

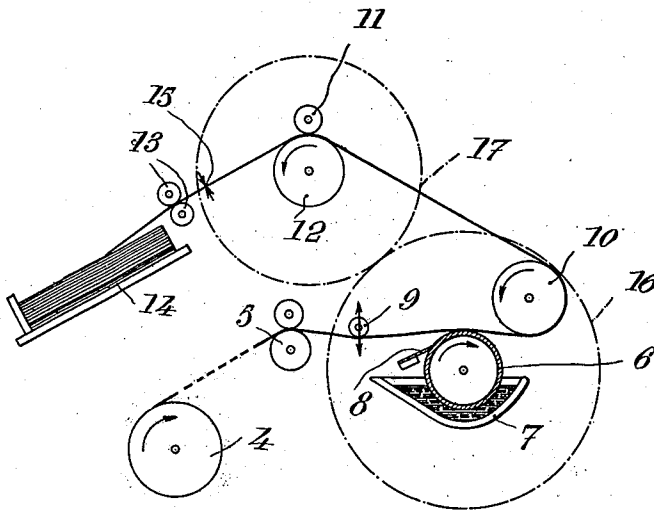
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INKING DEVICE

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## UNITED STATES PATENT OFFICE

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## INKING DEVICE

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Our invention relates to methods and apparatus for coating sheets of paper or other flat surfaces with ink. It concerns more especially, but not exclusively, methods and apparatus for coating at least some portions of sheets of paper with carbon copying ink.

The object of our invention is to provide a method and apparatus of the type above referred to which are better adapted to meet the requirements of actual practice.

The essential characteristic of the method according to our invention consists in making use, for applying the ink, for instance only on certain portions of a sheet of paper, of a printing process, that is to say of a process involving the use of a printing element for applying the ink onto the paper, and in causing said printing element to move with respect to the paper, in such manner that there is produced a sliding displacement between the portions of these elements that are in contact, for at least a part of the time during which ink is applied onto the paper.

The essential characteristic of the apparatus according to our invention consists, while providing a printing element, preferably fitted on a printing element carrying cylinder, and means for distributing ink over said printing element, as usually devised in printing devices, in so arranging these devices that the printing element moves at a speed such that there is produced a sliding displacement between said printing element and the paper while ink is being applied onto said paper.

Other characteristics of our invention will appear from the following detailed description thereof, given merely by way of example.

We will first consider the case in which it is desired to devise a machine for obtaining, through an intaglio printing process, sheets provided on their lower surfaces with copying portions.

We advantageously make use of a printing machine utilizing paper, either in the form of sheets or in the form of spools, and of a conventional design, with the exception of some of its elements. These elements are the printing element carrying cylinder, eventually the counter-cylinder that cooperates with said cylinder, and the means for driving said cylinder and said counter-cylinder.

According to our invention, the printing machine must further include:

Means for feeding paper to the point where ink is applied onto said paper;

Organs for conveying the ink onto the printing element carrying cylinder; and

Organs for conveying the paper to the desired place after said paper has been provided with copying zones. The organs that have just been stated can be of any suitable structure and arrangement.

Furthermore, if it is desired to make use, for obtaining copying zones, of ink that is solid in the cold state and liquid when warmed, such as that utilized in the manufacture of carbon paper, we preferably arrange the printing machine above described in such manner that the printing element carrying cylinder and also all the organs that are located before said cylinder, therefore the ink with which they are in contact, should be at a temperature higher than that of the guiding cylinder.

This result can be readily obtained, for instance in the known manner as follows:

On the one hand means are provided for heating the inking material from the tank as far as at least as the generatrix along which the guiding cylinder and the printing element carrying cylinder are tangent to each other, in such manner that printing may take place at a suitable temperature, account being taken of the nature of the ink, of the paper, of the number of sheets to be printed, of the colour of the sheets, etc.

On the other hand we provide means for cooling the upper face of the sheet as soon as the latter has been coated with ink so as to form copying areas, or a short time after this coating, in order to prevent the ink from passing through-out the paper.

As for the printing element carrying cylinder it is advantageously made in the following manner:

A copper plate, which is to form the printing element, is engraved, preferably in the same manner as in the heliogravure process, or again by knurling, account being taken as it will be hereinafter explained, of the dimensions of the copying areas to be obtained on the lower face of the sheet. This engraving is to produce, on the printing element a network design of any suitable kind, the lines of said network extending, for instance, in two directions at right angles to each other.

Anyway the engraving of the printing element is made in such manner as to provide:

On the one hand fine partitions the top of which is flush with the plane forming the limiting surface of the smooth or unengraved portions of the copper plate, and,

On the other hand small cells forming an intaglio structure with respect to said printing plate.

Although any network of the type above stated can be employed according to our invention, we have found that it is advantageous to have recourse to a network consisting essentially of a juxtaposition of very fine grooves, parallel to one another and to the directrices of the cylindrical surface the shape of which the printing element is to assume, these grooves being preferably partly filled from place to place by partitions adapted to prevent ink from flowing too easily along the grooves when the scraping member slides in contact with the printing element.

