

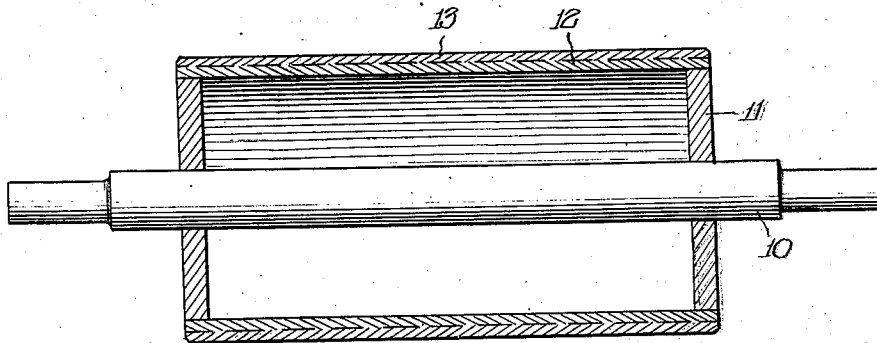
Oct. 8, 1940.

I. GURWICK ET AL.

2,217,015

ELECTROLYTIC PROCESS FOR THE PREPARATION OF PRINTING CYLINDERS

Filed July 16, 1936



Inventors:
Irving Gurwick,
Robert A. Jennings.
By Cromwell, Greist & Warden.
attys.

UNITED STATES PATENT OFFICE

2,217,015

ELECTROLYTIC PROCESS FOR THE PREPARATION OF PRINTING CYLINDERS

Irving Gurwick, Mount Vernon, and Robert A. Jennings, Pleasant Township, Knox County, Ohio, assignors to Shellmar Products Company, Mount Vernon, Ohio, a corporation of Delaware

Application July 16, 1936, Serial No. 90,848

3 Claims. (Cl. 204—25)

The present invention relates to the production of printing cylinders for use in the intaglio printing of materials such as transparent cellulose sheeting.

A principal object of the present invention is the provision of an iron surfaced intaglio printing cylinder in which the image desired to be printed is etched directly into the iron.

An additional object is to provide an improved intaglio printing cylinder and the method of providing the same whereby excellent results are obtained from the standpoint of depositing a satisfactory image and the cylinder will stand up for considerably longer periods of use than the cylinders known heretofore.

Still another object is to provide an intaglio printing cylinder having a seamless steel base and an image-receiving outer surface composed of electrolytic iron integrally bonded to the base.

These and other objects will be observed upon a consideration of the following specification of a preferred embodiment of the invention and by reference to the accompanying drawing in which the single figure is a cross sectional view of a printing cylinder constructed in accordance with the present invention.

In the production of the cylinder a standard cold rolled shaft 10 is cut to the desired dimensions and the end plugs 11 are forced into a seamless mild steel tube 12, the latter having a carbon content of 0.15 per cent or lower. The tubing preferably is of the hot rolled type and of uniform dimensions. The thickness of the seamless steel tube may be of the order of five-sixteenths inch and a diameter is chosen which will be about 0.05 inch oversize.

The plugs 11 are properly secured to the shaft 10 as by suitable pins. After the rough cylinder resulting from the above described procedure is produced, the shaft 10 is mounted in a lathe between centers and is turned by a high speed cutting tool down to a final diameter slightly less than the diameter of the printing cylinder. Thereafter the cylinder is mounted in a lathe having journaled bearings and again is turned to a somewhat accurate and smooth outer surface. We have found that the accuracy required in the operation makes it highly desirable to employ for the second turning operation a lathe having journaled bearings rather than a center mounting.

Thereafter, the steel cylinder is given a fine finish by grinding with a suitable stone. The grinding operation is followed by a polishing operation which may be effected with a carborun-

dum cloth or the like. In view of the particular nature of the metal and the previous operations this polishing generally can be accomplished in fifteen or twenty minutes.

The polished cylinder is cleaned thoroughly with a solution which may include sodium cyanide, salt and hydrochloric acid. Special bushings for plating are mounted on the ends of the shaft 10 and the cylinder is subjected to an operation for the electrolytic disposition of iron thereon, the ends of the cylinder being painted with a resistant lacquer which will prevent the disposition of metal thereon. Such lacquers are well known in the plating art.

The solution employed in plating the cylinder may vary to some extent. One solution which has proven satisfactory is composed of

30% $\text{FeCl}_2 \cdot 4\text{H}_2\text{O}$

35% CaCl_2 (Anhydrous)

35% H_2O .

It has been found that a technical grade of chemicals free of nickel, arsenic and lead may be employed for the plating solution, thereby considerably reducing the expense of the plating operation.

