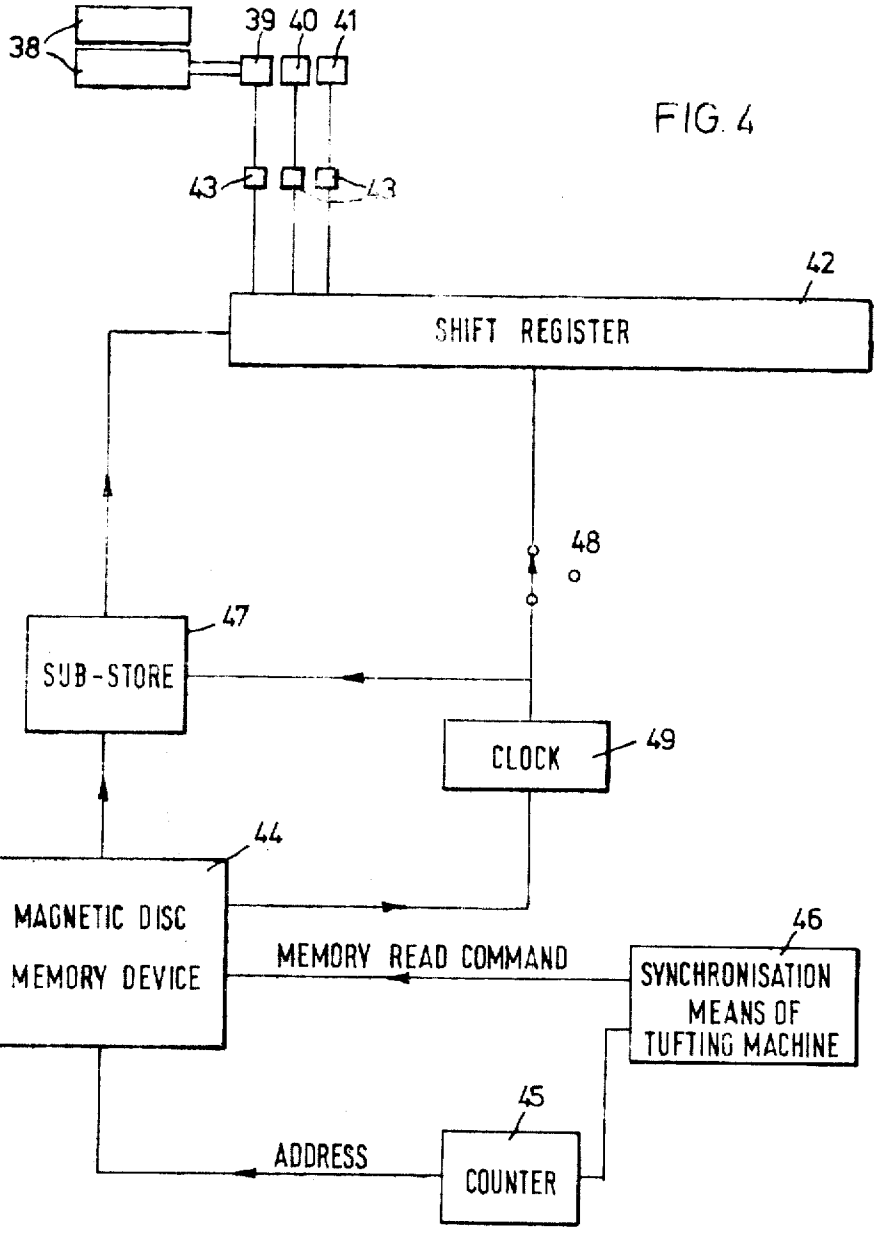

38
39
40
41
43
43
42
SHIFT REGISTER
48
47
SUB-STORE
CLOCK
49
44
MAGNETIC DISC
MEMORY DEVICE
MEMORY READ COMMAND
46
SYNCHRONISATION
MEANS OF
TUFTING MACHINE
45
ADDRESS
COUNTER

FIG. 4

PATTERN CONTROL SYSTEM

Prior Application: In Great Britain, on June 5, 1972 and March 7, 1973, No. 26207/72 and 11056/73 respectively.

The present invention relates to a pattern control system and is particularly suitable for use in a carpet tufting machine in which tufts of yarn of desired colour and/or yarns of desired length have to be supplied to a row of needles for insertion into a carpet backing material. It is not, however, intended that the invention be restricted to use with such tufting or other carpet machines and the control system may be used with any textile machine, such as a knitting machine, where patterning is needed.

