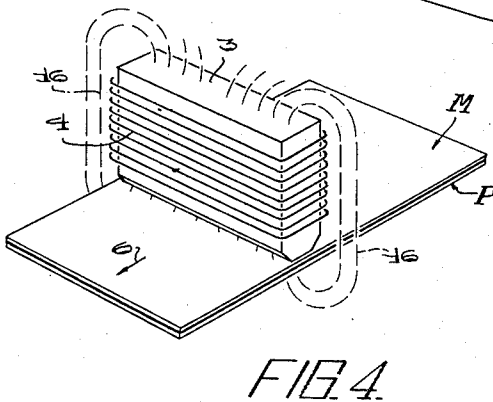
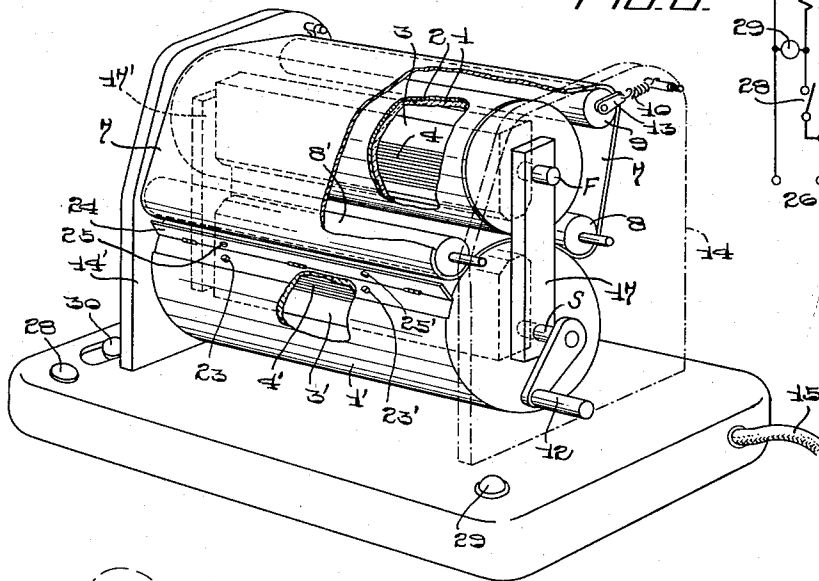
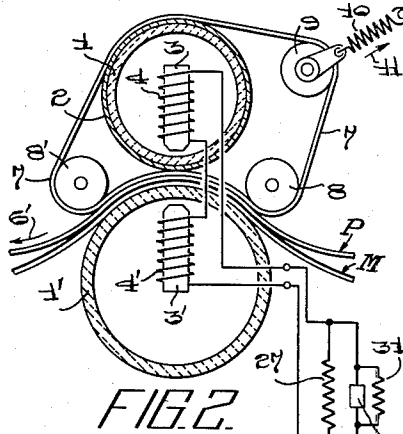
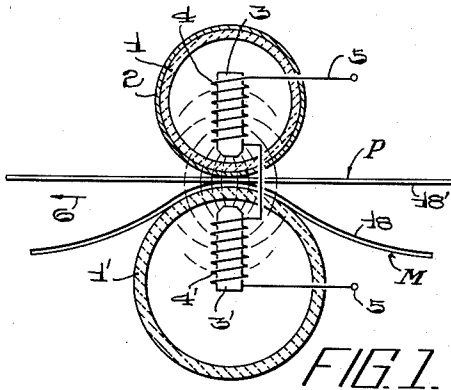


YASUSHI HOSHINO ET AL

DEVICE FOR COPYING MAGNETIC RECORDS

2 Sheets-Sheet 1



Dec. 20, 1960

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DEVICE FOR COPYING MAGNETIC RECORDS

Filed March 27, 1957

2 Sheets-Sheet 2

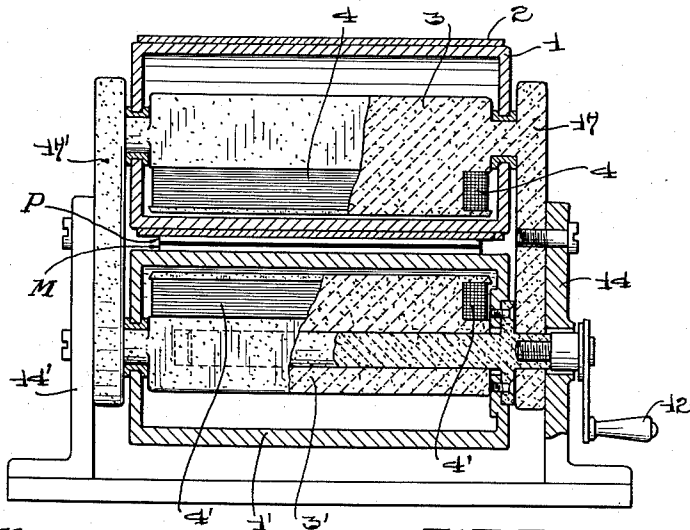


FIG. 5.

