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[54] **METHOD OF AND APPARATUS FOR DRIVING ENGRAVING MACHINES OF THE DRUM TYPE**
10 Claims, 1 Drawing Fig.

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[50] **Field of Search** ..... 178/6.6, 6.6 A, 6.6 B, 69.5 F

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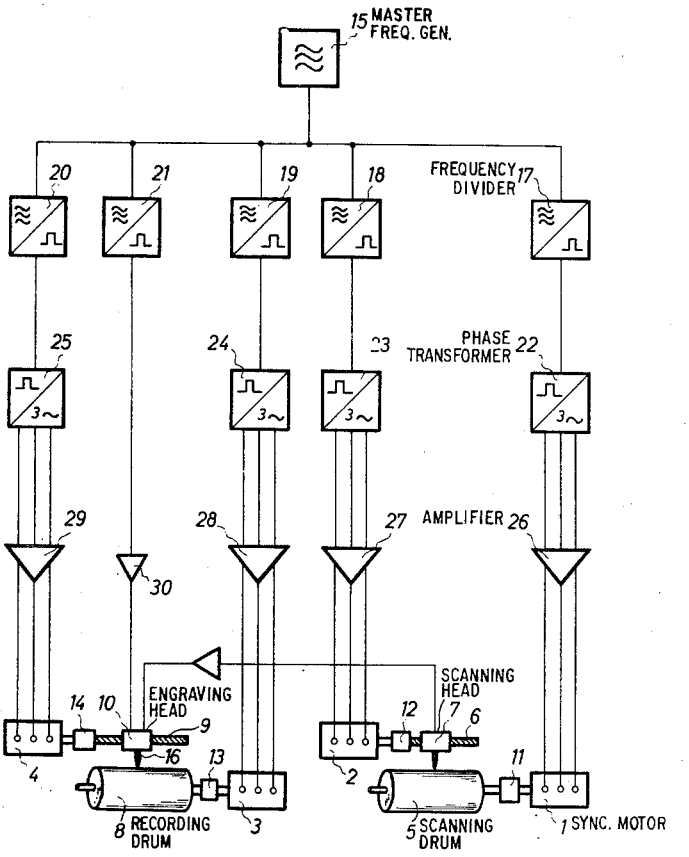
ABSTRACT: In an engraving machine the rotating drums which carry the original and a media for reproducing the original and the mechanisms for advancing movements of the respective styli are driven at various rotational speeds in accordance with the required ratios for reproduction by powering both the transmitting machine and the receiving machine by a constant frequency generator, or a pair of constant frequency generators, through the intermediary of a plurality of respective frequency transformation circuits, preferably circuits which perform a frequency division of the master frequency.