For simplicity, however, the invention will generally be described with reference to carpet tufting machines having tuft or yarn supply means. (Tufting machines for which the pattern control system of the present invention is especially suitable for use with, are described in British Pat. Nos. 1,201,552 and 1,318,226 and include yarn supply means such as disclosed in British Application Nos. 7626/71 and 35828/72 which are operable to supply differently coloured tufts to form a carpet with a colour pattern.) The control system may also be used to advantage with machines for producing carpets with a sculptured pattern i.e. contoured pile produced by tufts of different heights, which machines include yarn supply means, the rate of operation of which is variable by the control system to produce a sculptured pattern.

It has been found that the direct use of pattern-coded punched paper tapes for controlling the supply of tufts to a tufting machine is disadvantageous in that the tapes are subject to wear which results in inaccuracies in pattern, or necessitates relatively frequent changes of tape, which reduces the output of the machines. Further, it is considered that use of punched tapes at sufficiently high speeds as are required by tufting machines would prove difficult and unsatisfactory. It is known to control yarn supply means by utilising a transparent band or a drum having a reflective layer, and marking such with opaque ink in such a manner that a series of photoelectric cells will receive coded light patterns and will transmit such to the yarn supply means. Such known controls are not entirely satisfactory in that they are limited as regards the complexity of the pattern to be produced.

According to the present invention, a pattern control system for use with a carpet tufting or the like textile machine requiring discrete control of each of a number of tuft or yarn supply means for the needles of the machine, comprises a pattern memory device, an address circuit for the memory device including a counter actuable by synchronisation means of the machine, read command means for actuating the memory device to read information therefrom; said information being fed in parallel form to effect control of the tuft or yarn supply means.

The memory device may be of any suitable kind such as a semiconductor memory or a magnetic core store although is preferably a magnetic disc or drum. If a semiconductor is used as the memory device, then a direct parallel output can be achieved. However, at present semiconductors are costly and it is considered preferable to utilize other memory devices and to include in the system a temporary store and serial to parallel converter actuated by clock means for receiving a serial information output from the memory device and for delivery as a parallel output to control the yarn supply means; said system being operable such that upon issuance of a read command from synchronisation means on the machine, pre-stored serial information from the correct address in the memory is supplied to the temporary store and serial to parallel converter.

The temporary store and serial to parallel converter is preferably a serial-input, parallel-output static shift register which provides a parallel output for control purposes. The clock pulses provide synchronising means for ensuring correct operation of the shift register in conjunction with the memory device used, and is connected according to the type of memory used.

The address counter is of known kind and may additionally be provided with means for visually indicating a particular row of given information selected at any given time.

Where more than a three state parallel output is involved, it is preferable to deliver the parallel output to a decoder for numeric conversion and for subsequent delivery to and control of the tuft or yarn supply means. The decoder may be of any kind (but adapted to translate binary into decimal form). A parity check system is preferably incorporated in the coding of the individual stitch information. In certain circumstances, it has be found of advantage to provide a sub-store between the memory and temporary store, when used, to provide the information in a more readily accessible form.

The synchronisation means for operating the address counter and the read command means are located on the tufting machine and may be micro switches actuable by a rotary member although preferably comprises photo-electric reading devices and one or more discs provided with suitably arranged or shaped apertures and used to provide accurate synchronisation means, the discs being mechanically coupled to the machine so as to cause the memory to load the temporary store and serial to parallel converter at the appropriate part of the machine cycle and to advance the counter and thus select the next row of information in like manner.

The yarn supply means may be of any known kind such as a plurality of individually controllable pairs of yarn drive rollers or braking means acting on yarn to control the feed or tension thereof. Alternatively, the output of the control system is connected to actuate, for each needle, one of a plurality of clamping devices of a multi-cutter-unit and yarn feed arrangement such as is disclosed in British Application Nos. 7626/71, 259/72 and 35828/72 and to thus cause a tuft of required colour to be subsequently fed to each needle.