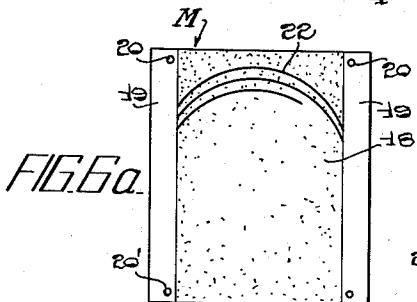


FIG 6a.

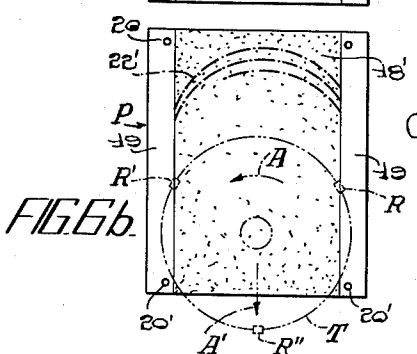


FIG 6b.

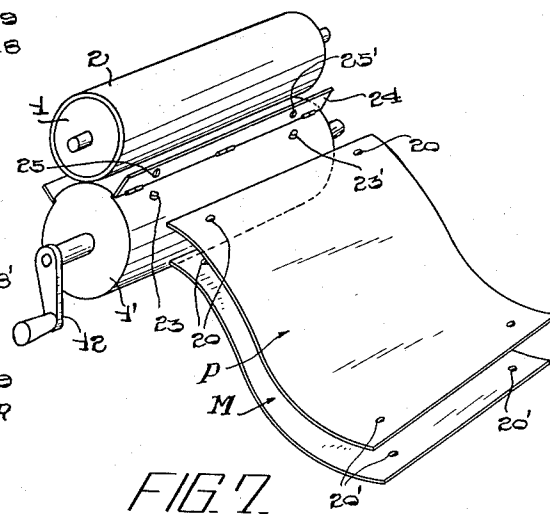


FIG 7

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DEVICE FOR COPYING MAGNETIC RECORDS

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4 Claims. (Cl. 179—100.2)

This invention relates to the processing of magnetic sound record sheets used on magnetic sound record reading machines.

An object of this invention is to provide an improved printing apparatus suitable for printing record sheets and wherein the magnetic coating films of a master record sheet and a record sheet to be printed are passed through a magnetic field in superposed relation by means of a pressing device and this superposed relation is maintained until the magnetic coating films being processed have entirely left the magnetic field.

Another object of this invention is to prevent undesirable effects on magnetic sound record sheets.

Another object of this invention is to provide for passing two record sheets in correct and perfect alignment through a magnetic field.

Still another object of this invention is to provide a printing apparatus which can also effect a demagnetizing operation by operation of a change-over switch.

The accompanying drawings illustrate some embodiments of this invention. In the drawings:

Fig. 1 is a longitudinal sectional view showing the essential parts of a printing device provided in accordance with the invention;

Fig. 2 is a longitudinal sectional view of a printing device of the invention provided with a demagnetizing device;

Fig. 3 is a perspective view of a printing device of the invention, the device being partially broken away to show the interior thereof;

Fig. 4 is a diagrammatic view of an apparatus of this invention showing the principle thereof;

Fig. 5 is a front view partly in section of a printing device of the invention provided with a device for concentrating harmful lines of magnetic force;

Figs. 6a and 6b illustrate respectively a master sheet and a sheet to be printed in plan view; and

Fig. 7 is a perspective view of a printing device of the invention provided with a device for setting sheets.

In Fig. 1, a master sheet M and a copy sheet P are supported on a support 1' which is, for example, a cylinder and the sheets are pressed by a pressing cylinder or member 1 covered by a coating 2 of a highly elastic material such as rubber. Electric current is supplied through a conductor 5 to coils 4, 4' having cores 3, 3' respectively. The electric current may be either direct current or alternating current.

The master sheet M may be a sound record sheet previously recorded by a magnetic sound recording and reading machine and has a magnetic coating film 18 on a carrier of a material such as paper or plastic. Copy sheet P is a sheet which has a blank magnetic coating film 18'. The magnetic sound record tracks on the master sheet M are to be printed on the copy sheet P.

