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F. W. KULESZA

2,884,348

ERASURE OF IMPRINTED MAGNETIC MARKINGS

Original Filed Dec. 20, 1954

FIG. 1

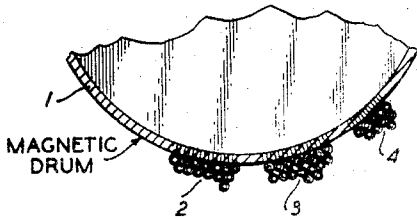


FIG. 2

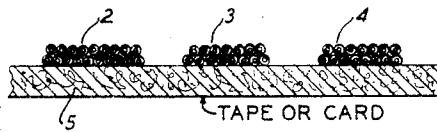


FIG. 3

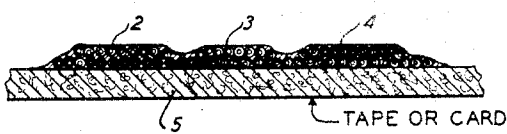


FIG. 7

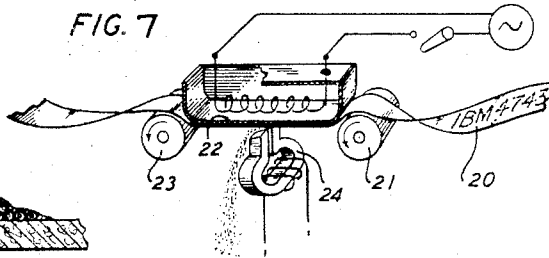


FIG. 4

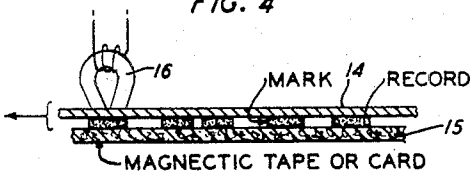


FIG. 5

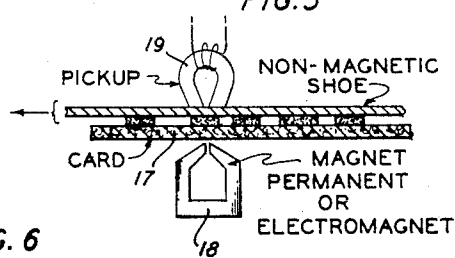
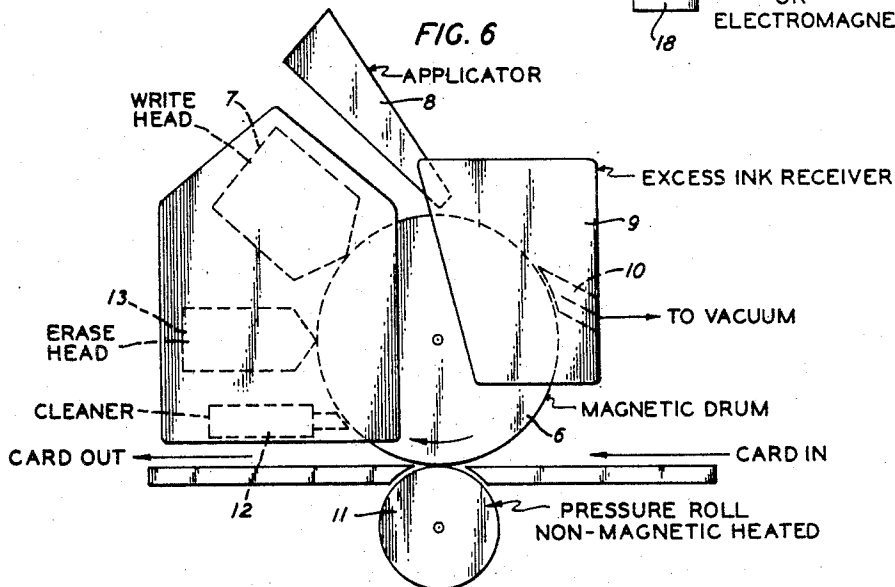


FIG. 6



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ERASURE OF IMPRINTED MAGNETIC MARKINGS

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Original application December 20, 1954, Serial No. 476,534, now abandoned. Divided and this application February 26, 1957, Serial No. 642,505

5 Claims. (Cl. 134—1)

This is a division of application, Serial Number 476,534, filed December 20, 1954, now abandoned.