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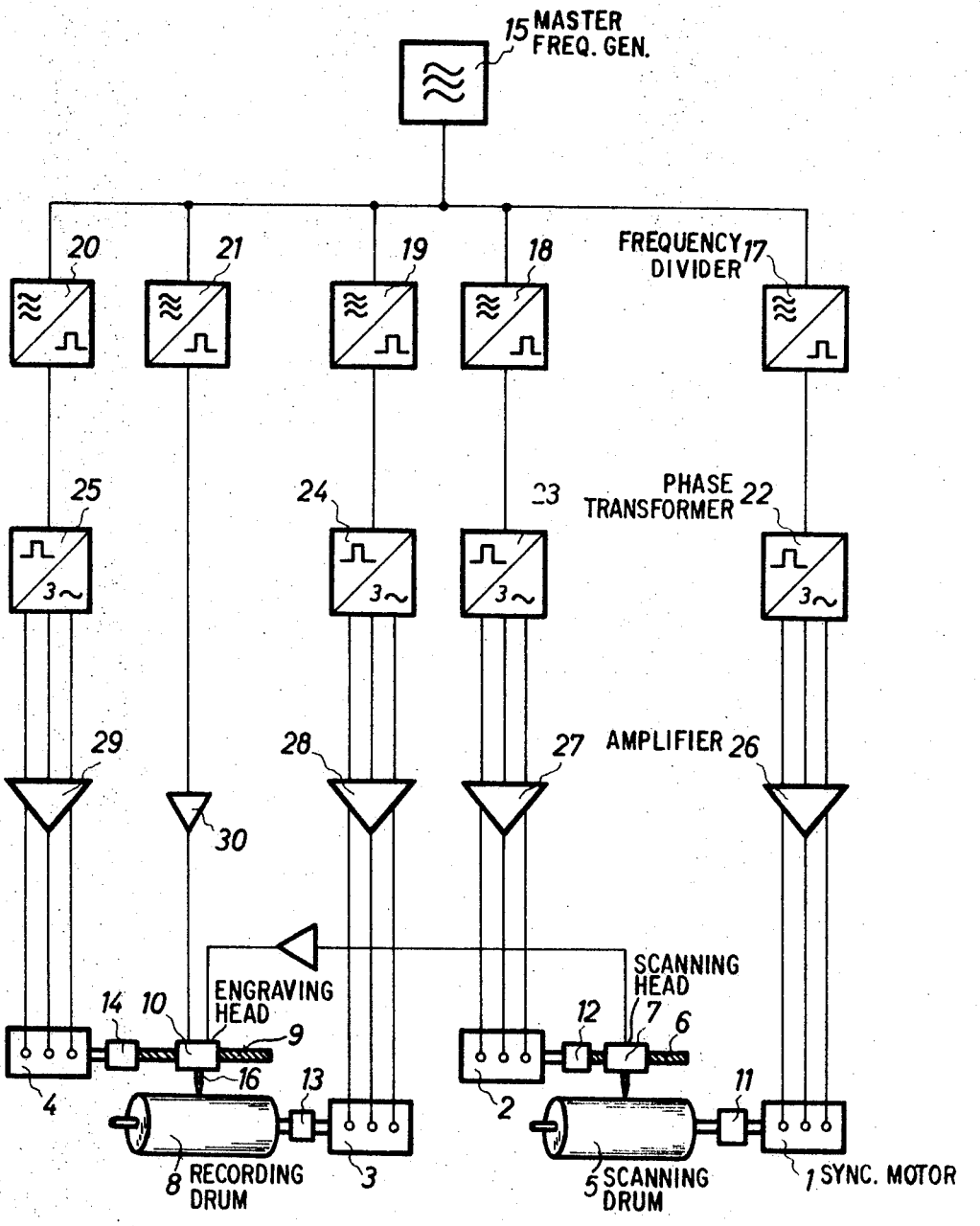

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METHOD OF AND APPARATUS FOR DRIVING ENGRAVING MACHINES OF THE DRUM TYPE

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to a method of an apparatus for driving engraving machines of the drum type, and more particularly to a method of and apparatus for driving engraving machines wherein there is required a great number of reproduction ratios between the transmitting drum and the receiving drum.

2. Description of the Prior Art

In known engraving machines of the drum type, tooth wheel gears are employed for producing the required drum rotation speed resulting from the drum diameter and the required peripheral or engraving speed, and for adjusting the desired advance movement of the styli. The tooth wheel gears are connected between the drum shaft or the advance spindle and the shaft of the driving motor of the machine.

If screened printers are to be made with the aid of such machines, an additional gear is provided for producing a determined transmission ratio between the drum shaft and the shaft of an electrical frequency generator or sound wheel for producing the frequency for the drive of the oscillating engraving stylus. This stylus frequency is selected to be sufficiently high according to the required engraving speed and, since the resonant frequency of the electromagnetic engraving system is limited by mechanical requirements, the stylus frequency must be higher than the resonant frequency. However, the decreasing slope of the resonance curve of the engraving system is very steep, so that relatively small fluctuations of the frequency result in unduly great variations of the stylus stroke and, consequently, of the ink densities during printing. Therefore, the stylus frequency must necessarily be kept constant.

