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METHOD OF MAKING PAPER PULP SCREEN PLATES

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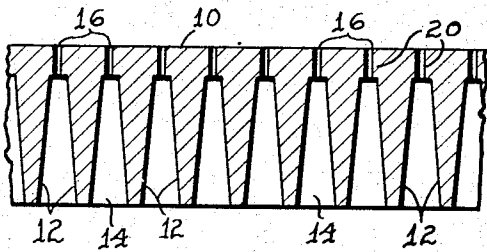


Fig. 1.

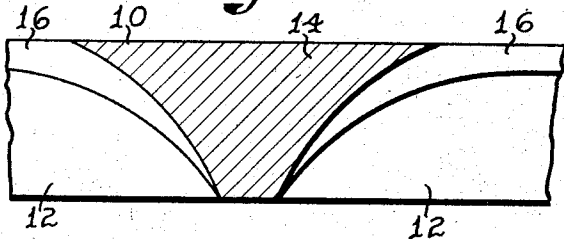


Fig. 3.

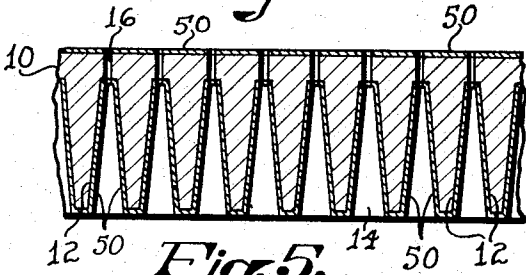


Fig. 5.

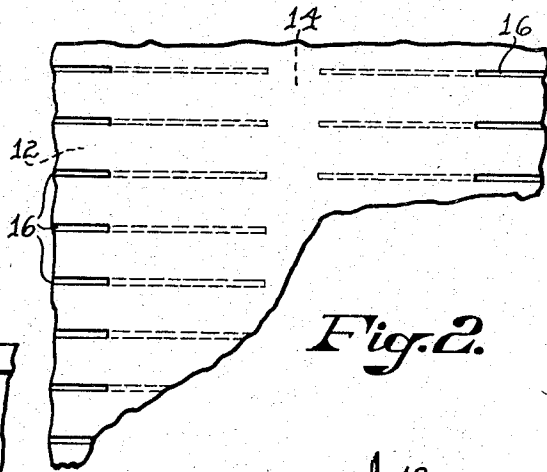


Fig. 2.

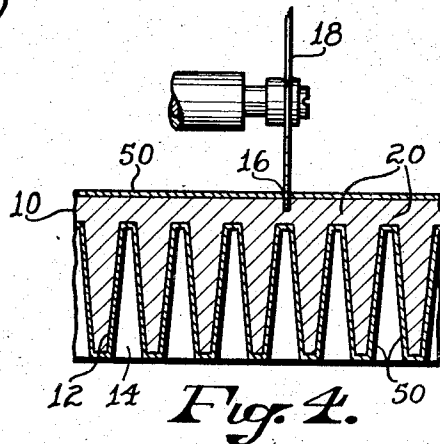


Fig. 4.

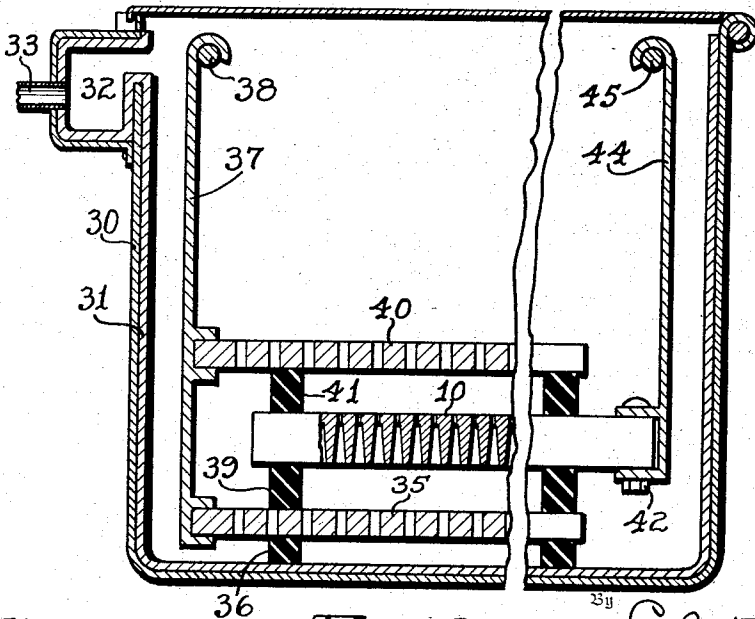


Fig. 6.