This invention relates to a method of erasure of imprinted magnetic markings which may be clearly erased by the application of heat in a magnetic field.

An object of the invention is to erase records imprinted on an expendable medium which will submit to both visual and magnetic inspection and which may be duplicated and easily erased.

A feature of the invention is a method of and means for recording information on any nonmagnetic surface in magnetically detectible and visually recognizable markings, and a method for erasure of such imprinted magnetic markings. According to this feature, and as one example thereof, a magnetic compound, hereinafter termed for convenience a magnetic ink, is deposited on a paper surface where it produces an outstanding color contrast so that it is clearly visible as conventional printing and where it will respond to magnetic scrutiny and removal.

A feature of the invention is a thermoplastic magnetic powdered substance which may be deposited on any surface by conventional or other means to produce visible and magnetically detectible markings such as letters, numbers, diagrams, or any type of intelligence representing characters. Such a substance may be termed a magnetic ink, since after application it produces markings similar to those produced by conventional inks.

This magnetic ink is basically a fine powder consisting of granules of iron coated with a thermoplastic composition. Where the ink is to be used on ordinary white paper a colorless wax may be used, but where the printing is to be done on tinted paper the wax may be colored to match the surface. The wax is generally of the color of the surface on which the ink is to be deposited in order that on erasure no marking will be left.

From a practical standpoint the ink consists of microscopic granules of iron each coated with a thermoplastic composition so that under pressure or heat or both, the ink will adhere strongly to a paper surface on which it has been deposited. The markings thus produced may be erased by heat and magnetism. By heating a surface containing such markings and selectively applying a magnetic field thereto the erasure may be selective.

This ink may be deposited on the paper or other medium by any conventional means. In accordance with one method a magnetic surface may be selectively magnetized, the powdered ink then dusted on, the excess ink removed, the recorded characters then transferred by pressure to a paper surface and then fixed by pressure or heat or a combination thereof. In accordance with another method, a paper carrying the desired characters in any ink that is wet or made tacky in some manner may be dusted with the said powder while wet or tacky so that the printed characters will assume the magnetic properties of this mixture. Another property of the ink of the present invention is that it has high infra red characteristics so that for fixing and erasure purposes the paper surface may be passed under an infra red heating source where

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the markings will be heated sufficiently to soften the thermoplastic coverings of the granules without overheating the paper or surface on which the markings have been imprinted. The invention, however, is not limited to this use of infra red rays for selectively heating the inked characters since any heat source may be used for softening the ink so that it may be fixed by pressure or erased in a magnetic field.

Other features will appear hereinafter.

The drawings consist of one sheet having seven figures, as follows.

Fig. 1 is a fragmentary cross sectional view very greatly enlarged showing how the ink in the form of a magnetic dust will cling only to the magnetized areas of a magnetic surface;

Fig. 2 is a cross sectional view very greatly enlarged showing how the ink in the form of a magnetic dust is transferred by pressure to a tape or a card;

Fig. 3 is the same, showing how the various contiguous spots of the ink have been integrated by pressure or heat or both;

Fig. 4 is a schematic, fragmentary and cross sectional view showing how the markings in the magnetic ink on a record may be employed to produce a duplicate record on a magnetic tape or surface;

Fig. 5 is a similar arrangement showing how a record on a card may be passed through a magnetic field so that the markings thereon may be detected;

Fig. 6 is a schematic representation of the essential elements of a high speed printer by means of which intelligence characters electrically transmitted may be printed in the magnetic material ink of the present invention;

Fig. 7 is a fragmentary, schematic representation, partly in cross section, showing the means employed for the magnetic erasure of matter printed in the ink of the present invention.

