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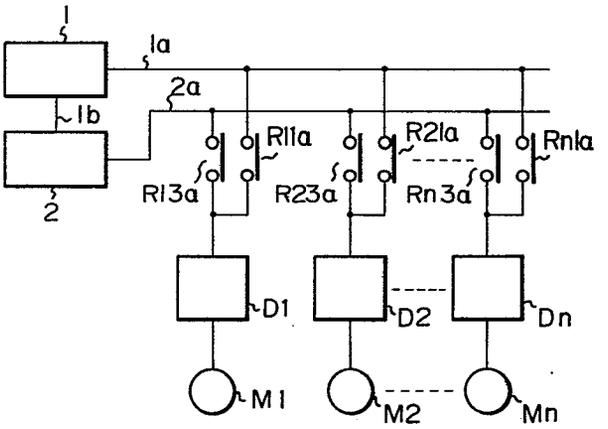
(71) Applicant: **TSUDAKOMA KOGYO KABUSHIKI KAISHA, 18-18 5-chome, Nomachi, Kanazawa-shi Ishikawa-Ken (JP)**

(72) Inventor: **Sugita, Katsuhiko, 264 Magae 3-chome, Kanazawa-shi Ishikawa-ken (JP)**

(74) Representative: **Blumbach Weser Bergen Kramer Zwirner Hoffmann Patentanwälte, Radeckestrasse 43, D-8000 München 60 (DE)**

(54) A mass driver circuit for weaving looms.

(57) A drive motor ($M1–M_n$) for each loom is selectively connectable to a given commercial frequency power source (1) for high speed rotation at normal running of the loom and to a low frequency power unit (2) for low speed rotation at inching operation, thereby assuring accurate inching operation with cheap cost on looms under mass drive condition.



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TSUDAKOMA KOGYO KABUSHIKI KAISHA

A MASS DRIVER CIRCUIT FOR WEAVING LOOMS

Background of the invention

The present invention relates to a mass driver circuit for weaving looms, and more particularly relates to improvement in construction of a driver circuit for accurate inching operation on weaving looms.

When a trouble such as yarn breakage of unsuccessful weft insertion occurs during normal running of a loom, the loom is either manually or automatically stopped and inching operation is performed in order to move the crank to a position suited for work to remove the cause of the trouble and/or weaving defects resulted from such a trouble.

One conventional electric circuit for such inching operation includes a push button switch which is given in the form of a manually operable, self-returnable contact so that electric power should be supplied to the drive motor for the loom as long as the push button switch is turned on. That is, the loom is driven for inching operation by turning on the push button switch for prescribed length of period so that the crank should be moved to a desired position.

Alternating current motors such as induction or synchronous motors are in general used for drive of looms, and such a drive motor is connected, for rotation, to an electric power source which puts out electric power of commercial frequencies. Such an electric power source is called "a commercial frequency power source" and will hereinafter be described as "a CF power source". So, once the CF power source to be used is fixed, the rotation speed of the drive motor per se is unchangeable. In order to obtain a desired running speed of the loom for which the drive motor is used, transmission ratio has to be changed in the power transmission coupling the drive motor to the crank shaft of the loom. More specifically, diameter of a pulley or pulleys used in the power transmission has to be changed.

With recent significant rise in running speed of looms, the diameter of pulleys for the power transmission has been increased accordingly. When the drive motor is connected to the CF power source also at inching operation on the loom under this condition, even short period turning-on of the push button switch results in relatively large rotation of the crank shaft due to the increased diameter of the pulleys, and the crank is moved past the desired position. In addition, since the push button switch is operated manually, the turning-period cannot be shorten limitless. So, it is now quite difficult to enable accurate inching operation on looms as long as manually operated push button switches are used.

It was proposed to use a pole-change type motor for drive of looms. In this case, the number of poles in the drive motor is increased at inching operation from that at normal running of the loom. This results in lower rotation speed of the drive motor and the loom is provisionally driven for slower running at inching operation.