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METHOD OF MAKING PAPER PULP
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2 Claims. (Cl. 204—24)

This invention relates to a method of making a screen plate for paper pulp and more particularly to a method of making a screen plate having a series of elongated very narrow slots which will serve to screen out all paper pulp fibres that exceed desired sizes, as well as dirt and bacterial growths.

A screen plate for sizing paper pulp fibres, prior to their being made into a paper web, may be made in various shapes and arrangements, such as shown in the drawing, but they usually comprise a thin top plate strengthened by cross ribs on the under side. The plate has elongated and very narrow parallel slots cut therethrough. The plate in the slotted portions may be from $\frac{1}{16}$ to $\frac{3}{8}$ inch or more in thickness, and the slots may range from about 0.006 to 0.085 inch in width. These slots should be accurately dimensioned, and various experiments have been proposed for forming such a plate and providing it with the strengthening ribs. These plates are usually made of brass or bronze or other comparatively soft wearable metal; and in use these plates made of such metals tend to corrode and to wear away and the slots become wider or their surfaces etched or roughened, so that fibres of too large a size escape through the slots or the plate tends to become clogged with pulp due to its catching on the roughened surfaces.

Screen plates have been provided with a plating of chromium in order to increase the wear resistance and to provide a smooth surface for the slot faces and thereby increase the life of the screen and minimize the maintenance cost. It has, however, been found difficult to obtain a satisfactory and uniform coating of chromium metal on the inner faces of the slot and particularly in cases where the plates have been provided with closely spaced supporting ribs. In the electrolytic plating process, chromium has a very low throwing power and tends to deposit excessively on the edges of the slot and to form too thin a deposit along the inner faces thereof. This results in the slots being partly obstructed near their edges and in the thinly plated portions corroding and causing the adjacent plating to flake off, so that the plate soon wears away and the slots become too wide for their intended use.

The primary object of my invention is to overcome such problems and to provide a metal screen plate having its exposed surfaces, and particularly the inner faces of the slot, coated with a suitable wear resistant metal, such as chromium,

and in which the plating is of a suitable thickness and quality.

A further object is to provide a method of making a satisfactory screen plate which has a top thin metal plate provided with elongated narrow slots and supported by a set of strengthening ribs, and wherein the slots and other desired portions of the plate, including the ribs, are plated with the required metal coating. Further objects will be apparent in the following disclosure.

The process of plating such a screen plate requires a careful control of the electrolytic conditions, and particularly where chromium is to be plated from an aqueous bath of chromic acid containing the sulfate ion. At a low current density, the primary result is that of merely reducing the acid to a trivalent chromium compound without the deposition of chromium metal, and a high current density is required to secure the metal deposit. Under this high current density, and owing to its poor throwing power, the chromium tends to deposit excessively on the near surfaces, edges and ribs, but the inner faces of the slots are not properly plated, and the plating operation cannot be continued long enough to insure a thick coating on the inner faces of the slots without providing too thick a coating elsewhere which may cause trouble.

In accordance with my invention, I propose to make such a screen plate by a procedure which comprises among other steps masking off that portion of the plate which tends to receive too thick a coating and plating the inner faces of the slots and other required portions of the plate separately by suitable procedure. This is preferably accomplished by plating the slots first and thereafter removing the mask and subjecting the plate to a second coating operation which provides a further deposit of plated metal on the inner faces of the slot as well as other parts of the screen.