The composition used for the purposes of this invention is fundamentally powdered iron treated with a thermoplastic mixture. The composition is formed by making a mixture of the iron powder, certain suitable waxes and resins in a suitable solvent whereby the separate granules of iron become coated with the thermoplastic mixture. When this syrupy mass has become hardened by evaporation of the solvents, it is ground to the desired degree of fineness and then used as a powder, though the invention also includes the use of this composition in liquid or paste form for conventional inking purposes. However, for high speed printing the powdered form is to be preferred.

Generally speaking, pure iron is to be preferred. While a higher permeability may be obtained by using some of the known high permeability alloys, it has been found that the permeability of the mass of iron granules in a matrix of thermoplastic material is not raised sufficiently over that of pure iron to overcome the cost differential. In other words, the extreme point in high permeability gained by the selective use of certain alloys is neither necessary for practicing the invention nor justifiable from the cost standpoint.

Certain commercially available waxes are employed. A chlorinated paraffin having the average molecular formula $C_{24}H_{29}Cl_{21}$ is employed. In order to raise the melting point of this wax a small portion of another commercially high melting point wax, which is a complex nitrogen derivative of the higher fatty acids and known to be a polyamide of stearic acid is added. These waxes plus the resin known as polyvinyl methyl ether, which forms a thermoplastic coating for the iron granules, are applied by dissolving them in toluene. The liquid formed of these waxes, resin and solvents is one that will satisfactorily wet the granules of iron so that the coating

thereof is complete. This solution is allowed to dry and harden and then the mass is ground by conventional methods to form a powder of the desired degree of fineness.

By way of example the following formula represents a composition found to be satisfactory from a commercial as well as a functional standpoint. It is to be understood that this is representative and that the invention is not limited to its use but that other compositions having similar properties may be used.

	Parts by weight
Iron powder (300 mesh screen) -----	30.0
Polyvinyl methyl ether (50% aqueous solution) ---	2.0
Polyamide of stearic acid -----	0.5
Chlorinated paraffin (C ₂₄ H ₂₉ Cl ₂₁) -----	3.0
Toluene -----	6.5
Total parts -----	42.0

In practicing the invention the surface of a magnetic tape or drum 1 may be selectively magnetized in spots in any conventional manner. If then this magnetic ink is dusted on this surface, masses of it will adhere to these magnetized areas. In Fig. 1 three such areas 2, 3 and 4 are indicated. The magnetic drum, very greatly enlarged in thickness for purposes of illustration is shown as having a plurality of lines normal to the surface thereof as an indication of the magnetized condition thereof. Masses 2, 3 and 4 of the magnetic ink in the form of tiny granules of iron coated with a thermoplastic composition are shown clinging to these magnetized areas, and forming a somewhat irregular outer surface. Other areas of the surface of the magnetic drum are shown as clean with none of the granules of ink clinging thereto. This is an indication of the fact that the granules of ink have low retentivity and therefore will not cling to another magnetic surface. In practice it is found that this ink will adhere more readily to a paper surface than to such a magnetic surface, so that if a paper such as a tape or a card is pressed against the drum carrying this area of ink powder, the ink will be transferred to the paper as indicated in Fig. 2, where the masses 2, 3 and 4 are shown as now adhering to the tape or card 5.

