Dec. 5, 1944. H. J. BRUNK 2,364,514

MACHINE FOR MAKING BLUE PRINTS AND THE LIKE

Filed Sept. 20, 1943 2 Sheets-Sheet 1

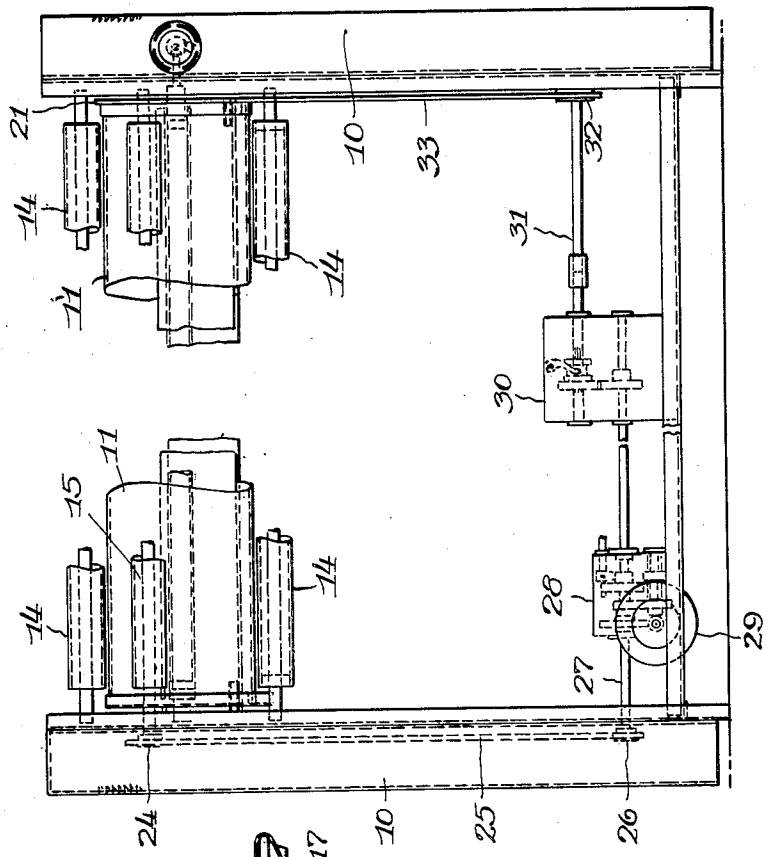


Fig. 2

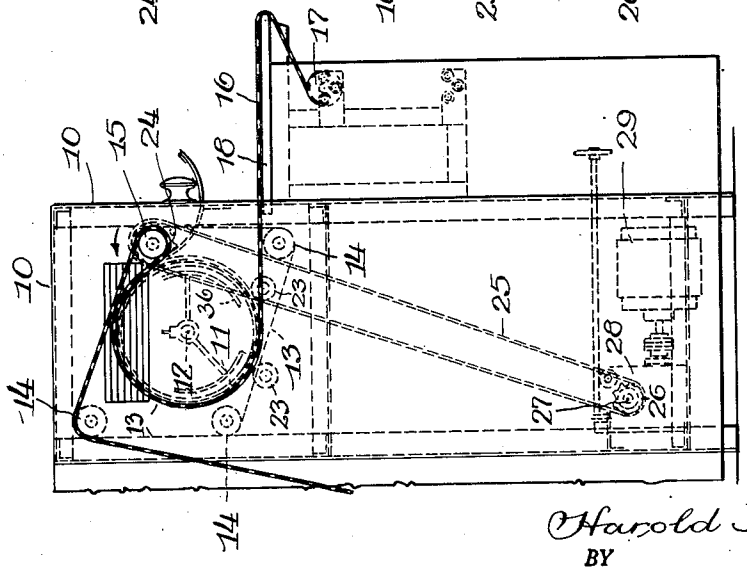


Fig. 1

INVENTOR.
Harold J. Brunk
BY
Chittom, Wales, Davies, Schraeder & Merriam
Attys.