Such a network can be obtained in the following manner:

A first series of parallel lines is reserved on the surface of the copper plate that is to form the printing element, for instance in the same manner as for any etching, in such manner as to protect them very strongly against subsequent attack by acids, said lines being directed along the directrices of the cylindrical surface above referred to, use being for instance made, for this purpose of a "linear network".

A second series of parallel lines is then reserved, but less strongly, said lines being, for instance, spaced at the same interval as the first mentioned lines, and being so disposed as to intersect the first mentioned lines (for instance at right angles).

Finally the plate thus prepared is attacked, for instance by means of a suitable acid, so that the first mentioned lines are not at all attacked and the second mentioned lines are slightly attacked, thus forming, in the grooves that separate the first mentioned lines, partitions the tops of which are located slightly below the surface that limits the smooth or unattacked portions of the printing element, but however limit microscopic cells adapted to retain ink.

Such a network has the advantage of facilitating the sliding movement of the paper with respect to the printing element and of reducing the risks of tearing said paper.

The printing element that has thus been obtained in the form of an engraved copper plate can be applied against the lateral surface of a cylinder and fixed thereto by means of clips, clamps, or the like, adapted to ensure a good contact between the printing element and said cylinder, the structure thus obtained forming a printing element carrying cylinder ready to be utilized.

We may also, according to our invention, instead of attaching a copper plate forming a printing element to a cylinder so as to form a printing element carrying cylinder, provide a copper envelope surrounding said cylinder entirely, and directly engrave the design or designs that it is desired to obtain in said envelope. We may for instance obtain said copper envelope, in a direct and simple manner, through electroplating.

A scraper, preferably movable, is disposed against said printing element carrying cylinder and in front of the printing generatrix, said scraper bearing of course only against the ridges of the lines of the engraved design and scraping ink, before each printing operation from the smooth areas of the printing element that correspond to the zones of the lower face of the sheet that must not be coated with copying ink. In this way ink is allowed to remain only in the small cells of the engraved network that have

been above referred to, the amount of ink being of course determined by the shape and depth of said cells, said shape and depth having been chosen in accordance with the fluidity of the ink that is utilized, the nature of the paper, the process of reproduction that is applied, etc., the relation between these factors and the shape and depth of the cells being easily found by experiments.

Concerning now the means for driving the printing element carrying cylinder, they are advantageously so devised that the peripheral speed of said element is different from the speed of unwinding of the paper.

Said peripheral speed may be given at will a value either higher or lower than that of said speed of unwinding of the paper, the difference between said speeds ranging for instance between 10 and 20%.

Of course the printing element carrying cylinder may be driven through any suitable means, such for instance as gears, the ratio of which will be chosen suitably according to the circumstances.

Finally, we preferably make use of a counter-cylinder adapted to apply the paper against the printing element carrying cylinder, the pressure with which the paper is applied against said printing element carrying cylinder being adjustable and so chosen as to avoid tearing of the paper.

Advantageously said counter-cylinder will be disposed in such manner that the paper may wind around it over a relatively large circular arc, ranging for instance between 180 and 240 degrees.

Said counter-cylinder can be driven through suitable organs, or it might be merely driven by the paper itself.

A preferred embodiment of a machine according to the present invention will be hereinafter described with reference to the accompanying drawing, given merely by way of example, and in which:

The only figure is a diagrammatical view of a printing machine according to our invention.

As shown in this figure, the cylinder 6 that carries the printing element is partly immersed in a reservoir 7 containing the copying ink and which is suitably heated. A scraper 8 is adapted to cooperate with said printing element as above explained.

The paper, which is supported to be unwound from a spool 4, passes between rollers 5 and is applied against the surface of the printing element 6 by a roller 9 adapted to be displaced in the direction of the arrows and by a counter-cylinder 10 around which said paper passes. Said counter-cylinder 10 also serves to cool the paper. The paper, on leaving cylinder 10, passes to feed cylinder 12, which cooperates with roller 11. The paper is then cut at 15 so as to form the sheets, which are taken by rollers 13 and piled upon plate 14.

The chief characteristics of the device according to our invention is that the parts are so connected that the peripheral speed of cylinder 12 is different from that of cylinder 6, so that the paper slides along the surface of cylinder 6. For this purpose, we may, as shown in the drawing, provide gears 16 and 17 adapted to connect together cylinders 6 and 12 respectively, the diameters of said gears being such that the peripheral speed of cylinder 12 is higher or smaller than that of cylinder 6.

Whatever be the nature of the printing ele-

ment and the means for printing the paper with copying ink, it will readily be understood that the portions of the printing element that are engraved or otherwise treated so as to be able to apply the copying ink onto the sheets of paper must be given shapes and dimensions in the direction parallel to the unwinding of the paper chosen by taking into account the relative displacement of the printing element carrying cylinder with respect to the paper in the course of the contact of said elements with each other.

