Papers For Information Industry

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INTRODUCTION :

Paper has become so indispensable an item to the modern generation of mankind that it ranks just below food and clothing in relation to the necessities of life. The paper is mainly used for (a) communicational and literary purposes (b) personal and sanitary purposes and (c) packaging either industrial or construcrion purposes. Over the past three decades or so, the pressing demand in communication systems, have led to development of a variety of speciality papers, that find use in the acceleration and simplification of passing on and processing information.

Inspite of the tremendous development in communication and information handling system, paper remains as the principal information career and plays a vital role in rapid and inexpensive reproduction and wider distribution of information. In recent years substantial increase has taken place in the range of products suitable for reproducing and duplicating documents. These may be broadly categorised into two groups.

The first group includes copying and duplicating papers like carbon paper, blue print paper, stencil duplicating paper, transfer and take up system of carbonless paper, chemical system of carbonless paper, self copying chemical papers etc.

The second group is the reproduction papers, which include electrophotographic paper, dielectric paper, electrosensitive recording paper, electrofax paper, thermal paper, thermal ink transfer paper, magnetic recording paper, photographic paper, ink jet recording paper, diazo copying paper, silver diffusion paper, electro-thermosensitive paper and photopolymerisation paper etc.

In the present article, we would however, restrict our discussions, to a few important types of both the categories of papers.

COLOUR REACT COPYING PAPER:

Carbon copying has been one of the classical methods of producing copies in office sector, but these paper suffer from a number of disadvantages. Carbon papers have certain limitations due to its functional and aesthetic short comings and other associated factors such as disposal and ecological problems, toxicity etc. Moreover, carbon paper cannot be used conveniently in modern business machines like electronic data processing equipments and computers, because of its increased weight and thickness in form sets. Reactive carbonless paper circumvents the short comings of the carbon papers. The advantages for using carbonless paper are that they are clean to handling and clear in image formation without smudging. No handling or disposal problem is associated with it. The use of this paper also avoids risks of confidential information being leaked out, which is possible with carbon paper. The carbonless papers are conveniently used in the modern electronic data processing equipments and for making multipart business forms.

The most usually encounted kind of chemical carbonless paper is illustrated in figure I, where two reacting component systems are carried on separate sheets. The transfer coating is formulated with microencapsulated colourless dye intermediates. The capsules of the colourless dye intermediates are coated on the paper substrate and then dried. The transfer film of colourless dye intermediates is rupturable by the pressure of a marking system. When localised pressure is applied either by by ball point pen, pencil, typekeys or by the platen of a data processing equipment, the wall of the capsule is ruptured and the fluid containing the leuco dye intermediateis transfered to the under sheet called receptor sheet, which when reacts immediately with the absorbent coating material present,

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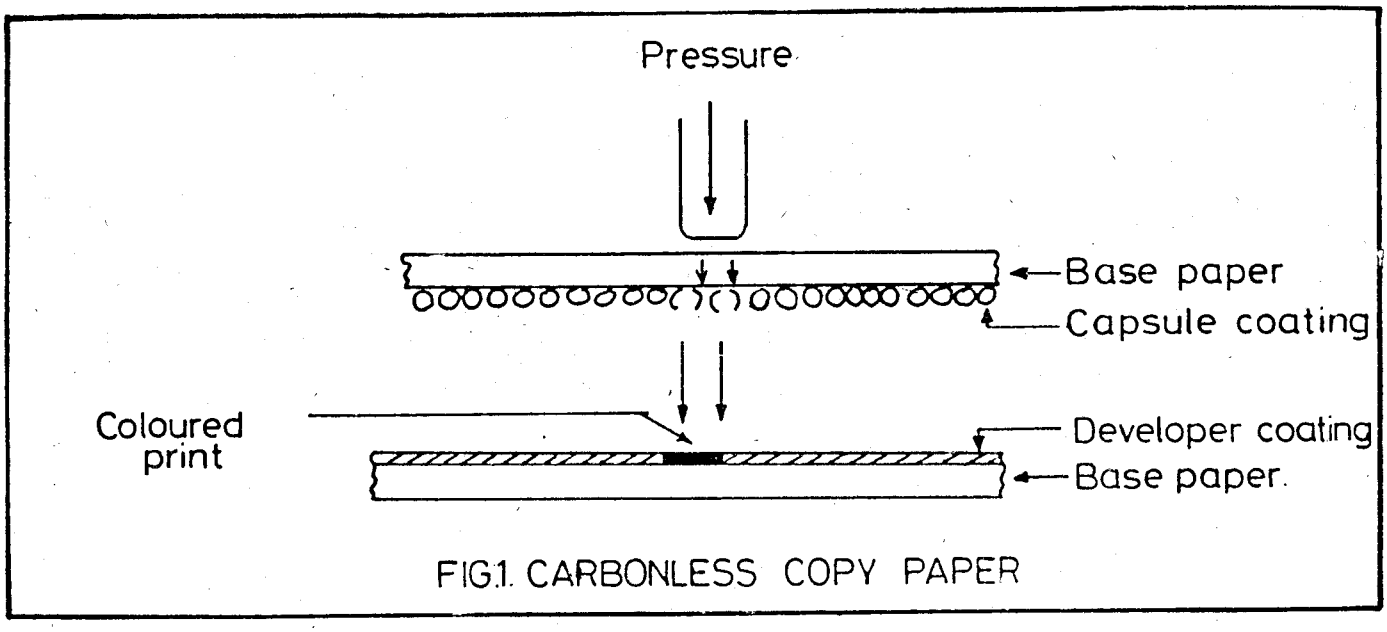