Dec. 5, 1944. H. J. BRUNK 2,364,514

MACHINE FOR MAKING BLUE PRINTS AND THE LIKE

Filed Sept. 20, 1943 2 Sheets-Sheet 2

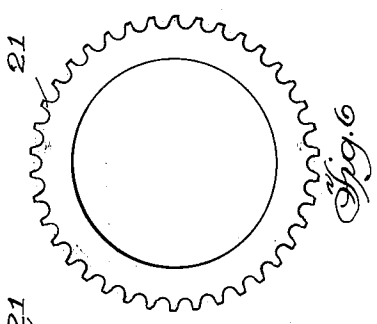


Fig. 6

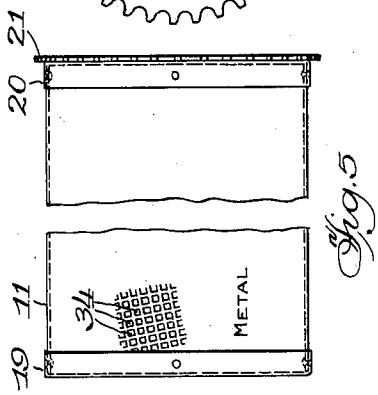


Fig. 5

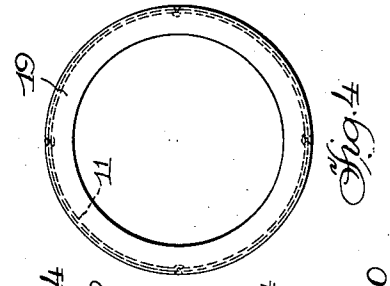


Fig. 4

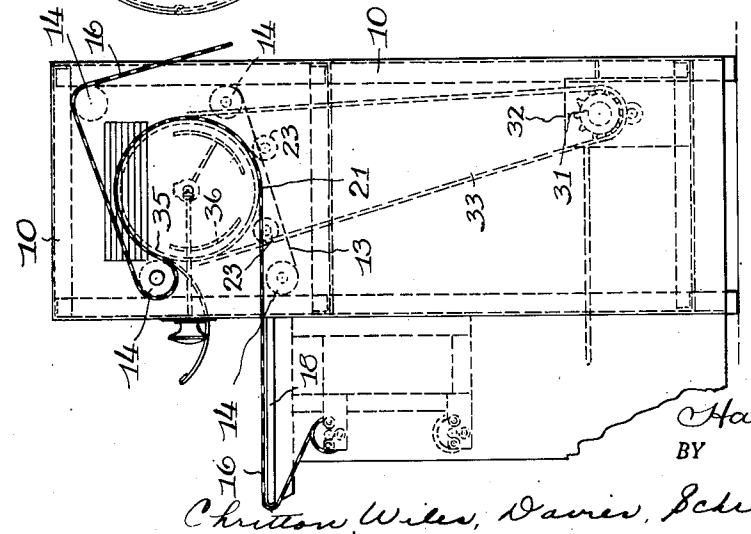


Fig. 3

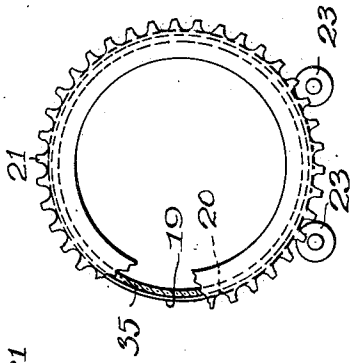


Fig. 8

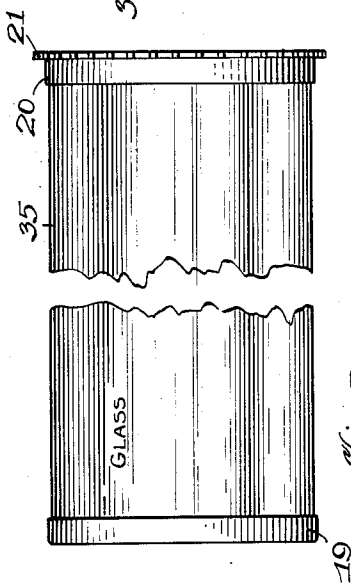


Fig. 7

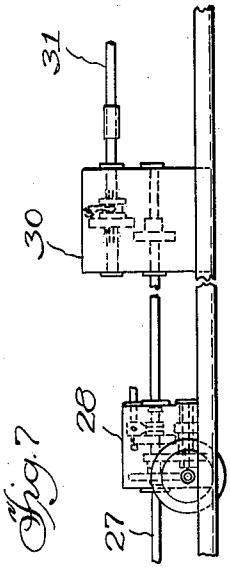


Fig. 9

INVENTOR.
Harold J. Brunk
BY
Chritton, Wiles, Davies, Schroeder & Merriam
Attys.