In Fig. 1, the magnetic sound record coating films 18, 18' of the master sheet M and the copy sheet P are superposed in contacting relation and interposed between

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the two rollers 1, 1', and the rollers are rotated to move the two sheets in the direction of the arrow 6 while electric current is supplied to the coils 4, 4' thereby forming a magnetic field of proper intensity between the two cores 3, 3'. The sheets P and M are subjected to the magnetic field and thereafter depart from the field and thus the magnetic sound record tracks on the master sheet are printed on the copy sheet. In this operation, the magnetic strength of the tracks of the magnetic sound record sheet may be lessened a little but only slightly, and therefore the master sheet may be repeatedly used for printing to produce a plurality of copy sheets.

The apparatus as shown in Fig. 1 has however, a defect as follows:

The two sheets M and P tend to separate from each other before they have left completely the zone of influence of the magnetic field and when they are still present in the zone where the leakage of the magnetic field exists. This has the effect of lowering the quality of printing on the copy sheet to a great extent and results in unsatisfactory printing.

For eliminating the disadvantage described above according to this invention, a device for pressing the master sheet M and the copy sheet P is provided in order to keep them in overlapping position until they have moved sufficiently far away from the magnetic field so that they are not subjected to the adverse influence of the leakage of the magnetic field. In Fig. 2, an endless belt 7 is supported by guide rollers 8, 8' and 9. The guide roller 9 is a tension roller and is constantly urged in the direction of the arrow 11 by means of a spring 10 to give proper tension to the belt 7. The rollers 8 and 8' act to press the sheets M and P by the part of the belt between said two rollers against the supporting cylinder 1' and move the sheets in the direction of the arrow 6'. The roller 8' is arranged in a position sufficiently far from the magnetic field and hence the sheets M and P leaving the roller 8' are not subjected to the influence of the leakage of the magnetic field and thus the defect as described above is eliminated to give a superior printing having strongly magnetized tracks.

Figs. 3 and 5 illustrate an embodiment of the printing apparatus of this invention. As seen in the drawings, the cylinder 1' is fixed on a rotatable shaft S, which has a handle 12 whereby the cylinder 1' is rotated.

On the other hand, the cylinder 1 is rotatably supported on a fixed shaft F. In these cylinders, the electric magnets comprising core 3 and coil 4 and core 3' and coil 4' are mounted in fixed positions. Cylinder 1' is thus rotatable with respect to the magnet therein. The apparatus further has guide rollers 8 and 8', tension roller 9, and an endless belt 7 which is extended over rollers 8, 8' and 9 and is stretched by means of a spring 10 adapted to pull the roller 9 by means of a metallic member 13. The rollers and the electric magnets are supported by plates 14 and 14' and electric current is supplied through a cord 15.

When printing is effected with this apparatus, the sheets M and P will be maintained in superposed relation between the belt 7 and the cylinder 1' and are moved in this condition until the completion of the printing operation, that is until the two sheets have completely left the zone where the undesirable influence of the magnetic field leakage is present. It will be understood that the cylinder 1 may be replaced by a pressing plate having the same curvature and that the sheets may be passed between said pressing plate and the roller 1' to leave the printing magnetic field.

In Fig. 4, the magnetic sound record coating films of the master sheet M and the copy sheet P are placed in superposed relation and they are moved in this condition in the direction of the arrow 6 while electric current is

supplied to the coils 4, 4' of the electric magnets 3, 3' to effect printing. Under such conditions, leakage magnetic flux will be issued from the electric magnets 3, 3' to places irrelevant to printing and extending far away, and thus, for example, a magnetic sound record sheet near the printing apparatus will be affected by the leakage magnetic flux. The leakage can also lower the efficiency of the magnetic circuit. However, as shown in Fig. 3 and Fig. 5, if concentration passages or members 17, 17' of high magnetic permeability, such as for instance, iron pieces, are provided to form a closed magnetic passage 3, 17, 3', 17', this prevents the leakage of magnetic flux from extending to zones unnecessary for printing and a good result can be obtained, no disturbances being caused in the copy sheet and the like.

It is another feature of this invention that, in the printing from a master sheet M to a sheet P, the printing can be carried out by keeping the two sheets in superposed relation.

As shown in Figs. 6a and 6b, the master sheet M and the sheet P have respectively a magnetic sound record film 18 or 18', a blank margin 19 and guide holes 20 or 20' for setting the sheets in a predetermined position on a magnetic sound recording and reading machine.