Such a pole-change type drive motor, however, requires corresponding increase in number of coil windings which is inevitably accompanied with low efficiency. In addition, reduction in number of coils at normal running causes lowering motor efficiency. In order to cover this deficiency, it is necessary to use a drive motor which is able to generate torque large enough to enable proper normal running of the loom. This inevitably connects to large construction of the loom. Further, since this system relies on change in number of poles in the drive motor, it is difficult to vary rotation speed of the loom over a significantly wide range. So, in particualr under high speed running condition, the rotation speed of the drive motor cannot be lowered enough at inching operation. In addition, change in rotation speed of the drive motor can be effected stepwise only, and, as a consequence, rotation speed of the drive motor cannot be adjusted analogously. So, it is difficult to move the crank of the loom always to a correct position at inching operation.

In most weaving factories, looms are divided into several groups depending on, for example, the type of product to be woven

and a mass drive system is employed for each group. Under normal condition, only one or two looms in a group require concurrent inching operation. Despite this real condition, the above-described pole-change system requires that every loom should be provided with a switch circuit for pole change. This apparently ends in high installation cost.

Summary of the invention

It is the object of the present invention to provide a cheap and small mass driver circuit which provisionally and selectively lowers, at inching operation, the crank shaft rotation speed accurately down to a desired level on a loom or looms in a given group which require inching operation.

In accordance with the present invention, a low frequency power unit is connected to a given CF power source and the drive motor of each loom is connected selectively to the output line of the CF power source at normal running and to the output line of the low frequency power unit at inching operation of the loom, respectively. This selective connection is typically carried out by electric switching operation.

The low frequency power unit will hereinafter be described as "LF power unit", and may include an inverter circuit, a triac

circuit or a motor-generator combination circuit.

Brief description of the drawings

Fig. 1 is a block circuit diagram for showing the basic construction of the mass driver circuit in accordance with the present invention,

Fig. 2 is a circuit diagram of one example of the individual driver circuit accompanying each loom,

Figs. 3 to 5 are circuit diagrams of various embodiments of the LF power unit advantageously usable for the mass driver circuit shown in Fig. 1, and

Figs. 6A and 6B are block circuit diagrams for showing the operation of the mass driver circuit shown in Fig. 1.

Description of the preferred embodiments

The present invention is advantageously applied to a group of weaving looms controlled by a mass drive system and each loom is, as described already, selectively connected to two sorts of power supply of different frequencies as shown in Fig. 1.

More specifically, a given CF power source 1 has two output lines 1a and 1b and the one output line 1b is connected to a LF power unit 2 having an output line 2a. Usually, power is taken by circuits D1 ~ Dn via relay a-contacts R11a ~ Rn1a whereas the output line 2a of the LF power unit 2 is also connectable to the individual driver circuits D1 ~ Dn but via different relay a-contacts R13 ~ Rn3a. The individual driver circuits D1 ~ Dn are electrically connected to drive motors M1 ~ Mn of the associated loom, respectively.

The driver motor is here given in the form of an induction motor and its output shaft is mechanically coupled to the crank shaft of the associates loom by means of a proper power transmissions. The driver motor is driven from a threephase alternating electric power source whose output lines are each made up of three wires. In the illustration, however, the three wires are represented by one output line for simplification purposes. The LF power unit 2 puts out electric power whose frequency is lower than the given commercial frequency and chosen in accordance with the real condition of the inching operation.

The other output line 1a of the CF power source 1 is connected to individual driver power transmission made up of, for example, pulleys and driven for rotation at different speed during normal running and inching operation of the associated loom as later described in more detail.

Different drive motors M1 ~ Mn are accompanied with individual driver circuits D1 ~ Dn of same construction. One example of the individual driver circuit D1 for the drive motor M1 is shown in Fig. 2, in which the individual driver circuit D1 is connected to a given common electric power source (not shown) by means of output lines 3a and 3b. The individual driver circuit D1 includes three sets of push button switches S11 ~ S13 and two sets of relays R11 and R13 arranged between the output lines 3a and 3b.