The memory may be loaded in any suitable manner but it has been found particularly advantageous when using a magnetic disc or similar memory, to first code the information to be stored into binary form and to transfer the appropriate information onto a magnetic or paper tape. A parity-check may be provided in the code used. Each row of information contained on the tape is loaded in turn into a temporary store in serial form and transferred to the appropriate point in the magnetic disc as determined by an address signal appropriate to that row of information, in conjunction with a write command signal. If needed, clock synchronisation may be used. The address signal is controlled by a counter which is updated at the end of each row of information thus ensuring that the row information is correctly located in sequence on the magnetic

disc. The procedure is continued until the whole pattern is written into the magnetic store. One or more complete patterns may be encoded or stored in the memory and where more than one pattern is stored, suitable switching means may be provided to enable selection of the required pattern. Also means are provided to enable each pattern to be repeated as desired.

In one embodiment according to the invention, the pattern control system includes a temporary store and serial to parallel converter and a decoder and the operation of such system will now be generally described. The pattern memory device, having been previously stored with at least one complete pattern code, receives an address signal from the counter (actuated by a synchronisation signal from a control located on and operated by the tufting machine) which indicates the required next row of functions to be performed e.g. row of tufts to be inserted in a backing material by a row of needles. A read command actuable by suitable synchronisation means (also located on the tufting machine) then instructs the memory device to issue or provide a serial output which is received by the temporary store and serial to parallel converter, which may be a shift register. The associated clock means are provided to ensure correct synchronisation. The temporary store and parallel converter when fully loaded provides a parallel output which is decoded by the decoders to provide an output to effect the desired control function for tuft or yarn supply means. For example, the decoder output controls the tuft supply means to supply tufts of required colour to the needles for subsequent location as a row of tufts in a backing in the desired arrangement. This operation is repeated until the complete pattern is produced, each row being updated every machine revolution by means of the counter controlled by synchronisation signals obtained from the machine. Thereafter the process may be recommenced to repeat the pattern, or a new pattern may be provided.

In a preferred arrangement according to the invention, the control system is incorporated in a tufting machine for making carpets, with the pattern memory device (and the temporary store and serial to parallel converter, if used, and/or the decoder therefor, also if used,) being connected so as to control the tuft or yarn supply means; the read command and counter being connected to the synchronisation means on the machine.

In a further preferred embodiment, the control system is used in combination with a tufting machine having yarn feed means and power transmission means therefor or yarn braking means for yarn fed by yarn feed means, the described control system being arranged to vary the period of operation of the individual power transmission means or the braking means for different cycles of operation of the tufting machine so as to thereby regulate the amount of yarn fed.

It will be appreciated that this form of control system used in combination with a tufting machine, operates to regulate the amount of yarn which is fed to each needle (or the needles of the machine in repeats of the pattern) and therefore may regulate the yarn tension and accordingly the eventual tuft height. The principle of being able to vary the operation of the drive means i.e. of being able to operate the feed for a required proportion of the machine cycle and to vary such operation for successive cycles, as desired, is of considerable importance since it provides the potential of infinitely variable pile heights between two limits for a particular carpet. The yarn feed means will be of any suitable type but normally and preferably comprises a plurality of pairs of feed rollers between which yarn is passed upon rotation thereof. One of each pair of the rollers is connectable by the power transmission means e.g. a clutch, so as to be driven by the power means of the machine. Alternatively, the yarn feed means may comprise a pair of driven yarn feed rollers and yarn braking means e.g. solenoid actuated clamping device, acting on yarn to slow or prevent yarn passing to the rollers.

The power transmission means operates so as to normally cause its associated pair of rollers to be driven at constant speed for a given tufting operation although other suitable means, such as variable gearing or other transmission apparatus or even a variable speed drive motor, may be provided should it be required to change the normal drive speed of the rollers for a given machine operation.

The power transmission means may comprise a separate drive motor, such as an electric motor, for each pair of feed rollers although it preferably comprises transmission means connectable to and operable by the main drive motor or other means of a tufting machine with which it is to be associated; said power transmission means including clutch means and preferably an electromagnetic clutch. The clutch is operable by the control means so as to drive the feed rollers for a predetermined period during each operating cycle of the machine i.e. during a complete operational movement of the needle bar etc. wherein a row of loops is created. The clutch may be double acting so as to cause braking of the rollers upon disengagement of the drive.

The control system is arranged to operate so as to cause the power transmission means to interrupt the drive of the feed rollers after the whole or a predetermined portion of each operating cycle has been executed; said period being variable from cycle to cycle as determined by the programming of the control system.

Preferably the power transmission means operates to drive the yarn feed means (rollers) at the beginning of each cycle. The control system issues a signal to interrupt the drive of the feed means; in the preferred arrangement this disengages the clutch at a predetermined point in each cycle. The control system issues signals to cause the clutch to be disengaged at a predeterminable point in each cycle.