For this purpose, a magnetic sound recording and reading machine may have pin-like projections in positions corresponding to the guide holes 20, 20' of the sheets M, P. Accordingly, the sheets M or P can always be set correctly in the same position on the magnetic sound recording and reading machine, however often the sheets may be put on and taken off from the machine simply by simply setting the guide holes 20 or 20' on the pin-like projections of the magnetic sound recording and reading machine.

As shown in Figs. 6a and 6b, the turntable T has a plurality of heads such as, for example, three heads R, R', and R'' arranged at equal angular distances of 120°. The linear distance between the heads R and R' is exactly equal to the width of the magnetic sound record coating films 18 or 18'. When the master sheet M is recorded by turning the turntable in the direction opposite to the direction of the arrow A while moving the turntable longitudinally in the direction of the arrow A', sound record tracks 22 will be formed on the master sheet. When, using this master sheet M, printing is carried out on the sheet P by the printing apparatus of this invention as described above, the magnetic sound record tracks 22 of the master sheet M will be printed on the sheet P to form tracks 22'. Accordingly, for reproducing the sound from the print sheet, the turntable T is turned in the direction opposite to the direction at the time of recording on the master sheet, that is in the direction of the arrow A.

In this regard, it is very important that the magnetic sound record tracks 22 of the master sheet M and the printed tracks 22' of the sheet P are perfectly in the relation of an object and its image in a mirror. In other words, there must be a perfectly symmetrical relation. In order to secure this result, as shown in Fig. 7, on the supporting roller 1' (or on the pressing roller 1), guide pins 23, 23' are provided in positions corresponding to guide holes 20 of the master sheet M and the sheet P, and in the printing operation, the holes 20 are set on said guide pins 23 to keep the two sheets in correct relation. When there is employed a pressing plate 24 having holes 25, 25' to secure the setting of the two sheets M and P, the setting may be effected more securely.

By rotating the roller 1' to effect the printing described above, while maintaining the two sheets in a perfect superposed relation, a perfect copy sheet is obtained and when said copy sheet is put on a magnetic sound recording and reading machine, it will reproduce the recorded sound perfectly.

The setting device is not limited to pins on the rollers 1 or 1' as the sheets M and P can be fixed on a flat plate having setting pins, and the electric magnets may be moved over the sheets to effect the printing. By this means, a good result can also be obtained.

In Fig. 3, 24 is the pressing plate having setting holes 25, 25' while 23 and 23' are setting pins on the roller 1'.

The printing apparatus according to this invention also has a demagnetizing device that can achieve very easily and in a short time demagnetization of the sound record which has been recorded on a magnetic sound record sheet, in addition to the printing as already explained.

In Fig. 2, the circuit for supplying electric current to the coils 4, 4' of the cores 3, 3' of the electric magnet 15 has an electric source 26 and a resistance 27. When the switch 28 is closed, a pilot lamp 29 is lighted to show that electric current is supplied to the circuit to effect the printing properly. By adjusting the resistance 27, a magnetic force of the magnetic field of a proper value for printing such as, for example 150 oersted, is applied to the magnetic sound record sheets M and P between the cores 3 and 3'.

However, for effecting demagnetization by this apparatus, electric current is supplied to the electric magnet 25 through a resistance 31 and an alarm buzzer 32 when a switch 30 is closed. The total resistance of the resistance 31, the buzzer 32 is much lower than the resistance 27 so as to cause a magnetic field of a much higher value, for example 350 oersted, between the cores 3 and 3'.

The magnetic sound record previously recorded is demagnetized when the sheet bearing the same is passed between the cores 3 and 3' with the higher field. In Fig. 3, 28 is the control button for printing, 30 the control button for demagnetizing and 29 the pilot lamp.

What is claimed is:

1. A device for printing a magnetic record onto a copy from a master comprising a pressing mechanism including a supporting cylinder and a pressing cylinder operatively associated therewith, the cylinders being rotatable, stationary magnets in the cylinders, coils on the magnets for exciting the same, a driven endless belt positioned between the cylinders for guiding the master and copy, and guide means for guiding the belt along a part of the periphery of the supporting cylinder to maintain the master and copy in contact to a position substantially devoid of magnetic flux generated by the magnets.

2. A device as claimed in claim 1 comprising shafts supporting the cylinders, the magnets being supported on the shafts, the shaft supporting the supporting cylinder being rotatable with respect to its magnet, and a handle on the latter said shaft.

3. A device as claimed in claim 1, the master and copy having guide holes, said device comprising pins on the supporting cylinder for engaging the guide holes.

4. A device as claimed in claim 1 comprising a resistor and switch in series with the coils, a demagnetization circuit in parallel with the resistor and switch, and an indicator coupled to the demagnetization circuit to indicate the operation thereof.

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