FIG.1. CARBONLESS COPY PAPER

thereon causing a distinctive coloured mark. The receptor sheet contains solid inorganic materials in fine particle form or synthetic polymeric materials, which react instantaneously with leuco dye intermediates, to provide visible colour.

Chemical carbonless papers are coated paper and therefore the chemical mix for coating, the base paper used and the coating methods adopted play important part in the final paper quality. The properties of base paper such as formation, dimensional stability, sizing and punching performance are important.

Carbonless copy paper is one of the fastest growing segments of the paper industry with a worldwide growth rate of 10 per cent per year. The world consumption of carbonless paper was 1,300,000 tons in 1985[1] and it is expected that the total world consumption will be trippled by 1991 in comparison to present consumption.

SELF CONTAINED PAPER :

The 'self contained' chemical papers are those in which the reactive chemicals are carried either within the paper web itself in a single coating on a sheet. Such papers can form a coloured copy simply by marking them or by applying pressure through a plain sheet of paper.

These papers are used either as copy sheet under letter head or for ribbonless entry work and as recording copies of continuous labels.

THERMAL PAPER ;

Thermosensitive paper has been used for many years in recording apparatus and during the last decade, this paper has achieved a miracle annual growth. Early thermosensitive papers were commonly called mechanical thermal papers in which a coloured base paper is coated on one side with a non transparent fusible materials. When it is exposed to heat, the coating melts and becomes transparent. Thus, the coloured base paper becomes visible, thereby, producing distinct impressions. Such papers are still produced for use in tachograph equipments.

Chemical thermosensitive is another type of thermal paper, where revelation of contrasting colour is not by a mechanical process, but by a chemical reaction of a colour former and a co-reactant.

In the chemical system, the colour formation takes place due to thermomechanical reaction and the nature of the system is such that the heat generated by a source, produces colour.

The chemical thermal papers have the advantage over the mechanical papers that the chemistry of the process can be adjusted to accommodate the demands

