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F. M. CARROLL ET AL

2,501,495

COPYING PROCESS

Original Filed May 5, 1944

FIG. 1

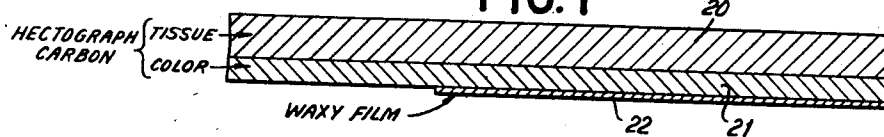


FIG. 2

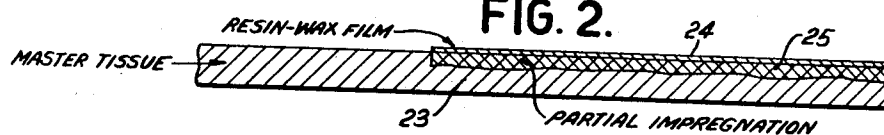


FIG. 3

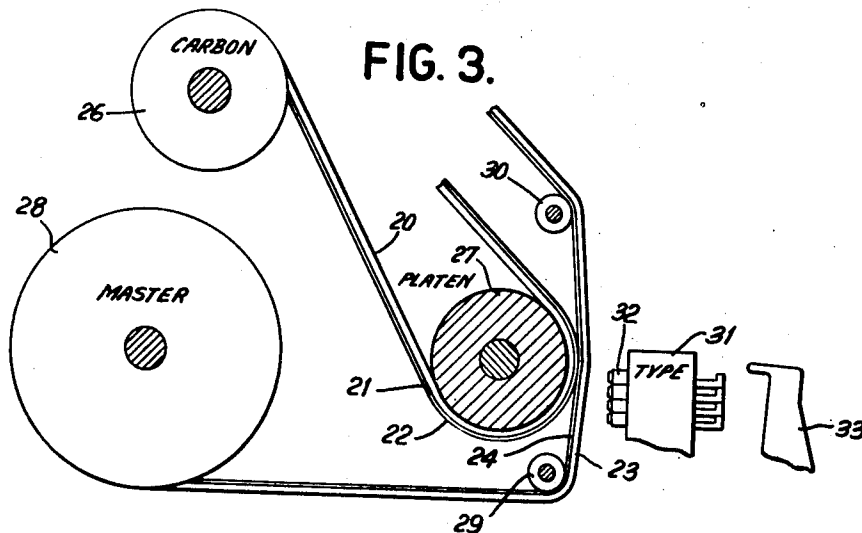
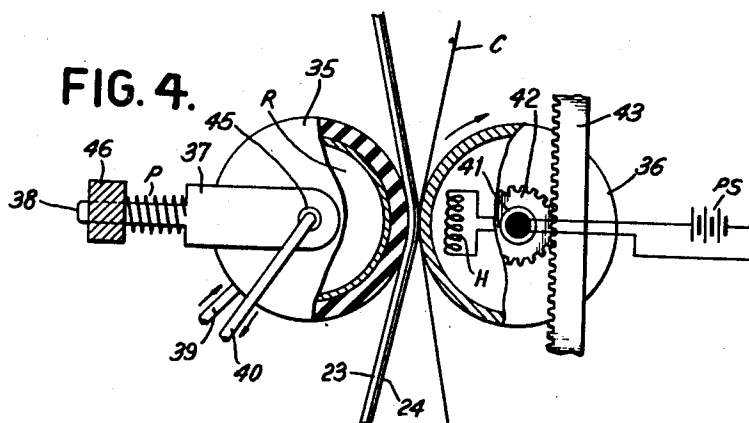


FIG. 4



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Original application May 5, 1944, Serial No. 534,212. Divided and this application May 4, 1946, Serial No. 667,334

3 Claims. (Cl. 101-149.5)

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This application is a division of our copending application Serial No. 534,212, filed May 5, 1944, for a Multiple copy process.

This invention relates generally to improvements in duplicating processes and more specifically to a novel method of associating a marked master sheet with copy sheets to receive record data thereon.

An object of the invention is the provision of an improved process of copying or duplicating through the use of a treated master sheet combined with the application of heat, pressure and cooling effects. The specially treated master sheet is placed against the copy sheet and both are directed through a pair of rollers which are pressed against each other. The one roller contacting the copy sheet is a metal roller which is heated to aid in having the coloring matter transferred from the master to the copy sheet. The other roller, which is the one pressing against the rear of the master sheet, is a rubber roller carrying a refrigerant or running stream of water to hold the temperature down to room temperature.