The solution is supersaturated at ordinary temperatures and the plating bath is maintained at a temperature of the order of 200 to 210° F. as by a suitable steam jacket. It is preferred that the plating tank be composed of a material such as ceramic tile or Portland cement. For the anode plates scrap iron, sheet steel or the like may be employed, it being necessary to separate the anode from the cylinder which forms the cathode as by suspending the plates in a porous ceramic pot.

The cylinder first is mounted in the plating bath with about one-third its circumference immersed. Rotation is imparted to the cylinder and the plating operation is carried on until an electrolytic deposition of iron of suitable thickness is obtained. This may require a time of the order of 1 to 3 hours, depending upon the thickness desired. The current density may be $2\frac{1}{2}$ to 3 amperes per square inch of total surface of a cylinder and the voltage may be 12 to 15. In general, higher current densities are employed since these result in a more dense deposit. In some cases a current of 20 volts and $5\frac{1}{2}$ amperes has been employed to obtain a very hard surface. The plating process is accompanied by the formation of impurities which are kept away from contact with the cylinder. It has been found that where a current of 12 volts and 3 amperes is em-

ployed in the plating and the operation is continued for 1 hour there will result a deposit of approximately 0.003 inch.

The plated surface is quite smooth, coherent and tough. It is free from imperfections and the entire coating is integrally connected to the base cylinder. This outer coating is indicated in the drawing at 13. It is preferred that the coating have a thickness of the order of 0.005 which may require a plating time of around 2 hours. The finish of the surface of the cylinder can be controlled to a considerable extent by controlling the rate of rotation of the cylinder in the plating bath, that is, as a general rule rotation at a relatively high peripheral speed results in a smoother finish than rotation at lower speeds. In one instance we have employed a peripheral speed of the order of 200 feet per minute, but higher speeds may be utilized to advantage.

As before stated, the plating bath is hot and after the plating operation is completed the cylinder is withdrawn from the bath and cooled sufficiently gradually to prevent buckling or warping of the cylinder. In order to prevent further action of the chemicals on the cylinder the latter promptly is washed with hot water after removal from the plating bath. The cylinder may be cooled by gradually reducing the temperature of the wash water so that a time of the order of one-half hour is consumed in bringing the temperature of the cylinder down to normal. One desirable way of cooling the cylinder is to immerse it into a bath of hot water and to allow the water to cool to room temperature or thereabouts.

After the cylinder is properly cooled it is mounted on a lathe and hand polished with a polishing cloth. This operation may require a time of the order of three-quarters of an hour.

The finish of the electrolytic iron is better than the finish of the copper shells employed heretofore for intaglio cylinders and the iron surface is a good deal harder than the copper.

After cleaning the cylinder with a mixture of pumice and 28 per cent acetic acid the cylinder is mounted in a transfer machine. Sensitized carbon tissue, exposed behind an opaque negative or design for a time which may be of the order of one-half longer than would be necessary for the production of a copper etched cylinder and thereafter, is mounted on a zinc plate coated with a rubber cement. The tissue then is transferred to the electrolytic iron surface of the plating cylinder in the usual manner. The cylinder then is immersed in water at around 115° F. and soaked for one-half hour, the paper backing for the tissue being removed. After removing the excess gelatin the cylinder is washed with alcohol and dried. Thereafter a high grade acid-proof paint is placed on the portions of the cylinder not to be etched, two coats of the paint being preferred. The cylinder then is subjected to an etching process in which the cylinder is placed in a solution consisting of a mixture of ferrous chloride and ferrous sulphate of about 40° Bé. density at 60° F. About 2½ pounds of anhydrous calcium chloride is added to 10 gallons of the solution. It is preferred that the solution be cooled to 60° F. by the addition thereto of solid carbon dioxide.

We have found that the solution may be stabilized and that the calcium chloride will dissolve more readily where small quantities of strontium chloride or lithium chloride or equivalent compounds are employed in the solution.

The amounts of these materials added to the solution may be 20 grams to ¼ pound, 2 or 3 ounces generally being employed.

The etching is effected electrolytically. A cylindrical sheet iron anode having a diameter of some 2 inches more than the diameter of the cylinder to be etched is employed, the printing cylinder being concentrically mounted within the anode. A 6-volt storage battery may be employed to provide a steady current, the battery being of the type supplying 20 amperes. Before the current is turned on the cylinder is revolved around in the etching solution to "open" the tissue. This procedure may require some fifteen or twenty minutes. Thereafter, the current is turned on until the color in the bottom of the cells is somewhat white. The current then is turned off and rotation of the cylinder continued until the cells again become green. Some 10 or 15 minutes may be required for the latter change. The current then is renewed at a decreased density until the cells again become white. The electrolytic process is carried just to the point where the carbon tissue begins to break down. This is evidenced frequently by a wrinkling effect. The cylinder then is removed from the solution and immediately washed with water to remove the etching solution.

After cleaning the remains of the tissue from the cylinder the latter is ready for use. The etching process is sufficient to dissolve the etched metal to a depth which provides adequate ink-carrying capacity and the cell structure of the etched portion is particularly stable.