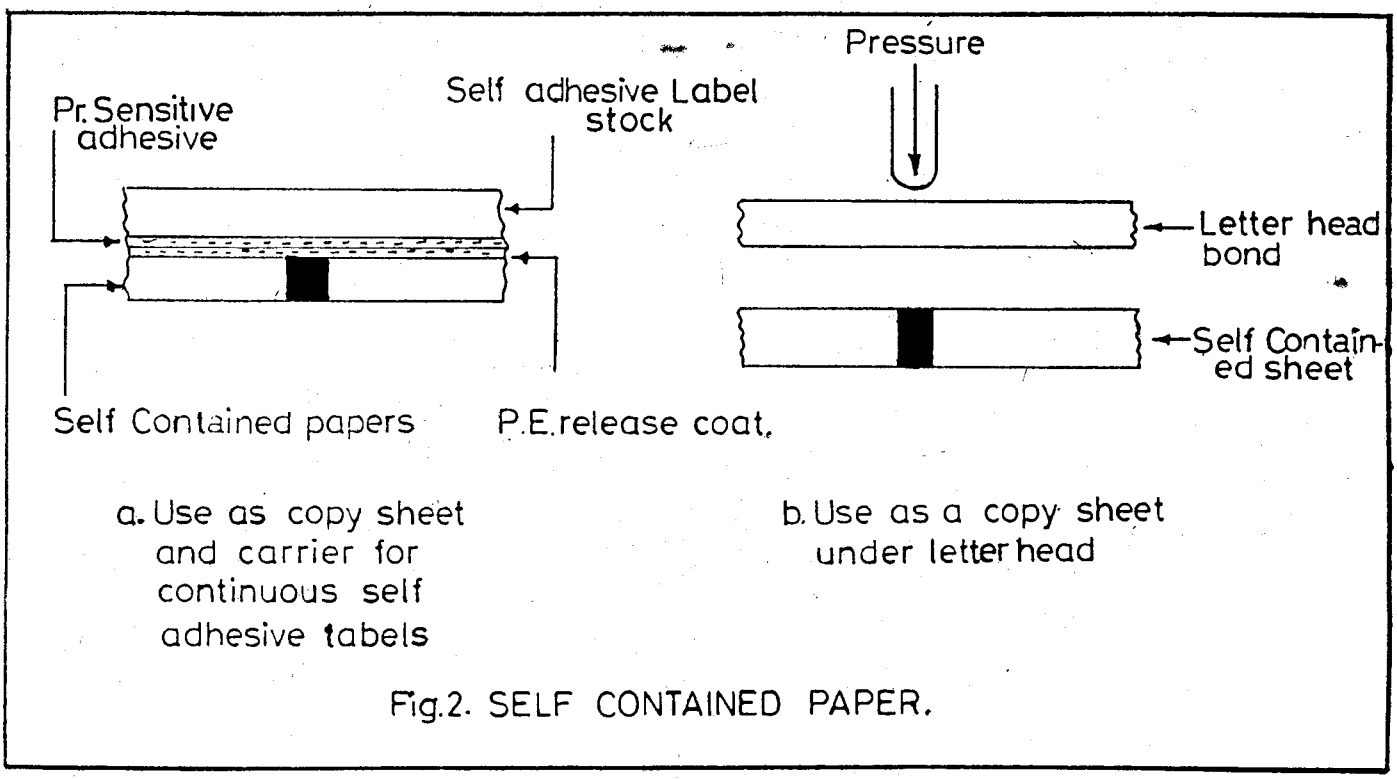

Fig.2. SELF CONTAINED PAPER.

of the apparatus. for which it is intended. The thermal papers are mainly used as computer print out media or as recording paper for cardiographs, seismographs etc.

Now-a-days, special grades of thermal papers are available which can produce two different colours. The colour generating mechanism of this paper consists in two layers of coating, which are different in dye reaction temperatures. The top layer is coated with a dye which produces image at low temperature while the dye of the second layer reacts at a higher temperature. These papers are costly and therefore, restrict to a limited use.

The origin of thermal paper dates back to 1930, but 3 M Company, USA, first introduced in 1950, the 'Thermofax' machines and copy papers. This was the first reprographic system that required only a piece of special paper and a machine to produce a dry copy. The 3 M Company also introduced in 1964, a transfer thermographic technique with its 'Copy Mite' machines.

The coating compositions for thermal papers are prepared by mixing dispersions of the reactive components with binder and modifier in either aqueous or solvent based formulations. In all cases, it is essential that the thermally active coating responds to the available thermal energy over a fixed period of time (2-10 milliseconds)[2]. All thermal systems have their own temperature limit, under which no reaction takes place. The machine coating conditions and base paper also play a vital role in obtaining a well finished and acceptable paper.

THERMAL INK TRANSFER PAPER :

In thermal ink transfer papers, the ink is transferred from ribbon or sheet onto smooth surfaced plain paper. In this system, the thermosensitive ink is usually coated on a thin film or paper of around 10 micron thickness so as to respond quickly to heat. Here, unlike thermal paper, ink is stable against light, moisture and chemicals because, the inks are made from chemically stable pigments. The thermosensitive ink transfer recording system however, has two main defects viz. (a) the ribbon or sheet cannot stand repeated use and therefore it is costly and (b) the printing effect deteriorates on rough surface paper.