The control system includes a synchronisation means which operates with the tufting machine. The timing device indicates the actual phase of the cycle and coordinates the issue of signals with the desired phase of the cycle so that the clutch is or can be disengaged at appropriate stages in each cycle. A reset means is provided to cause the power transmission means to be reengaged or remain engaged at the commencement of each cycle.

It will be understood that a number of outputs of the system are controlled individually and that a choice of outputs be given i.e. any one from n outputs. From this it will be seen that there are two basic variables, the number of outputs controlled, and the choice of a different number functions for the outputs. In practical terms for tufting machines where individual yarn tufts of appropriate colour are to be inserted in a backing, and where, for example, a 1 metre or ½ metre pattern repeat across the width of the machine is being pro-

duced it would appear to be acceptable to control typically 256 or 128 outputs i.e. needles, in each respective repeat with a choice of eight different functions i.e. eight different colours, be given for each output so that any one needle can supply any one of eight colours at any one stitch. In the case of variable pile height machines, a more limited variation would appear to be required; two pile height is common, three-pile height frequent, but above this, further choice is uncommon. The reason for this is probably a mixture of practical limitation to a maximum of three-pile-height and that additional height definition is of little use to the carpet designer as such alterations in height are not very visible to the eye. However, it would appear that previously designers have not had a great deal of latitude in pile height determination.

Accordingly, the present invention permits control of a number of different outputs, typically 128 or 256, and offers an output variation of typically between two and eight states. The outputs may control either colour selection or pile height.

One further feature of the invention is the degree of precision involved in the machine control. It is believed that previous controls may not have been directly synchronised to the machine cycle i.e. the exact part of the machine cycle at which any changes take place had not previously been accurately controlled as is the case with the present invention. This means that the present invention enables control of each individual stitch or tuft of the carpet in terms of both what takes place and when it takes place. Previous arrangements determined what would take place but when it took place was relatively ill-defined. Thus previously clearly defined patterns have been difficult to produce and this has put unnecessary restraints on the carpet designer. This fact is most clearly shown in the case of sharp geometrical straight lined patterns which previously tended to be reproduced somewhat raggedly, whereas with the form of the invention each individual stitch is clearly defined.

The invention will be described further by way of example, with reference to the accompanying drawings, in which:

FIG. 1 is a schematic illustration of one embodiment of the pattern control system; and

FIG. 2 is a schematic illustration of a loading system for a memory device in the form of a magnetic disc,

FIG. 3 is a schematic illustration of an alternative embodiment of the control system in combination with a tufting machine;

FIG. 4 is a schematic illustration of a further embodiment of the control system in combination with a tufting machine.

In the embodiment of FIG. 1 control is required of a carpet machine for the control of 256 needles with a choice of eight different states (colours) and including a parity check system.

The pattern control system includes a magnetic disc memory device **11** as a storage means for the pattern information required in the carpet machine as mentioned. The magnetic disc memory device **11** is a known item and consists of a disc coated or plated with a magnetic material and rotated at high speed, with a series of record/replay tracks (not shown) associated with appropriate record/replay heads (not shown). The information is coded in digital form. A typical small magnetic disc is capable of storing 600,000 bits of information. In the case of a carpet pattern 1 metre wide using 256 needles, each stitch is coded using a four bit binary code, three bits being used to indicate any one of eight states, and the fourth bit as a parity check digit. Consequently for each row of information $256 \times 4 = 1,024$ bits are required. Assuming a metre repeat with 450 rows per metre, a typical density, then the total information requirement is $1,024 \times 450 = 460,800$ bits of information, which is well within the capacity of the device. In practice, a larger capacity disc would probably be used permitting carpet patterns of greater length if desired, or the storing of more than one pattern. For example, a disc with a storage capacity of 2,000,000 bits would permit the storing of information for up to four patterns.

Assuming the information relative to the pattern to be used has already been stored on the magnetic disc **11**, then to extract the information appropriate to any particular row, it is necessary to apply an address signal to the magnetic disc so that the correct information is extracted. Assuming that commencement is at the start of the pattern, address "one" is sent from a counter **12** to the memory device **11** and upon application of a memory read command signal, the information is extracted in serial form by a read head from the memory device **11**. This information is applied to the shift register **13** acting as temporary store and serial to parallel converter under control of clock pulses derived from clock **11'** of the memory device **11** to enable correct synchronisation to take place. When the shift register **13** has been fully loaded, the parallel outputs **14** consisting of the 1,024 bits of information particular to the row of information required are taken to a plurality of decoders **15** only one of said decoders being shown.