The electrolytic iron, of which the outer surface of the cylinder is composed, is resistant to atmospheric corrosion and the wear that printing cylinders of this type encounter. Additionally, the cylinder does not have a tendency to receive scratches upon its surface. In use the cylinder will last for a considerably greater period of time than the cylinders known heretofore.

In a preferred embodiment of the invention the iron plated cylinder is provided with a flash of chromium. The chromium has a further preserving effect upon the iron and is more unctuous. The latter characteristic is of particular benefit since the cylinder is used in connection with a doctor blade which scrapes the ink from the portions of the cylinder which are not etched. To provide the flash of chromium, the cylinder may be immersed in a chromium plating bath and subjected to a plating current of 1 ampere per square inch at 4 to 6 volts. Ten minutes plating time generally is sufficient to provide the thin coat of chromium. The temperature of the bath is approximately 110° F. and after the chromium plating procedure the plated cylinder is immersed in a bath of water at 110° F. and allowed to remain over night to anneal the iron underneath the chrome plate, the iron plate being very sensitive to temperature changes.

By providing an iron base for the flash of chromium the latter is much less liable to be damaged than where the chromium is employed in connection with a soft metal base composed of copper or the like. The iron may have a hardness of 200, as indicated by the Brinell test, while the copper coating will have a hardness of the order of 25 on the Brinell scale. The chromium is integral with the electrolytically-disposed iron layer and the latter is integral with the base member. This construction is of par-

5 ticular utility where long runs of a particular design are to be made. The etched portion stands up under the action of the doctor blade for substantial periods without the destruction of the cell structure. Additionally, the un-etched portions of the cylinder remain perfectly smooth so that the doctor blade wipes such portions clean.

10 The amount of chromium is quite small, preferably being just enough to improve the wiping characteristics of the cylinder.

15 We have found that the improved cylinder is of particular utility in the production of cylinders for printing tone, etches, highlights and delicate patterns. In addition to the improved characteristics of the cylinder from the standpoint of the printing operation, the cylinders may be produced at a considerably lower cost than the cylinders known heretofore. The time required for producing the cylinders is somewhat shorter than has been required heretofore so that quicker deliveries of the printed matter now are possible.

25 Transparent cellulose sheeting has been recognized as being quite difficult to print, but the improved cylinders described herein produce a sharp and well defined image upon such materials. Lacquer inks may be used with the cylinders in standard gravure machines. The improved printing qualities may be due in part to the resistance of the etched iron cylinder to wear. Copper based cylinders have a tendency to flatten so that the bottom of the etched portion comes up to an extent sufficient to counteract the doctor blade. This does not occur in our improved cylinder.

40 The specific composition of the plating and etching baths obviously may be varied, as may the plating procedure. It may be found desirable in some cases to provide the base member with a coating of a material which will allow the deposit of the electrolytic iron and prevent the latter from becoming integrally bonded thereto. Where the integral bond is obtained and it is desired to reuse the cylinder, the electrolytically deposited iron is ground from the base member to an extent sufficient to remove the etched surface and the base cylinder again is polished and

subjected to an iron plating step which will renew the electrolytic iron layer.

The various changes which may be made without departing from the scope of the invention are intended to be included in the appended 5 claims.

I claim:

1. The method of forming intaglio printing cylinders, which comprises providing a steel base cylinder of a uniform diameter slightly less than 10 the desired diameter, polishing said steel cylinder to obtain a smooth surface, electrodepositing over said surface an even dense coating of a thickness between about 0.003 to about 0.005 inch of iron by rapidly moving said cylinder in the electrolyte 15 while maintaining a high current density, polishing said iron surface, and subjecting the iron surface to an etching process.

2. The method of forming intaglio printing cylinders, which comprises providing a steel base 20 cylinder, smoothing the surface of said cylinder, electrodepositing over said surface an even dense coating of a thickness of about 0.003 to about 0.005 inch of iron by rapidly moving said cylinder in the electrolyte while maintaining a high current density, polishing the resulting layer of iron, 25 subjecting the polished cylinder to an electrolytic process for etching a desired design, and subjecting the etched cylinder to the chromium plating process for depositing a thin coating of chromium thereon. 30

3. The method of forming intaglio printing cylinders, which comprises providing a shaft member, mounting a seamless steel tube about said shaft member, said tube having a diameter 35 slightly greater than desired, subjecting said tube to a turning, grinding and polishing operation to provide a smooth finish therefor, electrodepositing on said tube an even dense coating of a thickness of between about 0.003 to about 0.005 40 inch of iron by rapidly moving said cylinder in the electrolyte while maintaining a high current density, polishing said iron, subjecting the polished iron to an etching process for producing a design thereon, and depositing a light coating 45 of electrolytic chromium thereon.

IRVING GURWICK.

ROBERT A. JENNINGS.