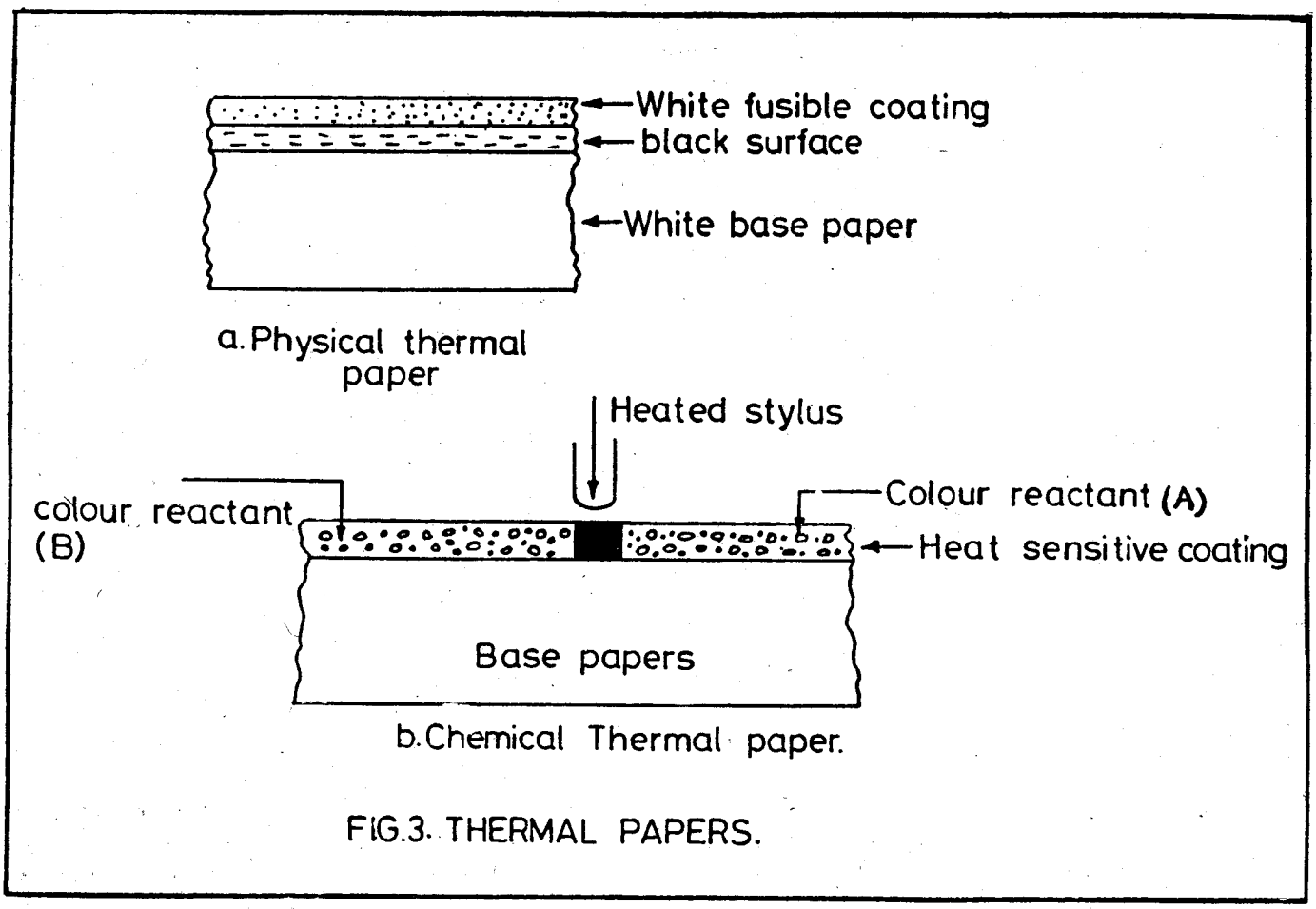

FIG.3. THERMAL PAPERS.

The thermal ink transfer papers are widely used in the fields such as drafts, cheques and official documents, where excellent image preservation, strong resistance against chemicals, water, light and clear reproduction of image and long preservation of printed image are some of the vital requirements.