As stated, a series of four bit characters are obtained from the shift register **13**, each four bit element containing the control signal for specific tuft or yarn feed means **16**.

The tuft feed means **16** are preferably such as disclosed in British Applications 7626/71 and 35828/72 with such including actuators **17**, e.g. solenoids, which are selectively operable to cause a yarn of required colour to be fed to a cutter (not shown). The tuft produced by the cutter is pneumatically fed via one of passages **18** to a main feed line **19** of the tufting machine having a flexible portion **19'** leading to a hollow needle **20** in a reciprocable needle bar **21**. The tufts **22** are located in a backing **23** with the aid of a reciprocating stop **24** mounted on support bar **25** and operating in known manner.

Only a single decoder **15**, tuft feed means **16** etc. is illustrated but it should be understood that a plurality of such are provided for supply of tufts to a plurality of needles. Each decoder **15** has eight outputs **15'** and for each tuft stitching operation of a needle of the machine, a signal is transmitted from the decoder **15** via an appropriate output **15'** to cause a tuft of required colour to be fed to a needle **20**.

Where the pattern is to be repeated across the carpet, each output of each decoder may be connected to corresponding actuators of other tuft feed means to achieve the desired repeat.

The carpet machine itself determines via synchronisation means **26** when the actual reading of the shift register output takes place, and after the reading period has been completed, the counter **12** is advanced by one by a signal from the carpet machine generated at the

appropriate part of the machine cycle. The whole process is repeated with the counter being updated and the shift register reloaded every machine cycle until the entire pattern stored has been extracted, at which point the counter is reset to its first position. A manual facility (not shown) may be incorporated to enable reset of the counter **12** to the first position. The counter **12** is reset at the end of the pattern by using advance reading means, i.e. "look-ahead-block" of circuitry (not shown), which enables the information to be examined before it is actually used. Now any given element i.e. four bit code must contain at least one digit since odd parity is being used. As long as there is a digit present, then carpet information exists. At the end of every pattern no information of any kind i.e. a series of zeros, is deliberately stored. When the advance reading means sees no information it knows that the pattern has come to an end and a reset signal is sent to the counter **12.**

More than one pattern may be stored by using a discrete number of tracks of the disc per pattern. For example, if a 32-track disc is used, four tracks per pattern may be allocated to give eight patterns. This assumes that four tracks will hold sufficient information which is substantially true but depends on the specific make up and format of the particular disc. A manually operated switch (not shown) is used to select the tracks appropriate to the desired pattern and the counter **12** is adapted to operate only on the tracks so selected. In addition, the switch is so connected that when changing from one pattern to another, the counter **12** is always set to its first position so that commencement is always at the beginning of the pattern rather than some random point.

To write the information onto the memory device **11** in the first place, the stitch information is first transferred into four bit binary terms by means of a keyboard and a tape punch. A standard 1 inch tape is used which laterally will hold eight characters, sufficient information for two stitches. At the end of each complete row of information, a code is punched to indicate the fact that the end of the row has been reached. Similarly, at the end of the entire pattern another code is used to indicate this fact. The information from the punched tape is fed via a tape reader into a 1,024 bit shift register **13** which is serial input and serial output as illustrated in FIG. **2.** In practice, it is the same shift register as previously mentioned operated in a different mode. Clock pulses for this function are controlled from the tape reader, and when the shift register is fully loaded, the end of row signal from the tape initiates a write command signal to the magnetic disc store and also changes the clock signal to one derived from the magnetic disc memory device **11** so that correct synchronisation is assured. In addition, the end of row signal from the tape reader is used to update the counter and therefore the address. This action proceeds until such time as all the information is fed onto the disc and the final end of pattern signal is received. It will be appreciated that the point in which the row information is stored on the memory device **11** is controlled by the counter **12** controlling the address to the magnetic disc.

Manual means (not shown) are provided for setting up the shift register **13** so that it is possible to correct any given row of carpet information by so loading the shift register **13.** Manual means are also provided for setting the counter and by so doing it is possible to change the information in any given row by operation of the appropriate controls.

