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CONDUCTIVE INK AND TABULATOR
SYSTEM

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1 Claim. (Cl. 41—41)

This invention relates to tabulating card systems, and particularly to the cards useable therein, and to the tabulating machinery, and further to methods of making conductive markings upon tabulator cards for the recording of data thereon and for the cooperation thereof with a tabulator mechanism.

For tabulating purposes, it has been customary to use individual data cards upon which the several items of data from a given transaction are recorded. The recording has previously been done customarily by the punching of holes at designated or significant positions on the card to indicate the desired data. These cards have customarily been sensed by the passage of mechanical members through the perforations to produce mechanical displacements thereof, which are utilized directly for the tabulation of the indicated data, or the movements of the mechanical members are utilized to complete electric circuits in which the current flow energizes magnets to produce the desired tabulating of the indicated data.

The present invention provides a data card system including a special marking ink, which is electrically conductive, which is applicable to the card at significant or designated points on the card to indicate the desired data. The spots are adapted to be sensed by electrical members, which permit current to flow when a significant ink spot appears in a given position on the card, but which prevent the flow of current when the ink spot is absent.

An object of this invention is to apply an electrically conductive ink to a significant spot upon a data card and to utilize the said inked spot to close an electric circuit for the production of a desired result, such as tabulating or sorting, etc.

Another object of this invention is to produce electrically conductive inks and more particularly those which when properly dispersed and impregnated into a suitable ribbon, are capable of being transferred from the ribbon to a record card or the like, by pressure, or by a blow exerted by a plunger or type under manual or automatic control, to produce on the card or record a deposit or mark, which is electrically conductive.

A further object is to cause the deposit to be so made on the card as to dry readily, and, after drying, smudge or blur as little as possible when rubbed.

Still another object of this invention is to produce a conductive mark on a record card by means of chemical action between sizing on a card and a suitable substance or vehicle carried

by a ribbon or other means. In this instance, it is desirable that the chemical action be practically instantaneous and the deposit permanent, also that the record itself should not be so affected by time or storage as to result in any physical deterioration.

Another object of the invention is to prepare conductive inks, which may be applied by a printing press or other well known means whereby the ink need not be conveyed by a ribbon. In this case, the ink need not possess the characteristics required for recuperation.

The device of the invention thus provides materials and processes for making tabulator cards in which the significant record is produced by an ink spot having electrically conductive properties; by means of ribbon materials, which are recuperative, which produce a permanent record, and are not subject to physical deterioration.

Other objects and details of the invention will be apparent from the following description:

In order that more than one mark be made from the same portion of the ribbon, the ink on the ribbon must be recuperative. In other words, the ink must remain permanently fluid in the ribbon. The ribbon employed should preferably be of high count, that is, of very fine weave, so that best recuperation is obtained.

Re-inking can be resorted to where a non-recuperative ink is used on a ribbon.

Conductive inks may be of two general types, one which is absorbed by or penetrated into the card, and the other which adheres to the surface only of the card. A combination of these two types is also possible.

Conductive inks, consisting of graphite or other metals in colloidal form in a volatile liquid, are well known, and, when applied to a surface, the volatile liquid evaporates, leaving a deposit which is homogeneous and electrically conductive. Such inks, however, cannot be used to accomplish the purpose of this invention.

To produce an ink of the character described herein, which will be absorbed by paper, it is preferable to use as the conductive medium, deflocculated Acheson graphite, mixed to colloidal fineness, with a proper oil vehicle, such as castor oil, and, if desired, an induline base and oleic acid. This mixture is thoroughly ground in a high speed colloid mill, and then applied to a ribbon such as is used in a typewriter. The mark produced from this ribbon is conductive, but it is found that superior results are obtained by mixing in, mechanically, a coarser grade of

graphite, indicating that the colloidal mixture should be relied upon for recuperation, and the larger particles for filling in the interstices formed by the oil film surrounding each particle of colloidal graphite.

5 Sodium silicate may be used as a dispersing medium, in which is ground deflocculated Acheson graphite, the whole of which is then made up in a viscous mineral oil vehicle. The purpose of the
10 mineral oil is to produce a certain stickiness, while the sodium silicate has the property of honey-combing the oil vehicle, thus increasing the conductivity.

15 A conductive mark may also be produced by thoroughly mixing a light oil with an equal weight of triethanolamine and one-half this weight of triethanolamine oleate. This triethanolamine is introduced as a dispersing medium and for also causing the oil to penetrate more readily.

20 A conductive ink may be prepared by mixing Acheson graphite and triethanolamine in a colloid mill. The mark, produced from a ribbon saturated with this ink, adheres to the surface of the paper and is electrically conductive. The conductivity of this mark can be increased by adding mercury and a trace of rosin. The triethanolamine is used in maintaining conductivity and recuperation, as it is non-drying and hygroscopic.

25 When graphite of ultra-microscopic particle size is used as the conductive medium, it is found that, when the ribbon is impregnated with the ink, capillary action takes place. This property is especially valuable where the ink is used on a stamp pad and also for placing deposits on a fabric or paper tape so that the markings may be
30 sensed from either or both sides of the tape.

35 It will be apparent to those familiar with inks that various substitutes may be employed for the graphite, such as carbon black, metallic colloids, metallic soaps, etc., and that various combinations may be made of the formulae described herein. Also various oils may be used as olive oil, petroleum, neat's-foot oil, petrolatum, petroleum jelly, etc.

40 The conductive inks may also be made in the following manner:

By preparing a metallic colloid in oil by the electric arc method.

45 By incorporating gelatine-water-glycerine colloid in a light mineral oil, in which graphite is incorporated by grinding.

By mixing electrically produced copper colloid in light mineral oil, partially dissolved in blue tungstate toner with graphite ground in.

By creating chemical action between suitable sizing material on the card and the proper reactive means carried by a ribbon or other means, a conductive mark will result when the reactive means is transferred from the ribbon to the card by suitable types. This result is accomplished by coating the card or record surface with gray zinc gelatine mixture. By bringing this surface in contact with a ribbon having impregnated thereon a solution of tin chloride, dispersed in heavy mineral oil, acidified with hydrochloric acid, a deposit of metallic tin is made on the card. A silk ribbon is used as it is not affected by the acid. Other means besides the ribbon may be used to introduce the reactive substance to the card surface.

This invention thus provides a tabulator card and ink material, which, in combination, produce upon the card a mark which is significant for the recording of items of information or data. The card, so marked, thus becomes available for use in a mechanical tabulator, or sorter, or other mechanical sensing device, in cooperation with electrode members therein. The ink mark and electrodes cooperate for the sensing operation, certain of the sensing members being actuated to permit a current flow, other sensing members being maintained in a condition for preventing current flow. The recorded data thus produces an appropriate operation of members associated with the sensing mechanism for obtaining such functions as sorting, tabulating, printing, etc.

While there are above disclosed but a limited number of embodiments of the device of the invention, it is possible to produce still other embodiments thereof without departure from the inventive concept herein disclosed. It is, therefore, desired that only such limitations shall be imposed upon the appended claim as are stated therein or required by the prior art.

The invention claimed is:

The method of producing a conductive mark upon a tabulator card comprising the steps of applying a non-conductive coating to the surface of the said card and applying thereto a spot of substances adapted to react therewith and produce a conducting spot upon the card, the said coating comprising zinc dust as a reducing material and gelatine as an adhesive, the spot producing material comprising a soluble salt of a conducting metal dispersed in a non-volatile oil medium.

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