It is necessary in an engraving machine of the drum type, particularly if it is designed for making printing cylinders for rotogravure, that such a machine is not restricted to operation with drums of the single diameter, but with a great number, say several hundreds, of recording drums having different diameters. This flexibility requires that for each drum diameter, another transmission ratio must be available. Furthermore, several different distances between screen lines and some different screen angles for the production of color separation printers are required. Each distance between screen lines and each screen angle requires the availability of additional transmission ratios.

In addition to the above, it is also desirable to be able to repeat, that is to successively reproduce, an original several times on the same printing cylinder. For this purpose the rotational speed of the smaller scanning drum is required to be an integer multiple of the rotational speed of the recording drum.

From the foregoing it is evident that the fulfillment of all these requirements would result in an unbearable expenditure with respect to tooth wheel gears in that a greater flexibility of reproduction requires several hundreds of different gears to be kept on hand. In addition, the tooth wheels for gears of engraving machines must be manufactured with extreme precision and the space required for multistage gears is excessive.

It is highly desirable, therefore, and an object of the present invention to satisfy the above-mentioned requirements at a reasonable cost and in a space saving manner.

SUMMARY OF THE INVENTION

According to the invention, the drums and the devices for advancing the styli are driven by a corresponding number of synchronous motors, and the frequencies of the motor supply voltages corresponding to the various rotational speeds and the frequency for the drive of the engraving system are derived from the frequency of a single stabilized electric master frequency generator by frequency transformation, preferably by frequency division. The various required transmission ratios are thus simply attained by correspondingly dimensioned frequency dividers.

This invention warrants that the actual amount of the stylus frequency is independent of the selected transmission ratio, whereas with the known engraving machines equipped with wheel gears, the selected stylus frequency can sometimes only be approximated, depending upon the occurrences of certain unfavorable transmission ratios which can only be approximated to a certain degree by gear means without an excessive time and monetary expenditure.

If either drum and either device for the advance movement of a stylus is driven by such separate synchronous motors, a further advantage arises in the possibility to scan the original and to engrave the printing cylinder on separate machines. Further, these machines can be installed at two places far distant from each other. In such a situation, however, one needs not transmit the frequency of the master frequency generator from the one place to the other, but the two machines may be equipped with separate frequency generators inasmuch as it is possible by providing suitable stabilizing means (e.g. a synchronizing channel) to maintain the two master frequencies efficiently constant during the production time of a printing cylinder.

BRIEF DESCRIPTION OF THE DRAWING

The invention, its organization, construction and operation will be best understood by reference to the following description taken in conjunction with the single drawing which is a schematic illustration of an engraving machine according to the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

In the drawing four three-phase synchronous motors **1**, **2**, **3** and **4** are employed to drive the scanning drum **5**, the advance spindle **6** of the scanning head **7**, the recording drum **8** and the advance spindle **9** of the engraving head **10**, respectively. These motors **1**—**4** are followed by reduction gears **11**, **12**, **13** and **14**, respectively; however, these reduction gears need only be one-stage gears.

The frequencies of the supply voltages for these motors and the frequency for driving the engraving system stylus **16** in accordance with various rotational speeds, are derived from the frequency of a common stabilized master frequency generator **15**. This is accomplished by means of frequency dividers **17**, **18**, **19**, **20** and **21** which are dimensioned according to the required division ratios at a particular time. For example, if ring counters are employed as frequency dividers, square-shaped voltages occur at their outputs, which voltages are single-phase like the alternating voltage of the frequency generator **15**. Inasmuch as three-phase voltages are required for the motors **1**, **2**, **3** and **4**, each frequency divider **17**, **18**, **19** and **20** is followed by a phase transformer **22**, **23**, **24** and **25**, respectively in which, by means of a further ring counter in connection with gate circuits, a six-phase square wave voltage is produced. Two-phases of each opposite phase of the six-phase voltage are then combined to produce a three-phase square wave voltage.