It is possible to switch the circuitry into a mode whereby the information stored on the magnetic disc may be used to generate a punched tape copy. This is done by feeding the output from the memory device **11** into the shift register as if to control the carpet machine, but instead feed the information out in serial form to a tape punch which then produces a punched tape corresponding to the information contained in the shift register and subsequently the entire carpet pattern stored.

In the embodiment of FIG. **3,** the pattern control system is combined with a tufting machine having a plurality of pairs of yarn feed rollers **27** (only two pairs being shown) and electromagnetic clutches **27'**, each clutch **27'** being capable of coupling a pair of rollers to the main power drive of the machine (not shown). Each clutch **27'** in its normal condition is engaged so as to provide drive to the rollers **27** and is disengageable by the control means.

The control system shown comprises a pattern memory device in the form of a magnetic disc store **28** (including a clock **29**) on which there is stored a pattern code. The disc store **28** provides a serial output to a sub-store **30** which transmits such to a shift register **31** (buffer store) forming the temporary store and serial to parallel converter and transmits upon receipt of a read command issued by synchronisation means **32** on the tufting machine. The sub-store **30** is provided to enable information to be read from the memory device **28** and stored in an easily accessible form, whilst the shift register **31** is presenting information to a series of decoders **33** (only two being shown). Upon completion of one cycle of operation, the information in the sub-store **30** is passed into the shift register **31.** A parity check is provided.

The decoders **33** have a decoding counter **34** associated therewith which is actuated by synchronisation pulses from the machine. The output of the decoders **33** is determined by the state of the decoding counter **34** and the data input form **31.** Accordingly the output signal of the decoders **33** is a function of data and machine positions.

The synchronisation pulses are derived from a disc **32***a* rotatable with a shaft of the tufting machine and having phase reference means provided by one or more apertures **32***b* therein (or one or more transparent portions and/or one or more reflective portions). Light sources (not shown) and photoelectric cells **32***c* and **32***d* acting as sensors are associated with the disc **32***a* and the apertures are so arranged that rotation of the disc generates pulses at different phases in the cycle of the machine. Some pulses are fed to the decoding counter **34** which gates the information into the decoders **33** and permits the disengagement of the clutches **27'** at a particular point or phases in the cycle as determined by the data provided by the memory device **28.** Another set of pulses (generated by the reset photoelectric cell **32***c* and reset aperture **32***e*) operates to reset the system, and to transfer or trigger information from the sub-store **30** to the shift register **31** at the commencement of each cycle. (This particular synchronisation arrangement can be utilised in the other embodiments of the invention). The apertures **32***b* and **32***e* provided in the disc **32***a*, are shaped and/or dimensioned so as to indicate particular phases or points of

a cycle and so as to provide the required timing and may be variable e.g. by providing an adjustable transverse member in a slot (not shown).

In operation and assuming information relative to the three height sculptured pattern to be used has been stored on the device **28**, information appropriate to any particular row is obtained from the device **28** by applying an address signal from counter **35** and by subsequent application of a memory read command signal. The information is fed in serial form from the magnetic disc **28** to sub-store **30** with the switch **36** being in the open position to prevent transfer of information to the shift register **31**. Sub store **30** is provided to permit rapid transfer of information to the shift register **31** when required. The transfer of information to shift register **31** is effected by closing switch **36** thereby clocking information (by clock **29**) into the shift register **31**. The information is fed through the parallel outputs **37** of the shift register **31** and gated into decoders **33** and effects disengagement of the clutches **27'** at the desired phase in the cycle to thereby regulate the amount of yarn supplied to the needles (not shown). As mentioned, a plurality of pairs of rollers **27** and clutches **27'** are provided and each pair of rollers has a plurality of yarns which are fed thereby to a plurality of corresponding needles in the respective pattern repeat regions.

The embodiment of FIG. 3 enables the number of feed rollers and clutches etc. of known carpet tufting machines to be advantageously reduced and the control enables a better pile definition to be achieved.

The embodiment illustrated in FIG. 4 includes a control system in combination with a tufting machine having a plurality of pairs of yarn feed rollers **38** (only one pair being shown). Each pair of rollers **38** is adapted to be driven at different speeds for different cycles of the machine and this is achieved by engagement of one of, for example, three electromagnetic clutches **39, 40, 41**. The clutches **39, 40, 41** are arranged to couple the pair of rollers with any one of, for example, three drive shafts (not shown) rotating at different speeds. Alternatively, the clutches are each differently geared to a single drive shaft (not shown) rotating at constant speed and are thus adapted to drive the rollers at different speeds dependant upon whether low, medium or high pile height is required. The parallel output of shift register **42** is amplified by one of three amplifiers **43** to cause appropriate engagement of one of the clutches **39, 40, 41**.