Thus, for instance, if a printing zone of rectangular shape, two of the sides of which are parallel to the generatrices of the printing element carrying cylinder moves, during the time of contact of said zone with the paper, a distance greater by 5 centimeters than the distance the paper has moved forward during the same interval of time, it will be necessary to give said rectangular zone of the printing element a width greater by 5 centimeters than that of the printed zone to be obtained on the paper.

Of course, inversely, if the peripheral speed of the printing element carrying cylinder is lower than the speed of travel of the paper, the printing zones must be given widths smaller than those of the copying zones to be obtained on the paper.

It will be obviously possible, in each particular case and whatever the shape of the copying surfaces may be, to determine, eventually, by giving the sliding displacement a given value, the outline to give to the engraved zones of the printing member.

Whatever be the relative displacement of the printing member and of the paper, the friction produced between these two elements ensures a better adhesion of the copying layer owing to the crushing to which said layer is subjected while said relative displacement is taking place, the paper being applied against the printing element carrying cylinder.

Another advantage of the process according to our invention results from the fact that the crushing of the copying layer gives the latter a smoother surface than if no sliding displacement had taken place, which will prevent traces corresponding to the network of the printing element, if said element is provided with a network, from being visible on the copying zone, and ensures, in a general manner, a more homogeneous distribution of the ink.

The process and apparatus that have just been described make it possible to obtain, in a simple and reliable manner, sheets provided on the lower face with copying areas of any desired shape.

It may be sufficient to treat, as it has been above explained, sheets of paper already printed on the upper face, by means of any suitable printing machine, so as to present characters or signs of any desired nature, the treatment above referred to consisting in coating the lower face of the sheets, over predetermined areas of any desired shape, with copying ink.

It is also possible to make use of blank sheets and to perform simultaneously (that is to say by means of a single printing machine of suitable type) the following operations:

(a) The printing, on the upper face of the sheet of the characters, forms, or figures of a text, this printing being performed through any suitable method (typography, lithography, offset, hellogravure, etc.); and,

(b) The application, through the process

above described, of copying areas of any desired shape on the lower face of the sheet.

There will be no difficulty in devising a machine performing these two functions, whether the paper is provided with a margin, with a manual or automatic delivery, is in reams, or is unwound from continuous spools.

In the latter case all the cylinders are parallel to one another; the paper is first provided, at least partly, on one or both faces, with texts, characters, figures, etc., through any suitable printing process; said paper is then provided with the copying areas as above explained.

Of course our invention is entirely applicable with some modifications to the process above described by way of example. For instance the sliding displacement between the printing element and the paper or equipment element might take place only during a part of the time for which said elements are in contact, for instance in cases of the printing element carrying cylinder being provided with driving means that impart an irregular or discontinuous movement thereto.

It should also be well understood that the essential feature of our invention, that is to say the relative sliding displacement of the printing element and of the paper or the equivalent can quite as well be applied with printing processes other than the intaglio printing process, for instance with processes in which the printing element is in relief, as in typography for instance. Our invention also applies to the case in which the printing element is replaced by a stencil and even to the case in which ink would be applied by means of a cylinder, of india-rubber or a similar material, such as those that are made use of in the offset method.

Our invention is also applicable to the case in which the printing is performed by means of flat printing elements.

It is also applicable to the case in which it is desired to manufacture carbon paper coated with copying matter over its whole surface with eventually the exception of small zones for facilitating its handling. In this particular case it will be possible, eventually, to dispense with the counter-cylinder and to provide a certain surface of contact between the paper and the printing element.

While we have described what we deem to be practical and efficient embodiments of our invention, it should be well understood that we do not wish to be limited thereto as there might be changes made in the arrangement, disposition, and form of the parts without departing from the principle of our invention as comprehended within the scope of the appended claims.

What we claim is:

1. Method of applying carbon copying ink to limited parts only of paper, which comprises applying such ink to a printing element having a pattern thereon of a size different from the size of the coated part to be produced, bringing the patterned part of the printing element into contact with the paper, and, during such contact, causing relative sliding motion between the paper and the printing element of such proportions as to cause the printing element to produce on the paper a coated part of the desired size.

2. A method according to claim 1 wherein said patterned part of the printing member has an intaglio surface.

3. A method of applying carbon copying ink on limited parts only of paper, which comprises spreading such ink on portions only of the pe-

riphery of a printing cylinder, such portions being of a size different from the size of the coated part to be produced, passing the paper over the inked portion of the periphery of such cylinder in a direction at right angles to the axis of the cylinder, and causing relative sliding movement between the paper and the periphery of the cylinder during such contact of such proportions as to cause the inked portion of the cylinder to produce on the paper a coated part of the desired size.

4. In a process according to claim 3, said paper and said cylinder sliding during only a part of

the period of contact between the paper and the cylinder.

5. In a method according to claim 1, in which said paper and said printing element are both moving, said printing element moving at a greater speed than said paper.

6. In a method according to claim 1, in which said paper and said printing element are both moving, said paper moving at a greater speed than said printing element.

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