The thermal ink transfer printing is a significant development and today, thermal recording system has the advantage of simple recording mechanism. These papers are used in word processors, serial printers, electric typewriters and recently colour copiers using thermal transfer recording with digital scanner have been developed[3].

DI-ELECTRIC PAPER :

Dielectric paper consists of a conductive support such as electroconductive base paper to which a coating consisting of a thin dielectric film of high resistivity have been applied. In dielectric or electrostatic recording, the principle is that by producing a strong electric field between the printing electrode and the black electrode, charges in the form of dots are built up on the dielectric coating, which acts as a condenser. The latent electric image formed on the dielectric coating is made visible by contact with a toner. The latent electric image can also be produced by cathode ray tube or with small needles. The advantage of this process lies in the fact that electric signs which are for instant, produced by a computer or transmitted through a electric line, can be made visible at a high speed. It is a method that is particularly well suited to the quiet inexpensive and high speed generation of hard copy from electrically transmitted informations such as from digital computer[4].

A thin dielectric coating is applied on a conductive base paper to make dielectric papers. Highly resistive polymers such as polystyrene PVA, polyvinyl butyral

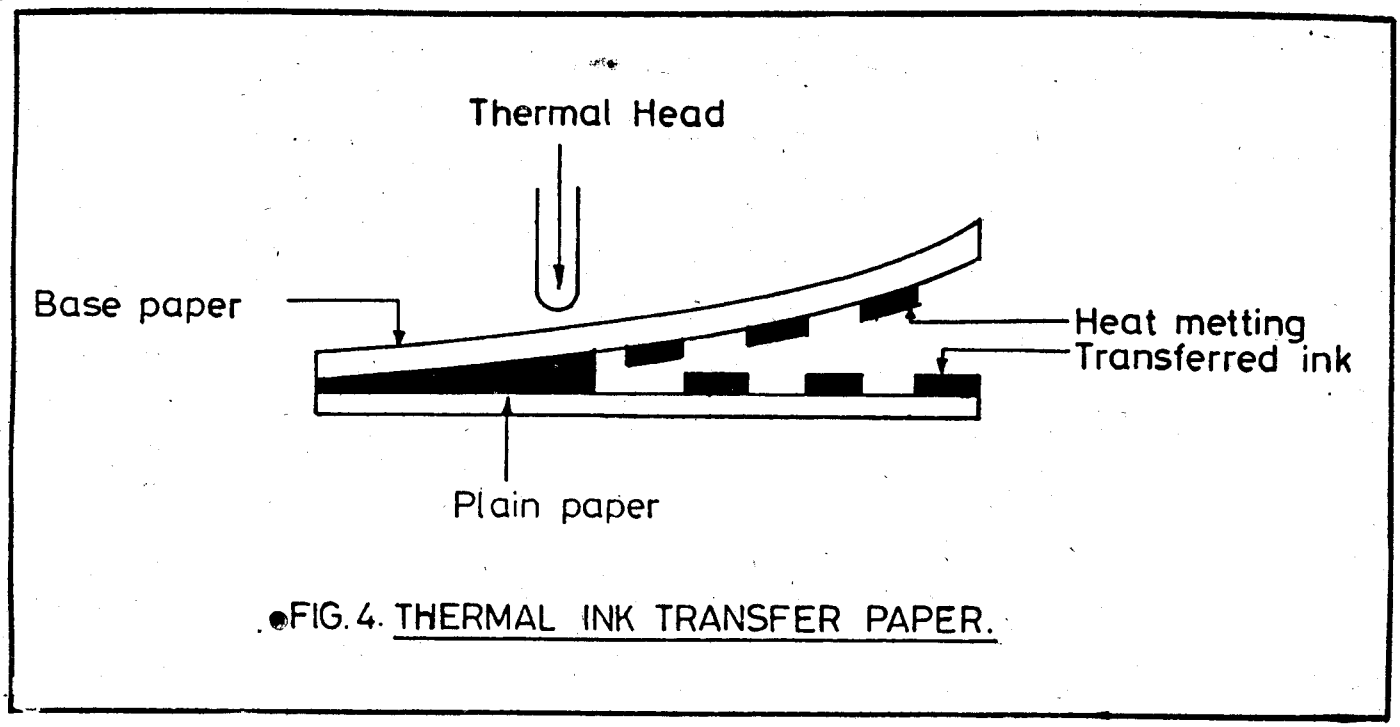

FIG. 4. THERMAL INK TRANSFER PAPER.

and polymer of acrylic esters in organic solvents are used for making dielectric coating.