In operation, an address signal is applied to the magnetic disc memory device **44** from counter **45** and a memory read command is applied from synchronisation means **46** on the tufting machine to load sub-store **47** (which may be omitted if the machine speed is compatible with the access time of the memory); switch **48** being open so as to disconnect the clock **49** from the shift register **42** and thereby prevent undesired transfer of information into the shift register **42**. The clock **49** is subsequently connected to the shift register **42** by closing switch **48** and information in the sub-store **47** fed into said shift register **42**. Switch **48** is then disconnected and the operation repeated in dependance of signals from the synchronisation means **46**. The outputs of the shift register **42** may be inhibited during data transfer from the sub-store **47** to the shift register **42**. This feature is desirable but not essential.

I claim:

1. A pattern control system for use with a textile machine requiring discrete control of each of a number of yarn supply means for the needles of said machine, said system comprising a pattern memory device, an address circuit for said memory device, said circuit including a counter actuable by synchronisation means of said machine, read command means actuating said memory device to extract information therefrom; and means for feeding said information in parallel form to effect individual control of said yarn supply means.

2. A system as recited in claim **1**, wherein said information feeding means includes a temporary store and serial to parallel converter actuated by clock means for receiving a serial information output from said memory device and for delivering said information as a parallel output to control said yarn supply means; said system operating such that upon issuance of a read command from said synchronisation means, pre-stored serial information from an address on said memory is supplied to said temporary store and serial to parallel converter.

3. A system as recited in claim **2**, including a decoder receiving said parallel output from said temporary store to parallel decode said output and subsequently delivering said decoded output to control said yarn supply means.

4. A system as recited in claim **2** in which said temporary store and serial to parallel converter is a shift register.

5. A system as recited in claim **2** including yarn feed means with power transmission means, wherein said control system is capable of varying in predetermined manner, the period of operation of said power transmission means at different cycles of operation of said textile machine so as to thereby regulate the yarn fed.

6. A textile machine including a control system as recited in claim **1** and having yarn supply means controllable by said system.

7. A machine as recited in claim **6** wherein said yarn supply means comprises a plurality of assemblies each controllable to cut off a tuft of yarn of desired colour from one of a plurality of yarns fed to a cutter assembly, and means for subsequently delivering said cut off tuft to a needle of said machine.

8. A machine as recited in claim **6**, wherein said yarn supply means comprises a plurality of individually controllable feed means adapted to act on yarn to control the feed thereof.

9. A machine as recited in claim **6** wherein said yarn feed means includes individually controllable braking means acting on yarn supplied to the needles of the machine to selectively control the tension of said yarn.

10. A machine as recited in claim **6** in which said synchronisation means comprises phase reference means operated at different phases of the cycle of said machine, and sensors co-operating therewith to transmit signals to a resettable counter which gates information into the decoder.

11. A machine as recited in claim **10**, in which said phase reference means comprises a disc rotatable in synchronism with a shaft of said machine with phase indicator light control portions defined on said disc, and in which said sensors comprise light sources and photoelectric cells associated with said disc so as to transmit signals at different phases of the cycle of said machine upon rotation of said disc, said signals being transmitted to said resettable counter which gates information into said decoder.

12. A machine as recited in claim 10, including a sub-store between said memory device and said temporary store and serial to parallel converter said sub-store providing quick access of information, and means for loading said temporary store on receipt of a command signal from said machine.

13. A machine as recited in claim 8 wherein said feed means includes a pair of drive rollers and a power transmission means for each pair of said drive rollers.

14. A machine as recited in claim 13, in which said power transmission means each comprise a clutch for engaging and disengaging said pair of rollers from a drive.

15. A machine as recited in claim 6, wherein said pattern memory device is a magnetic disc store.

16. A machine as recited in claim 6, in which said yarn supply means includes a plurality of pairs of yarn feed rollers, each pair of rollers having a plurality of individually operable power transmission means adapted to drive one or both rollers at different speeds for different cycles of the machine.

17. A machine as recited in claim 16, in which said power transmission means each comprise an electromagnetic clutch connectable to drive means.

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