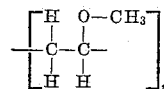
For a better understanding of this operation one should refer to Fig. 6 where a schematic representation of a device similar to a tape printer is illustrated. There is provided a magnetic drum 6 which is being constantly rotated in the direction indicated and at a surface speed very much higher than one on which conventional printing may be impressed. A write head 7 is provided by which, through electrical transmission of pulses thereto, spots on the surface of the drum may be magnetized, much in the manner in which characters are written on a moving surface disclosed in the C. E. Hunt, Jr., Patent Re. 23713. As the drum 6 rotates, a mass of the iron dust ink stored in the applicator 8 is poured on the surface thereof so that masses of it will adhere to the magnetized spots on the drum. The excess ink will be collected in the excess ink receiver 9, partly by centrifugal force and partly by vacuum cleaning means applied by a nozzle 10. Therefore, masses of ink, clearly defining intelligence characters will be carried by the drum 6 toward the point where a tape or a card will be pressed solidly by a roll 11 against the drum 6 so that the ink is thus transferred to the tape or the card. The roll 11 may be heated so that the thermoplastic coating of the granules will be melted. When heat is applied for the purpose of fixing the record, or for purposes of erasure, hereinafter described, a separate source such as an infra red ray lamp placed in the path of the record as it leaves the transfer roll may be employed. Here the heating effect will be selectively greater on the ink partly because of its color than on the record surface so that the melting or softening of the thermoplastic coating of the granules may proceed at a speed commensurate with the

printing speed. It is to be noted that the transfer of the ink to the paper may be made under pressure alone or under the combination of pressure and temperature, the amount of pressure decreasing as the temperature is increased.

The ink produces a good record since it does not smudge and does not erase easily by convention means, yet remarkably clean erasures may be made by heating the record and then passing it through a magnetic field whereupon the ink is lifted off the record without injury to the surface of the paper. Generally speaking, where there is any likelihood of erasure, the waxes employed in the compounding of the mixture are either neutral or of the same color as the surface on which the printing is to be done, or do not stain such surface so as to leave a noticeable marking after the magnetic erasure. Such erasure method is illustrated in Fig. 7 where a printed tape 20 is passed from the right to the left over a roller 21, the face of a heater 22 here shown as a conventional electrically heated plate, and thence over another roller 23, the rollers 21 and 23 merely representing any conventional means for holding the tape 20 in contact with the hot plate 22. As the tape moves toward the left and the thermoplastic coating of the iron granules becomes softened by the heat, the tape passes the magnet 24, which cleanly lifts the inked markings off the tape. Since the thermoplastic mixture is neutral in color it leaves no stain on the paper tape and hence the erasure is complete and the paper is left substantially in its original condition. The magnet 24 is here shown as an electromagnet so that erasure takes place only during the energization thereof, even though the tape may be heated by passage over the face of the hot plate 22. In this manner the erasure may be made selective, that is only selected characters, letters, words, or other portions of the printed matter may be removed. It will be understood, however, that the magnet 24 may be a permanent magnet so that all matter passing it may be removed.

For reference purposes, it may be noted that the chemical nature of some of the components of the composition may be stated as follows.

Polyvinyl methyl ether is commercially available under that name and cannot be identified under any other name. Its chemical structure may be expressed as



Polyamide of stearic acid is commercially available as Acrawax C. Applicant does not know its exact chemical structure.

Chlorinated paraffin (C₂₄H₂₉Cl₂₁) is commercially available under the trade name Chlorowax 70.

What is claimed is:

1. The method of erasing characters printed with a composition consisting of a mass of microscopic granules of a high permeability magnetic material coated with a thermoplastic mixture which consists of heating the printed medium and thereafter lifting the said composition by magnetic force.

2. The method of erasing data imprinted on the surface of a business card with ink consisting of a dry and dusty powder rendered temporarily tacky by heat applied thereto during the imprinting process which consists of passing said card over a heated surface within a magnetic field.

3. The method of erasing data imprinted on the surface of a business card with a dry thermoplastic magnetic ink which consists of temporarily rendering said markings tacky by heat and lifting said tacky ink therefrom by magnetic force.

4. The method of erasing data imprinted on the surface of a business card with a dry thermoplastic magnetic ink which consists of loosening the adherent grip

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of said ink to said surface by passing said card over a heated surface and lifting said loosened ink by magnetic force.

5. The method of erasing data imprinted on the surface of a nonmagnetic business record with a powder dry thermoplastic magnetic ink which consists of loosening the adherent grip of said ink to said surface by passing the rear surface of said record over a hot surface and attracting said loosened ink away from said heated record by magnetic force.

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