Today full range dielectric papers are available wherein electronic conductive metal oxide powder is incorporated with polyelectrolyte in the conductive layer. This new dielectric paper is functional with the entire humidity range and can be used in instruments in areas where extreme dryness or humidity prevail[5]. Dielectric paper will retain a substantial share in the market on the strength of high recording speed, clear and longer preservation image on the copies.

MAGNETIC RECORDING PAPER :

Magnetic coatings are applied to a web for manufacturing tapes and papers for storage of informations. Iron oxide is used as magnetic material, which as a result of polar alignment in conjunction with electronic devices, can store or retrieve informations. In making these papers, iron oxide coating is applied either from a solvent dispersion system or from a hot melt system. Cleanliness is the utmost importance in the preparation of the coating formulations and handling systems in making magnetic papers. Specially in manufacturing audio or video tapes, highest accuracy and absolute absence of fault in coating have to be maintained because microscopicaliy small fault can cause remarkable variation in the minute details of the recorded magnetic impulses. This type of high standard is of course not required to be maintained in making tapes used in office and dictating machines. For this short of applications, coated paper tapes have been developed which are considerably economic[6]. Now a days, magnetic oxide stripes on paper are available for use with highly sophisticated computer equipments, but these have been produced by laminating pre-coated film tape to the paper. Recently. carefully prepared paper audio tapes have also appeared in the market.

ELECTROPHOTOGRAPHIC PAPERS :

This class includes mainly those papers which are used in so-called plain paper copiers. The principle of this system has been established itself on worldwide basis under the designation of xerography. It creates a latent electrostatic image by exposing a charged photoconductive surface to light in the form of the image to be copied. The latent image is developed by applying a finely divided dispersion of a coloured toner to the image in the photoconductive surface, the coloured particles in the toner adhere to the charged areas to form a visible image. The developed toner image is then transferred to render it permanent to subsequent handling, storage and use.

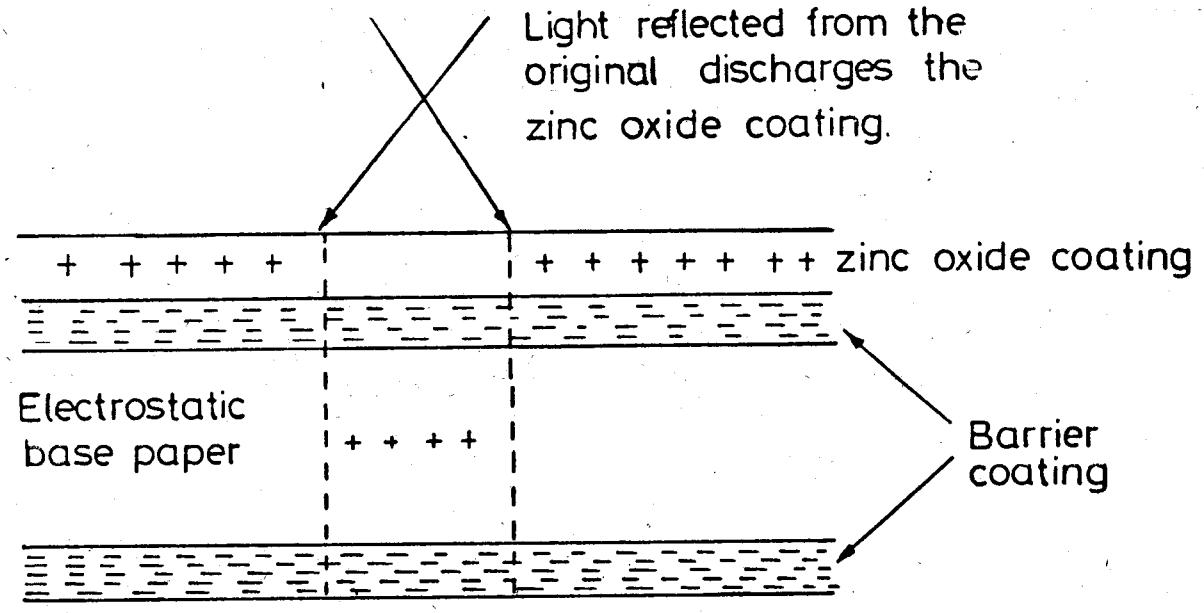

FIG. 5

Behaviour of zinc oxide coating during copying.