More specifically, the first switch S11 is a normally open switch used for starting the drive motor M1, the second switch S12 is a normally closed switch used for stopping the drive motor M1, and the third switch S13 is a normally open switch used for the inching operation of the loom.

The one terminal of the start switch S11 is connected to the output line 3a via a relay b-contact R13b, which is normally closed, of the relay R13 whereas the other terminal of the start switch S11 is connected to the output line 3b via the relay R11. The one terminal of the stop switch S12 is connected also to the output line 3a via the relay b-contact R13b whereas the other terminal of the stop switch R12 is connected to the output line 3b via a relay a-contact R11a', which is normally open, of the relay R11 and the relay R11. The one terminal of the inching switch S13 is connected to the output line 3a via a relay b-contact R11b, which is normally

closed, of the relay R11 whereas the other terminal of the inching switch S13 is connected to the output line 3b via the relay R13.

As the relay R11 is activated, the relay a-contacts R11a and R11a' are closed and the relay b-contact R11b opens. As the relay R13 is activated, the relay a-contact R13a is closed and the relay b-contact R13b opens.

One embodiment of the LF power unit 2 used for the mass driver circuit in accordance with the present invention is shown in Fig. 3, in which the LF power unit 2, i.e. the frequency converter, is given in the form of an inverter. The inverter converts alternating current power into direct current power which is then chopped at a frequency lower than the given commercial frequency for generation of low frequency electric power. The inverter is accompanied with a control circuit 4 having a frequency setter 5. The control circuit 4 generates on its output lines 4a base drive electric current.

When such an inverter is used for the LF power unit 2, it is advantageous to raise its voltage-frequency ratio (V/f) in order to increase the output torque. This is because the short inching period and variation in load on the loom necessitate large starting torque.

Another embodiment of the LF power unit 2 in accordance with the present invention is shown in Fig. 4, in which the LF power unit 2 is given in the form of a triac. The triac controls passage of alternating current half waves in order to generate mimic low frequency electric voltage. The triac is accompanied with a control circuit 6 which generates ignition pulses on its output lines 6a.

The other embodiment of the LF power unit 2 in accordance with the present invention is shown in Fig. 5, in which the LF power unit 2 is given in the form of a combination of a motor 7 with a generator 8. More specifically, the motor 7 is connected to the output line 1a of the CF power source 1 and the output shaft of this motor 7 is mechanically coupled to the generator 8 which is thereby driven for rotation for generation of low frequency electric voltage.

In practical application of the present invention, it is advantageous to use drive motors of a delta-star shiftable type. Delta connection is employed for the inching operation in order to lower the input voltage to the frequency conterter below that of the CF power source without lowering the output torque, thereby enhancing voltage resistance of the frequency converter, i.e. the LF power unit.

With the above-described construction, the mass driver circuit in accordance with the present invention operates as follows. Since the operation is quite same for different drive motors M1 - MD, the first drive motor M1 is taken as an example.

Before running of the loom starts, the circuit assumes the condition shown in Fig. 1. That is, the relay a-contacts R11a and R13a are both kept open. Further in Fig. 2, the start and inching switches S11 and S13 are kept turned off and stop switch S12 is kept closed.

In order to initiate running of the loom, the start switch S11 is turned on. Then the relay R11 is activated and thereby a-contact R11a is closed so that the drive motor M1 should be connected to the CF power source 1 via the output line 1a. The drive motor M1 starts rotation in order to initiate running of the loom. Concurrently with this process, activation of the relay R11 closes the relay a-contact R11a' (see Fig. 2) so that activation of the relay R11 should be retained by self-holding if the start switch S1 is turned off. Activation of the relay R11 further opens the relay b-contact R11b so that the relay R13 should not be activated even if the inching switch S13 is unexpectedly turned on by error. This condition is shown in Fig. 6A.