Other objects of the invention will be pointed out in the following description and claims and illustrated in the accompanying drawings, which disclose, by way of example, the principle of the invention and the best mode, which has been contemplated, of applying that principle.

In the drawings:

Fig. 1 is a sectional view showing the different layers of the treated carbon sheet.

Fig. 2 is a sectional view showing the different layers of the treated master sheet.

Fig. 3 is a diagrammatic elevation view showing the arrangement of the sheets with reference to the platen and type, when printing or typing takes place.

Fig. 4 is a sectional elevation view showing the arrangement of the pressure rolls and the process used while duplicating from the master sheet to the copy sheets.

In Fig. 1 the carbon sheet is shown to have a paper or tissue backing 20 covered with the usual color layer 21. Upon this color layer 21 is applied a thin coating of waxy film 22. This film is successfully applied by spraying the color surface with a dilute solution of wax, or resins and wax, in a suitable solvent. The coating may also be applied by dipping the carbon in such a solution or by passing the carbon surface over a roller which is partly immersed in such a solution. The following formulas are representative of the most satisfactory film forming solutions:

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- 1% solution of Be Square Special wax, 180/185 M. P. in benzol
- 1% solution of Be Square Special wax, 180/185 M. P. in naphtha #6
- 3% solution of resins and wax in benzol, consisting of 1% each of #5460 Aroclor resin, #4465 Aroclor resin, Be Square Special wax 160/165 M. P.
- 2 1/3% solution of resin and wax in benzol, consisting of 1 1/3% of #4465 Aroclor resin, and 1% of Be Square Special wax, 180/185 M. P.
- 4% solution of Glyco BZ-A wax in benzol

As a further definition of the resins and waxes used, it may be pointed out that the Be Square Special waxes are microcrystalline petroleum waxes, the Aroclor resins are chlorinated biphenyls of varying degrees of polymerization; and the Glyco BZ-A wax is a synthetic beeswax used as an alternative to ordinary refined beeswax. Many related combinations of such resins, waxes, and solvents would probably accomplish results similar to those of the above formulas.

The film formed by the foregoing solution serves a three-fold purpose; first, as an aid in the transfer of the carbon to the master by attaching the carbon particles to the master coating wherever struck by the type; second, in preventing "splashing" or "dusting off" of particles of the carbon, due to heavy type blows; third, as a protective film to prevent smudging when handling. Even with this added coating, considerable care must be taken in choosing a suitable grade of commercial carbon sheet, since hardness and depth of the carbon deposit, as well as thermal properties vary considerably with carbon grades and manufacturers. It was found that Philco Purple Gelatin Intense Hectograph and A. P. Little Purple Hectograph Intense Finish carbons give good results.

Reference to Fig. 2 shows that a master tissue 23 is treated by the deposit thereon of a resin wax film 24, which partially impregnates the tissue over an area 25. The following formulas are representative of those giving the best result for forming the coating 24:

|                                  | Per cent |
|----------------------------------|----------|
| (1) Monsanto Aroclor resin #4465 | 93       |
| Carnauba wax                     | 7        |
| (2) Monsanto Aroclor resin #1262 | 67       |
| Be Square Special wax, 180/185   | 33       |
| (3) Monsanto Aroclor resin #4465 | 25       |
| Be Square Special wax, 180/185   | 25       |
| Monsanto Aroclor resin #1262     | 50       |

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|                                        | Per cent |
|----------------------------------------|----------|
| (4) Monsanto Aroclor resin #4465 ----- | 50       |
| Be Square Special wax, 180/185 -----   | 15       |
| Monsanto Aroclor resin #1262 -----     | 35       |
| (5) Monsanto Aroclor resin #4465 ----- | 75       |
| Be Square Special wax, 180/185 -----   | 25       |

A difference in the above formulas is the tackiness of the film at room temperature, tack increasing in order (1), (5), (4), (3), (2).

The base 23 (Fig. 2) of the master sheet is a good grade of tissue of uniform texture and not over .0015 of an inch thick. This base is partly impregnated and completely coated on one side 24 in a single operation by passing the tissue over a coating roll as it rotates in a molten mixture of the synthetic resins and waxes, and thence is carried over a heated bar to smooth out the surface coating. The resultant coating should not increase the tissue thickness by more than .0001 to .0002 of an inch.