Patented Dec. 5, 1944

2,364,514

UNITED STATES PATENT OFFICE

2,364,514

MACHINE FOR MAKING BLUEPRINTS AND THE LIKE

Harold J. Brunk, Chicago, Ill., assignor to The C. F. Pease Company, a corporation of Delaware

Application September 20, 1943, Serial No. 503,049

9 Claims. (Cl. 95—77.5)

My invention relates to improvements in machines for making blue prints and the like, and particularly to the printing section of such machines, the improvement making it possible to expose a sensitized sheet directly to the arc lamps or other source of ultra-violet light and at the same time prevent wrinkling of said sheet.

Heretofore commercial blue printing machines have been of two types, (1) where a rotatable glass cylinder is used, and (2) where the blue print paper is drawn over a stationary curved sheet of glass. In the first type, the sensitized paper and the tracing are rolled between the rotatable glass cylinder and a fabric belt or belts, holding them against the cylinder, with a source of light (such as arc lamps or mercury tubes) inside of the cylinder. In the second type, the sensitized paper is also caused to travel by means of an endless belt which draws it over a curved sheet of glass, held in fixed position, on the opposite side of which a series of arc lamps or mercury tubes are arranged.

The sources of light employed emit a considerable proportion of light waves in the form of short waves at the ultra-violet end of the spectrum, and this is particularly true where so-called high pressure quartz mercury arc lamps are used. One form of such tube now in quite general use develops wave lengths as short as 1800 Å.

The glass which is used in continuous blue print machines is opaque to or filters out waves under 3200 Å. The quartz tube referred to above is said to produce practically half of its total output in these short wave lengths below 3200 Å. Under these circumstances, the necessity of using glass as the support over which the blue prints and tracings must be drawn, greatly reduces the efficiency from the printing standpoint, rendering the quartz tube in effect only 50% efficient.

In the type of continuous blue print machine in which a revolving glass cylinder is used, said cylinders cannot be made perfectly cylindrical. Also the tracings, especially large ones, are never flat, and it has proved impossible to wrap an unevenly distorted piece of paper or cloth around a cylinder which is in fact a true cylinder. Much less is it possible to properly wrap such cloth or paper around an imperfect cylinder. For this reason the desired intimate contact cannot be made between all portions of the plue print paper and the negatives, and hence the finished blue print is not perfect. Since a belt is necessary to hold the blue print paper and the tracings against the glass cylinder, and where irregularities occur in the tracing, said belt has the effect of compressing the loose part of the tracing against the cylinder, causing wrinkles to appear in said tracing and correspondingly imperfect lines in the blue print. Another difficulty in the use of a revolving cylinder is that any imperfection in the glass itself, or any dust or foreign matter on the surface of the glass, shows on the finished blue print.

In a continuous blue print machine in which the print and the negatives are drawn over a stationary curved sheet of glass, even though the negatives are not perfectly flat, and even though the band of sensitized paper which may be several feet wide is likewise not perfectly flat, the sliding action over the curved surface or cylindrical surface has the effect of ironing out the irregularities toward the edges, and thus this difficulty is overcome. The interposed glass, however, cuts off a substantial percentage of the short waves, as previously explained.

The main object of this invention is to provide a blue print machine in which the advantage of the sliding contact is retained but without the decreased efficiency occasioned by interposing a sheet of glass between the light source and the sensitized sheet. Otherwise expressed, the main object of the invention is to greatly reduce the printing time required, for the reason that those light rays most effective for the printing operation are available and hence a shorter exposure can be made.

Contributory objects of the invention are as follows:

To provide a printer in which a revolving cylinder is used having perforations therein, so that the light from the source within said cylinder may pass through said perforations and at the same time the sensitized paper and the negatives may travel over the cylinder at a different surface speed from that of said cylinder, so as to provide the necessary ironing operation and also to insure exposure of the entire area of the sensitized sheet to the light rays.