The voltages produced by the above techniques serve for controlling the power supply amplifiers **26**, **27**, **28**, **29** and **30**, the outputs of which are connected with the motors **1**, **2**, **3** and **4**, and the engraving head **10**, respectively.

When it is necessary to transfer to other rotational speeds of the motors, only the division ratios of the frequency dividers **17**—**20** need to be changed, such changes being obtainable by techniques which are well known in the art.

In the system described, therefore, the motors **1**—**4** may be driven at a plurality of speeds without the transformation ratios being provided by tooth wheel gears and the frequency of the engraving stylus **16** may be held substantially at a constant value by employing the techniques of the present invention.

While we have described our invention by reference to a specific illustration thereof, many changes and modifications will become apparent to those skilled in the art without departing from the spirit and scope of the invention as set forth in the appended claims.

What we claim as our invention is:

1. The method of driving engraving machines at a plurality of transmission ratios, between a transmitting drum, a receiving drum, a transmitting scanning head and a receiving scanning head each of which is connected to a corresponding synchronous motor, comprising the steps of generating a voltage at a stabilized master frequency, deriving from the voltage at the master frequency voltages having frequencies for operating the synchronous motors at rotational speeds corresponding to the required reproduction ratios, and applying the derived voltages to the corresponding synchronous motors.

2. The method according to claim 1 wherein the derived frequencies are less than the master frequency, and said step of deriving is further defined as dividing the master frequency to obtain a plurality of lower frequencies.

3. An engraving machine comprising: a scanning drum; a scanning head operatively associated with said scanning drum; a recording drum; a recording head operatively associated with said recording drum and operatively connected to said scanning head; first means including a first synchronous motor for rotating said scanning drum at a first speed; second means including a second synchronous motor for traversing said scanning head across said scanning drum at a second speed; third means including a third synchronous motor for rotating said recording drum at a third speed; fourth means including a fourth synchronous motor for traversing said recording head across said recording drum at a fourth speed; generating means for providing a voltage at a master frequency; and means connected between said master frequency generating means and said first, second, third and fourth synchronous motors for deriving corresponding frequencies for establishing the corresponding speeds of rotation.

4. The engraving machine as defined in claim 3, wherein said scanning head, said scanning drum and said first and second means for rotating the scanning drum and traversing the scanning head are at a first location and wherein said recording head, said recording drum and said third and fourth means for rotating said recording drum and traversing the recording head are located at a second location remote from the first location, and said master frequency-generating means comprises a first generator at said first location and a second generator at said second location, and said frequency dividing means includes a first dividing means at said first location and a second frequency-dividing means at said second location, the first and second frequency-dividing means being connected between the generating means and the drum and head moving means at their respective locations.

5. In an engraving machine having a scanning drum, a recording drum, a scanning head and a recording head which may be operatively moved in accordance with a plurality of desired reproduction ratios, apparatus for establishing said reproduction ratios comprising: means for generating a master frequency; a plurality of frequency-translating means connected to the master frequency-generating means for providing from the master frequency a plurality of other frequencies which are individually representative of desired speeds of movement and accordingly represent reproduction ratios; and a plurality of means individually connected between said frequency-translating means and the scanning drum, scanning head, reproducing drum and reproducing head for moving the last-mentioned elements in accordance with the translated frequencies.

6. Apparatus as defined in claim 5, wherein each of said frequency-translating means comprises a frequency divider.

7. Apparatus as defined in claim 6, wherein said master frequency generator is single phased and wherein each of said frequency-translating means further comprises means for deriving three-phase output voltage.

8. Apparatus as defined in claim 7, wherein said means for deriving a three-phase voltage includes means for deriving a six-phase voltage and means for combining phases to provide said three-phase voltage.

9. Apparatus as defined in claim 8, wherein each of said translating means comprises amplifying means connected between said means for deriving three-phase voltage and the respective movable element.

10. Apparatus as defined in claimed 5, wherein the recording head includes a stylus and wherein said apparatus comprises additional frequency-translating means connected between said master frequency generator and said recording head for providing said stylus with a constant operating frequency.