In principle every paper can be used for such plain paper copiers. However, in order to achieve perfect runnability in the copier and especially for obtaining adequate resistance to the high fusing temperature, it is necessary to meet certain specifications. Thus, the paper should be made from bleached chemical pulp in order to reduce the tendency to yellowing. Moreover, the paper must have sufficient stiffness to feed reliably in copiers. The papers must have smooth level surface and be sufficently opaque to prevent show through.

ELECTROFAX PAPER :

The papers used in the direct system of electro-photographic copying is called Electrofax paper, which is coated with photoconductive zinc oxide. The photoconductive layer is provided with electric charges in the dark and the image formed on it is then toned and fixed.

The function of the direct electro-photographic copying system, is that the zinc oxide coated paper is first delivered to a corona discharge unit, where a negative charge is induced on the coated paper. The copy is then exposed to visible light radiation, reflected from the surface of an original. When light is reflected from the original, it discharges the negative charge at a corresponding spot on the copy paper. The discharge takes place because of the photoconductivity of the zinc oxide, which acts as an electric insulator in the dark and as a conductor during exposure to light. The latent image of charged and non charged areas is next delivered to a bath of liquid toner in which fine carbon particles are carried by a solvent. These particles are attracted to the charged areas on the paper and form a visible copy. The excess liquid is squeezed off and the copy paper is dried with moving air and in most cases with heat.

The manufacture of electrostatic base paper requires complex coating formulations and highly developed coating techniques. The prime requirement of the base paper is the good solvent holdout properties on both sides. The paper support is usually rendered conductive by surface treatment of the paper or by incorporating a conductive chemical such as cationic

polyelectrolytes in the paper. Many barrier coatings are compounded with some pigments to increase opacity and create a smooth surface for zinc oxide coating. Some base papers are supercalendered to obtain maximum smoothness and density. Electroconductive polymer that operate over a broad range of RH and cationic polymers with a high charge density have been developed to increase the electrical conductivity of the base[4].

The photosensitive electrofax coating is prepared by dispersing proper grade of zinc oxide in solvent with resin binders. Sometimes special class of dyes are incorporated with the photoconductive coating to improve response to light during copying. Two common classes of sensitizers are the triphenyl methane dyes and the cyanine dyes.

The electrosensitive paper is used more in computer printers than in facsimiles. On the strength of clear image reproduction and simple recording mechanism, these papers have demand in limited sectors.

ELECTRO THERMOSENSITIVE RECORDING PAPERS:

Direct conversion of electronic signals to visible images are performed by methods like electrolytic, sparking, thermal and ink ket recordings. All these methods have their own limitations such as corrosion of machine, stylus wear and sensitivity to environment etc. The latest development is that electroconductivity and thermosensitivity properties could be incorporated together to form a electro thermosensitive recording type paper, where direct conversion of electrical signals into visible images could be obtained without the aid of ink, tone or chemicals. The process is completely dry[7]. The paper finds use in many recording instruments with simple mechanism.

CONCLUSION:

The papers used in the storage and dissemination of information account for more than 70 percent of speciality grade papers. All forms of information oral, written, photo or drawing, whether on paper, film, radio or TV could be transformed into these information carrier papers in one form or other. The dynamic progress of the electronic communication system, appears to be a threat not only to the papers used in the information handling systems, but to the paper industry in general. Developments in electronic industry like computer microfilm recording, key data recording, direct telephone data entry, audio input devices and community antenna systems may fossilize some of the present communication systems with a resultant decline in paper demand. However with the advent of new communication system and automation in offices the information career papers will occupy distinct position in a country like India where electronic industries are yet to develop fully. As such there is sufficient scope for producing the above mentioned speciality papers, the demand for which are expected to grow in immediate future because of the rapid tempo of industrialization and adoption of sophisticated methods in handling and processing of information in all sectors.

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