To provide a printer in which the combined area of all the perforations is more than 50% of the entire effective area of the cylinder, and in which said perforations are arranged in helical paths to prevent the remaining material from acting as a shield such as would prevent the light from reaching the sensitized sheet.

To provide a printer in which the short wave lengths in and below the ultra-violet region may be utilized.

To provide a machine in which the amount of

printing accomplished per kilowatt of current used will be much greater, and even twice as great, as that of the present day machines using a quartz mercury arc light source.

To provide a machine in which a perforated rotatable cylinder is driven at substantially constant speed, and the belt which holds the sensitized paper and the negatives against said cylinder is driven at a faster rate of speed and in the same direction, so as to reduce static to a minimum.

To provide a printer in which the contact between the sliding members and the curved surface is improved.

To provide a machine in which glass may be dispensed with as the support against which the prints are held.

To provide a machine that is easy to ventilate and is not limited to any particular size or output.

In the accompanying drawings I have illustrated two embodiments of the invention:

Fig. 1 is an end view of the printing section of a blue print machine, which may also be considered as a complete unit independent of the developing and drying section of the machine;

Fig. 2 is a partial front elevation thereof;

Fig. 3 is an elevation of the opposite end;

Fig. 4 is an end elevation of one form of cylinder which may be employed;

Fig. 5 is a front elevation thereof, partially broken away;

Fig. 6 is an elevation of the opposite end of said cylinder;

Fig. 7 is an elevation of another type of cylinder;

Fig. 8 is an end view thereof; and

Fig. 9 is an elevation of the gear train shown also in Fig. 2, but in a different position.

The equipment, in the first embodiment of the invention shown in the drawings, comprises a suitable frame **10** in which is mounted a rotatable cylinder **11** the wall of which is perforated and is made usually of opaque material, but not necessarily so. A quartz mercury tube **12** may be within said cylinder substantially at the axis of rotation thereof, and the belt **13** may be of the usual character supported on idler rolls **14** and also passing over a driving roller **15**, which causes it to travel in the direction indicated by the arrow. As hereinafter described, the cylinder rotates in the direction of the arrow thereon, and the movement of the belt is at a faster rate than the surface speed of the cylinder and is also in the same direction.

The sensitized paper **16**, which may be the usual blue print paper, is mounted in the form of a roll **17** near the front of the machine and passes over a horizontal table **18**, the negatives being laid on the traveling sheet so as to cover as much of the area as possible. The negatives are drawn in between the belt and the cylinder, travel more than halfway around the same, and are discharged at the front of the machine in the conventional manner. The blue print paper then travels downwardly and rearwardly and is washed and developed, fixed and dried in any suitable manner.

The perforations in the cylinder, as hereinafter described, are preferably staggered or offset laterally, and are of sufficient area to expose the entire width of the sensitized sheet as the latter travels part way around said cylinder.

Referring now to Figures 4, 5 and 6, said cylinder **11** is provided with a steel ring **19** at one end and with another ring **20** at the opposite end, the sprocket **21** being secured to and forming in effect part of said ring. Said cylinder is supported by and confined by a plurality of ball-bearing rollers **23** which form a nest for the same.

The roll **15** is provided with a sprocket **24** driven by a chain **25** from a second sprocket **26** on a shaft **27** in the lower part of the machine, which shaft is rotated by a reduction unit **28** driven by a motor **29**. Said shaft extends to a gear train unit **30**, from which a shaft **31** extends to the other side of the machine and has a sprocket **32** thereon and a driving chain **33** which drives the sprocket **21**. As indicated in dotted lines, the gears in the unit **30** may be thrown into or out of mesh to render ineffective the chain and sprocket drive to said cylinder. The relative rates of rotation of the shafts **27** and **31** are determined by the gear ratio. The surface speed of the belt **13** is greater than that of the surface speed of the cylinder, and is preferably about twice as great, although the surface of the cylinder may be caused to travel faster than the belt. When the work is driven faster than the cylinder, the printing operation is carried out at a rapid rate. However, an advantage of rotating the cylinder at a surface speed in excess of that of the belt is that said cylinder tends to uncurl the entering edge of rolled tracings.