When running of the loom has to be ceased due to occurence of some trouble such as yarn breakage, the stop switch S12is turned on. This is performed either manually or automatically. Then the

self-holding for the relay R11 is cancelled and the activation disappears. This deactivation of the relay R11 opens the relay a-contacts R11a and R11a' and closes the relay b-contact R11b so that the entire circuit resumes the condition shown in Fig. 1. The drive motor M1 is now disconnected from the CF power source 1 and stops its rotation in order to cease the running of the loom.

For inching operation, the inching switch S13 (see Fig. 2) is turned on under this condition. The relay R13 is thereby activated in order to close the relay a-contact R13a and open the relay b-contact R13b. Then, the drive motor M1 is connected to the LF power unit 2 via the output line 2a and driven for rotation at a speed lower than that for the normal running of the loom as long as the inching switch S13 is kept turned on. This condition is shown in Fig. 6B. Due to the open state of the relay b-contact R13b, the relay R11 should never be activated even when the stop switch S12 is turned on by error during the inching operation.

Thus, the loom is provisionally driven for inching operation at a speed lower than that for the normal running and the crank can be moved accurately to the desired position by turning on the inching switch for a proper length of period. High rate of frequency conversion at the LF power unit 2 enables further significantly slow rotation of the drive motor so that further accurate positioning of the crank can be attained at inching operation.

After the correct position is obtained for the crank of the loom, the inching switch S13 is turned off in order to deactivate the relay R13. This deactivation of the relay S13 opens the relay a-contact R13a and closes the relay b-contact R13b so that the entire circuit should resume the condition shown in Fig. 1 in which the drive motor M1 is disconnected from the LF power unit 2. As a consequence, the loom ceases its inching operation.

After the cause for the trouble has been removed, the start switch S11 is again turned on so that the loom should initiate its normal running under the condition shown in Fig. 6A.

As described already, looms are usually divided into several groups under mass drive condition and, usually, each group contains one or two looms which require concurrent inching operation. So, no large capacity is required for the LF power unit, i.e. frequency converter, in accordance with the present invention. As a consequence, despite the general high cost of frequency converters on market, only insignificant installation cost is required for application of the present invention. Small capacity of the LF power unit naturally connects to low price and small construction of the entire mass driver circuit. Further, continuous frequency setting at the LF power unit can suffice any delicate requirements in inching operation and extent.

The separate arrangement of the circuit from individual looms allows accordingly reduced size of each loom construction.

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Claims .

1. A mass driver circuit for weaving looms comprising

a commercial frequency power source,

a low frequency power unit connected to said commercial frequency power source and capable of lowering the frequency of the electric power supplied by said commerical frequency power source, and

means for selectively connecting a drive motor of each weaving loom to said commercial frequency power source at normal running of said weaving loom and to said low frequency power unit at inching operatin of said weaving loom.

2. A mass driver circuit as claimed in claim 1 in which said selectively connecting means includes

an individual driver circuit connected to said drive motor for each weaving loom and including a first relay, start and stop switches connected in parallel connection to said first relay, a second relay, and an inching switch connected to said second relay,

a relay a-contact of said first relay interposed between said individual driver circuit and said commercial frequency power source, and

a relay a-contact of said second relay interposed between said individual driver circuit and said low frequency power unit,

whereby said relay a-contact of said first relay is closed to electrically connect said drive motor to said commercial frequency power source when said start switch is turned on whereas said relay a-contact of said second relay is closed to electrically connect said drive motor to said low frequency power unit.

3. A mass driver circuit as claimed in claim 1 in which

said low frequency power unit is given in the form of an inverter.

4. A mass driver circuit as claimed in claim 3 in which

the voltage-frequency ratio of said inverter is enlarged for low frequencies.

5. A mass driver circuit as claimed in claim 1 in which

said low frequency power unit is given in the form of a triac.