Fig. 3 shows the arrangement of the carbon and master sheet when processed in a printing device such as typewriter or accounting machine. There it is seen that the carbon sheet 20 is drawn from a roll 26 and passed around the platen 27 with the wax coated and color bearing side 22 facing outwardly. As the other recording medium, the master tissue 23 is drawn from a roll 28 and curved around a pair of guide rollers 29 and 30, which are situated so that the master tissue is arranged in contact with the surface of the carbon sheet as it passes over the platen at the printing line. The master tissue is arranged with the treated surface 24 facing inwardly, away from the type and toward the coated surface of the carbon sheet. The type bar 31 carries type 32 with the printing faces adapted to be selectively positioned opposite the printing line, so that when the hammer 33 strikes the selected type the master sheet is impressed against the carbon, so that the coloring matter is transferred.

Since the coloring matter is transferred on the rear of the master sheet, it appears as a negative image when that side of the sheet is exposed to view. However, due to the thinness of the tissue and since its transparency is augmented by impregnation with wax, it is possible to read the printed matter by gazing on the side of the master sheet opposite to the color bearing side. When this master sheet has received the printed impressions in cooperation with the carbon sheet, it is ready for storage or for immediate use in copying without the use of any solvents or gelatin transferring mediums.

The devices and process used in copying or duplicating the printed matter of the master sheet are shown diagrammatically in Fig. 4. There the master sheet 23 is shown to be associated with one of the many copy sheets C, with the treated and colored side 24 of the master sheet facing the copy sheet. The two sheets are seen to be pressed between a pair of rollers 35 and 36. Roller 35 is formed with a rubber outer shell and has a hollow interior suitable for receiving any refrigerant R or a running stream of cold water. When water is used, a pair of inlet and outlet pipes 39, 40 are connected to the hollow shaft 5.

Shaft 45 is carried by two or more flexible slide elements 37 formed with a reduced end 38 and a shoulder against which a spring P applies pressure, which is backed up by a stationary bar 46, in which is guided the reduced ends of the carry slides. As roller 36 is rotated, roller 35

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follows along therewith and pressure from springs P is maintained throughout the operation.

Roller 36 is rotated by a rack 43 cooperating with a gear 42 fastened to the side of the roller and pivoted on the hollow shaft 41. The rack is operated in any suitable manner to produce the required number of revolutions of the rollers, so that the master and copy sheets pass completely through the copying devices. The metal roller 36 is heated by an electrical coil H contained within the roller and connected to an outside power source PS by wiring directed through insulation material held in the hollow shaft 41. The heater H is arranged to maintain copying temperatures ranging from 160° F. to 200° F. Although the heat is applied constantly to a metal roll to hold it at the desired temperature, this heat when communicated through the paper to the pressure roller 35 is not allowed to accumulate on the side of the device carrying the master sheet 23. The refrigerant cooperating with pressure roll 35 dissipates the heat on the master sheet side of the device. It is seen that a portion of the cool pressure roll is shown forcing the coated and typed face of a section of the master tissue firmly against a section of the untreated copy paper heated by contact with the warm copy roller 36. This application of heat and pressure over a very short interval of time produces a complete copy after which other sheets of copy paper can be continuously advanced for a like treatment until the desired number of copies of a given master have been produced. A wide variety of grades of paper can be used as the copy sheets.

While there have been shown and described and pointed out the fundamental novel features of the invention as applied to a single modification, it will be understood that various omissions and substitutions and changes in the form and details of the device illustrated and in its operation may be made by those skilled in the art without departing from the spirit of the invention. It is the intention therefore to be limited only as indicated by the scope of the following claims.

What is claimed is:

1. A method of duplicate printing comprising the steps of associating a marked master sheet with a copy sheet, said master sheet having markings of carbon over resin and wax, applying pressure to force the master against the copy, and at the same time applying heat on the side of the copy sheet, and applying a refrigerant on the side of the master sheet.

2. A process of duplicating comprising the steps of successively coating a carbon sheet with a layer of resin and wax, coating a master tissue with a layer of resin and wax, assembling the carbon and master with the treated faces facing, impressing data recordings of carbon deposits on the master, associating the treated master tissue with a plain copy sheet momentarily, applying pressure to force the master against the copy sheet, applying heat to the copy sheet, and applying a refrigerant to the master tissue, said applications of pressure, heat and refrigerant being effected simultaneously.

3. A process of duplicating comprising the steps of successively coating a carbon sheet with a layer of resin and wax, coating a master tissue with a layer of resin and wax, assembling the carbon and master with the treated faces facing, impressing data recordings of carbon deposits on the master, bringing the carbon treated face of the master tissue against a plain copy sheet,

running said assembled master tissue and copy sheet in the bight of two rapidly revolving cylinders to make momentary line contact between them, applying pressure to force said two cylinders and said tissue and sheet therebetween together, applying heat to the cylinder on the side of the copy sheet, and applying a refrigerant to the cylinder on the side of the master tissue.

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