The perforations in the cylinder, as shown in Fig. 5, may have the form of square openings **34** with the intervening strips of metal arranged somewhat diagonally. In other words, half of said strips show a helical path around the cylinder. These perforations, however, may be of any suitable shape and staggered or otherwise displaced laterally and arranged at an angle to give proper distribution of light. The cylinder may be made of any suitable material, preferably stainless steel, provided with perforations about ¼ of an inch square with 60% of the metal removed, leaving 40% in the form of the grid shown. In general, the smaller the openings the better will be the contact. The cylinder may, however, be made of plastic material or of glass or of a radiator type, which may be water cooled.

To illustrate the method of exposing the sensitized sheet to the source of light, and assuming that the cylinder is 8" in diameter with a circumference of about 25", it will be seen from Fig. 1 that the sensitized sheet is in contact with more than half of the circumference, in fact about 18" or ¾ of said circumference. Assuming 40% solid metal, the solid equivalent of this 18" path would be 7.2". If the perforated surface travels only half the distance traveled by the print and by the belt, the final solid sliding contact equivalent would be ½ of this amount, or 3.6". This results first in providing for uniform distribution of the light over the entire surface of the print, and second, sufficient solid metal is provided to iron out any inequalities in the tracing, as previously described. In other words, a sliding revolving contact is provided, with the amount of slippage more or less optional and the minimum being limited by the necessity of providing uniform light distribution despite the opaque areas of the cylinder, which must move relatively to the surface of the print.

With the arrangement described, the sensitized sheet and the negatives are held in intimate contact with each other and with the smooth surface of the cylinder, insuring sharply defined prints. In addition, the sliding contact irons out the negatives and the prints, preventing wrinkles, and furthermore, the negatives and

the print are exposed directly to the source of light and thus the ultra-violet rays are rendered available and greatly increase the printing speed. It has been generally believed heretofore that tracing cloth or tracing paper has a filtering effect on short waves similar to that of glass, whereas my tests have demonstrated that standard tracing papers and cloths are capable of transmitting much shorter wave lengths than the best short wave transmission glass available at the present time. Furthermore, various agents are now being made to render tracings more transparent to the passage of short wave light.

The construction described also lends itself to proper ventilation to prevent overheating, and is not limited to any particular size or output.

In Fig. 3 the cylinder used may be assumed to be a glass cylinder **35**, rotated in the same manner as the perforated metal cylinder previously described and at a rate preferably slower than the travel of the belt. In this figure the same reference characters have been employed for the remaining parts as have been used previously. This construction retains the advantage of the sliding contact and avoids some of the disadvantages of the conventional rotatable glass cylinder used in continuous blue print machines. However, the advantage of increased efficiency arising from ultra-violet rays is sacrificed. As a further alternative, it will be apparent that if the driving shaft **31** is disconnected from the gearing unit and the motor (as in Fig. 9), the latter will drive only the chain **25**, the roller **15** and hence the belt **13** in the manner previously described. Said belt will cause the glass cylinder to rotate and thus the cylindrical surface and the belt will travel together, providing in effect the conventional revolving contact machine. Thus the driving equipment including the gearing unit **30** and associated parts **31**, **32**, **33** previously described may, if desired, be provided in the form of an attachment or supplement to said conventional revolving contact machine.

If the equipment is assembled without the gear unit **30**, driving shaft **31**, and the sprocket and chain actuated thereby, the motor drives only the chain **25**, the roller **15** and the belt **13**, which in turn causes the glass cylinder **35** to rotate, as previously stated. Said cylinder, which is shown also in Figs. 7 and 8, may be used without the sprocket wheel **21** on the end, if the chain is omitted.

The preferred form of the machine in which an opaque perforated cylinder is employed may, of course, be constructed as part of a continuous blue print machine, or may be furnished as a separate unit adapted to supplement the developing and drying unit as separate entities.

Said machine may be equipped also with suitable cooling means, light shutters and reflectors. The curved member **36** shown inside the cylinder in dotted lines (Figs. 1 and 3), is the reflector and light shield. It blocks off the light which otherwise would pass through what may be called the front portion of the cylinder, which is not covered by the belt or belts.

It is apparent that the percentage of openings, the material of which the cylinder is made, and the relationship of the surface speed of the cylinder and the work, may be varied within substantial limits. Various changes may be made, therefore, in the construction described, within the scope of the appended claims.