6. A mass driver circuit as claimed in claim 1 in which

said low frequency power unit is given in the form of a combination of a motor and a generator mechanically coupled to the output shaft of said motor.

7. A mass driver circuit as claimed in any of claims 1 to 6 which

said drive motor is a delta-star shiftable motor and set to delta connection at inching operation.

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Fig. 1

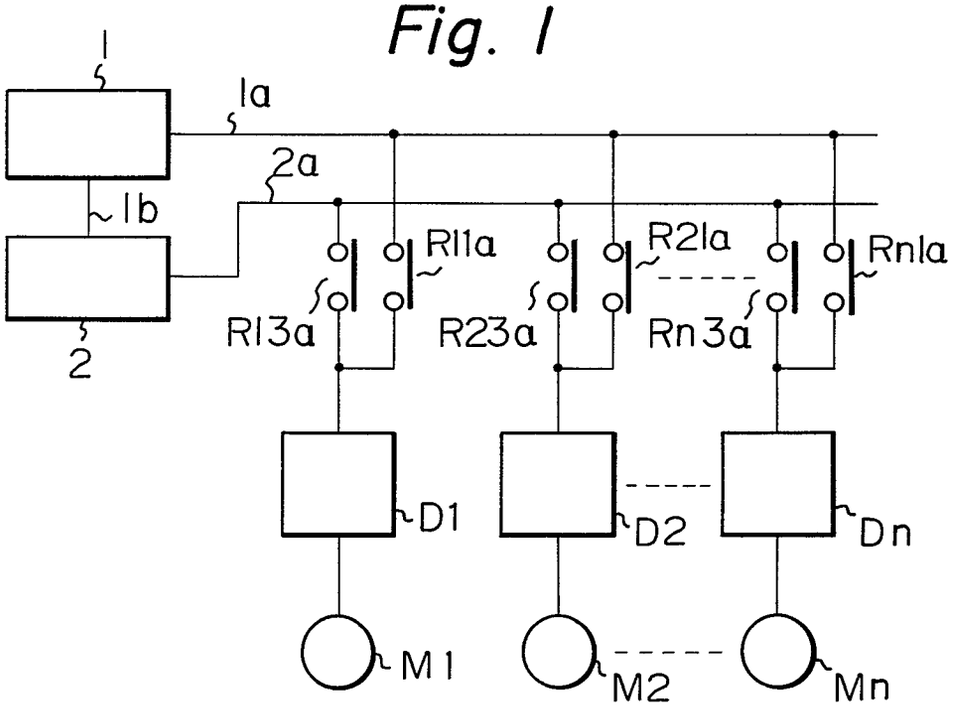

Fig. 2

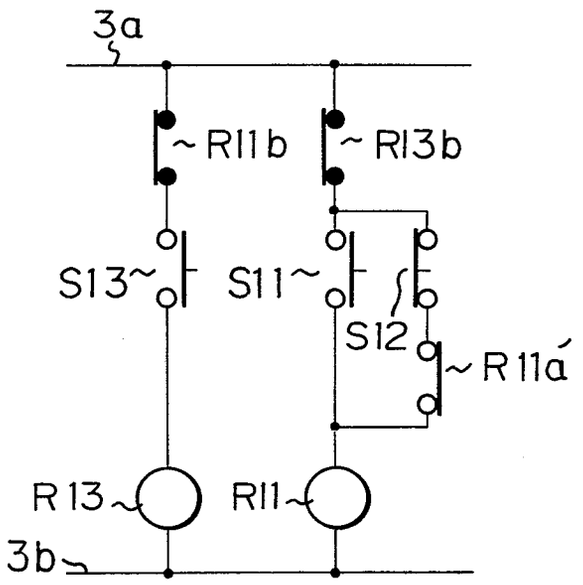

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Fig. 3

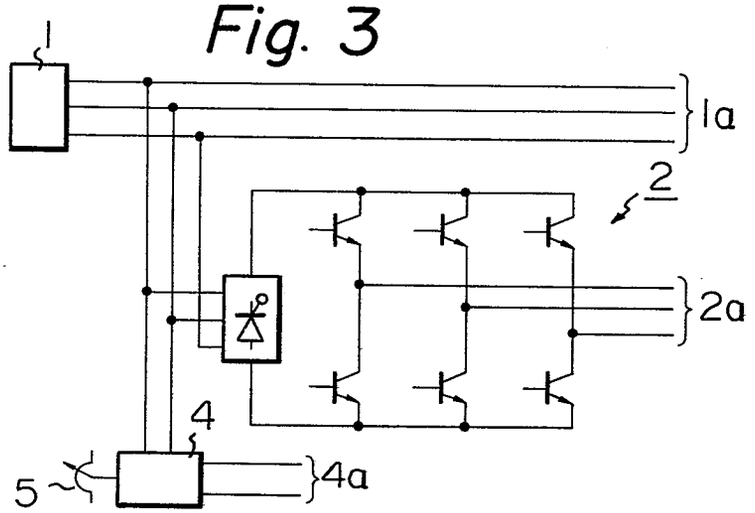

Fig. 4

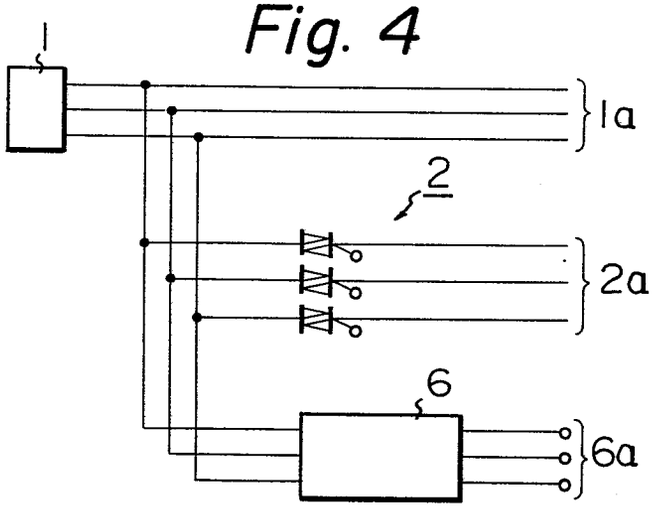

Fig. 5

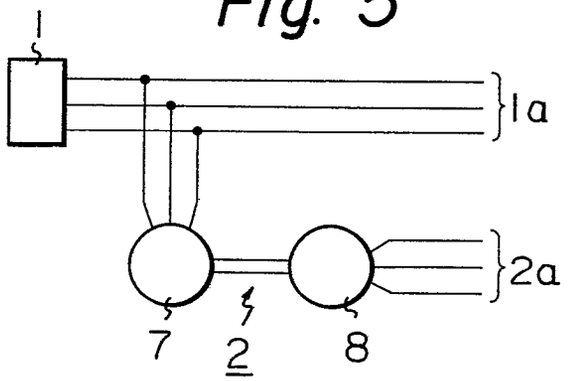

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Fig. 6A

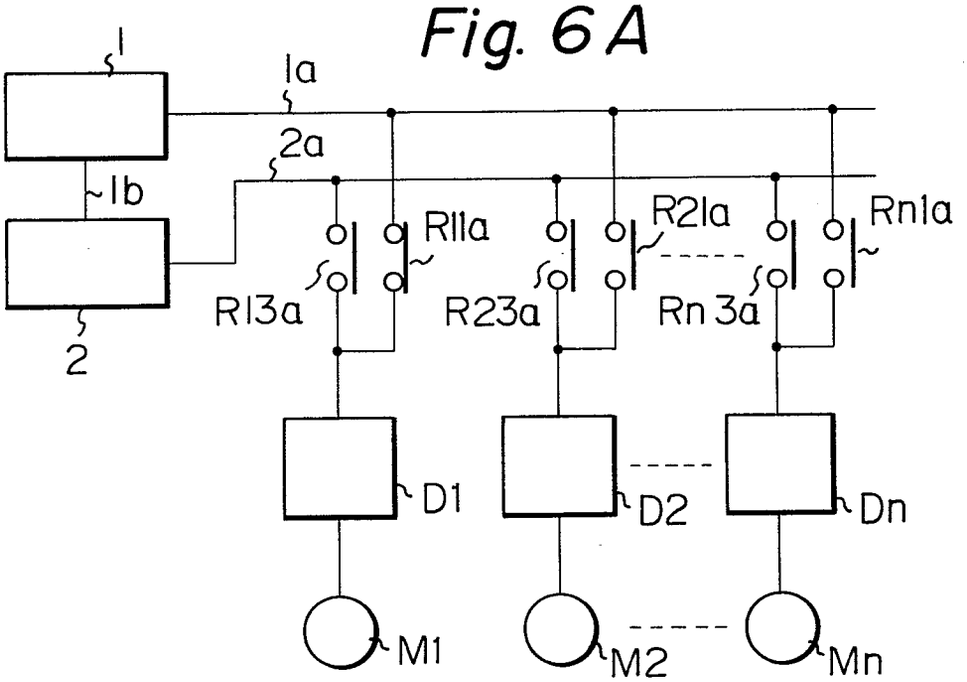
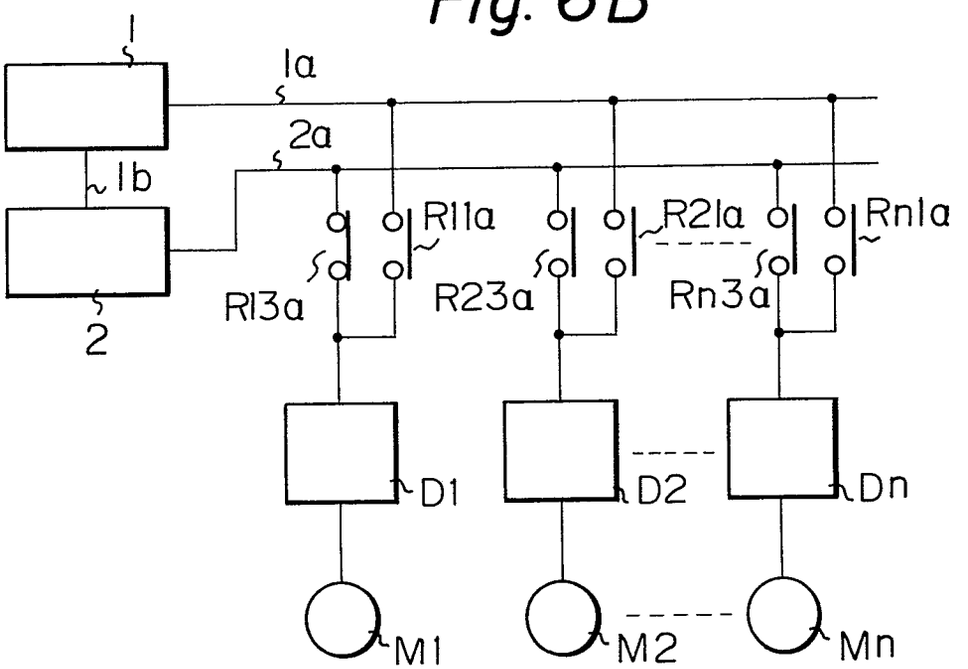


Fig. 6B



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EUROPEAN SEARCH REPORT

Application number

EP 82 10 9617

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. ³)
X	DE-C- 587 124 (SIEMENS) * Complete document * -----	1,3,6	D 03 D 51/00

TECHNICAL FIELDS SEARCHED (Int. Cl. ³)
D 03 D 51/00

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
BERLIN	03-06-1983	KLITSCH G

CATEGORY OF CITED DOCUMENTS

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