I claim as my invention:

1. A machine for printing paper coated with light-sensitive material comprising, a rotatable cylinder, a source of light within said cylinder, means for drawing a span of said paper over said cylinder and rotating said cylinder at a rate which permits said paper to travel at a different surface speed from that of said cylinder whereby the portion of the cylinder wall interposed between said paper and said light is continually changing, to prevent the printing of undesired images on said paper.

2. A machine for printing paper coated with light-sensitive material comprising, a rotatable cylinder, a source of light within said cylinder, an endless belt in contact with said cylinder, means for rotating said cylinder, and means for driving said belt at a surface speed in excess of that of said cylinder whereby sensitized paper and negatives fed between said belt and said cylinder are drawn over different circumferential portions of said cylinder and exposed to light passing through different circumferential portions thereof, and whereby sliding friction is reduced to a minimum.

3. A machine for printing paper coated with light-sensitive material comprising, a rotatable cylinder, a source of light within said cylinder, an endless belt in contact with said cylinder, means for rotating said cylinder, and means for driving said belt at a surface speed in excess of that of said cylinder whereby sensitized paper and negatives fed between said belt and said cylinder are drawn over different circumferential portions of said cylinder and exposed to light passing therethrough, said means including a gear shift whereby said rotating means and said driving means may operate concurrently to drive both said cylinder and said belt, and whereby said driving means may move said belt only.

4. A machine for printing paper coated with light-sensitive material comprising, a rotatable cylinder, a source of light within said cylinder, an endless belt in contact with said cylinder to hold a length of said light-sensitized paper against said cylinder, means for rotating said cylinder at substantially constant speed, and means for moving said belt at a surface speed in excess of that of said cylinder and in the same direction, to prevent the printing of undesired images on said paper.

5. A machine for printing paper coated with light-sensitive material comprising, a rotatable cylinder, a source of light within said cylinder, an endless belt in contact with said cylinder to hold a length of said light-sensitized paper against said cylinder, means for rotating said cylinder at substantially constant speed, and means for moving said belt at a surface speed in excess of that of said cylinder and in the same direction, said cylinder comprising sheet metal having perforations extending in helical paths around the same to insure exposure of all of said paper to said light source.

6. In a blue print machine, a frame, a perforated cylinder therein, a source of light in said cylinder, supporting rollers on which said cylinder is mounted, a sprocket on said cylinder, a chain drive therefor, an endless belt, and rolls on which said belt travels in contact with part of the periphery of said cylinder, whereby said cylinder may be rotated at one surface speed and said belt may be caused to travel over the surface of said cylinder at a different surface speed and cause the print, which is to be ex-

posed to the light, to slide relatively to said surface.

7. In a blue print machine, a frame, a perforated cylinder therein, a source of light in said cylinder supporting rollers on which said cylinder is mounted, a sprocket on said cylinder, a chain drive therefor, an endless belt, rolls on which said belt travels in contact with part of the periphery of said cylinder, and a sprocket and chain drive for one of said rolls for causing said belt to slide over said cylinder in the direction of rotation of the latter, and cause a print to be held between said belt and said cylinder and likewise to slide over said cylinder as it is being exposed to the light within the same.

8. In a blue print machine, a frame, a perforated cylinder therein, supporting rollers on which said cylinder is mounted, a sprocket on said cylinder, a chain drive for causing said cylinder to rotate, an endless belt, rolls on which said belt travels in contact with part of the periphery of said cylinder, a sprocket and chain drive for one of said rolls for causing said belt to slide over said cylinder in the direction of rotation of the latter, and a quartz mercury tube mounted in said cylinder, said perforations having an area in excess of 50% of the total area of said cylinder and arranged to permit the light to strike the entire area of a sheet of blue print paper as it passes over said cylinder between said endless belt and cylinder.

9. In a blue print machine, a frame, a perforated cylinder therein, supporting rollers on which said cylinder is mounted, a sprocket on said cylinder, a chain drive for causing said cylinder to rotate, an endless belt, rolls on which said belt travels in contact with part of the periphery of said cylinder, a sprocket and chain drive for one of said rolls for causing said belt to slide over said cylinder in the direction of rotation of the latter, and a source of ultra-violet light within said perforated cylinder, the perforations therein having a staggered arrangement and comprising a total area such as to expose the entire width of a sheet of blue print paper drawn over said cylinder by said belt.

HAROLD J. BRUNK.