Furthermore, a preferred method of making such a plate involves providing a bronze or other plate of a uniform required total thickness, such as 0.375 inch, and then milling out spaced portions of the under side of the plate so as to leave strengthening ribs between the slots. Thereafter, the slots may be formed by means of a metal saw or abrasive disk of the required thickness. The primary feature of the invention involves coating the original thick plate with a suitable material, such as a lacquer, prior to the slots being cut therein, so that when the slots are sawed through both the plate and the mask, the coating mask

will run sharply to the edge of each slot and the initial plating operation will coat only the inner faces of the slots and not be permitted to build up on any exposed corners or edges. This expedient may be employed whether or not the plate is provided with the strengthening ribs on its under side. Other features of the invention will be brought out more fully hereinafter.

Referring to the drawing which illustrates screen plate parts in exaggerated size:

Fig. 1 is a cross sectional view of a fragment of one form of plate which may be made according to my invention;

Fig. 2 is a top plan view thereof;

Fig. 3 is a fragmentary sectional detail of the plate;

Fig. 4 is a fragmentary view of the plate covered with a protective mask, and which indicates the operation of sawing the slots in the plate;

Fig. 5 is a fragmentary sectional view of the coated and slotted plate prior to the electroplating operation; and

Fig. 6 is a diagrammatic sectional view of an electrolytic cell suitable for use in coating the screen plate.

Referring to Figs. 1 to 3 inclusive, I have there shown one form of screen plate, which may be made from a rectangular plate three or four feet long, a foot wide and having a uniform thickness, such as about 0.375 inch. This plate 10 may be made of bronze or other suitable material, and the slots and ribs may be made by milling and sawing operations. That is, the ribs 12 may be cut by means of a milling cutter which is operated to leave a plate of required thickness, such as 0.0625 inch. The ribs 12 may be about 4 inches long and intersect with cross ribs 14 which aid in strengthening the plate. The ribs 12 may be so arranged that a single slot 16, or several, may be cut between each two ribs and thereby form a plate having 6 to 8 slots, more or less, per inch arranged in parallel sets. These pulp screening slots 16 are preferably formed by means of a narrow saw indicated diagrammatically by the part 18 in Fig. 4 which is operated to cut through the thin portion 20 of the plate and provide the slots of required width. The screen plate as thus formed is usually mounted in a screen box and so arranged that the pulp suspended in water flows thereover. It is also customary to employ a suction device, such as a vibrating diaphragm located beneath the screen plate, which aids in drawing the water and pulp fibres of the proper size through the screen slots. The reinforcing ribs withstand that vibrating motion. It, however, is entirely feasible, insofar as the features of my invention are concerned, to provide a thin screen plate which does not have either or both of the strengthening ribs 12 and 14.

In order to provide a suitable coating of chromium, nickel or other desired metal on the screen plate, and particularly on the inner faces of the slots 16, I may utilize a suitable electroplating apparatus, such as that illustrated diagrammatically in Fig. 6, which may comprise a steel cell 30 having a lining 31 of lead and preferably a fume exhaust conduit 32 leading to a pipe 33 through which the fumes are suitably removed by means of a fan. Covers 34 may be hinged to the top of the cell so as to hold the spray therein and permit it to be exhausted through the fume conduit. The screen plate 10 to be coated with a desired metal may be suitably mounted in the cell with anodes adjacent each of its sides. One form of mounting as shown in the drawing in-

volves arranging the electrodes horizontally and having a perforated lead anode plate 35 near the bottom of the cell supported in position by means of rubber or other suitable non-conductive blocks 36. The anode plate is suitably secured to an anode conductor 37 suspended from a bus bar 38 in the top of the cell. The anode in turn carries the screen plate 10 on rubber insulating blocks 39. A second anode plate 40 is likewise connected to the conductor and supported above the work to be plated by means of blocks 41, and the parts may be secured together by clamps or bolts, if desired. The screen plate is suitably connected into the circuit, as by means of a forked clamping device 42 carried by a cathode conductor 44 likewise suspended on a bus bar 45. Bus bars 38 and 45 are connected to a suitable source of direct current of required voltage. The anodes may both be flat plates, or they may be shaped to project into the spaces between the ribs 12 of the screen plate so as to provide a somewhat more even distribution of current.

While the electrolytic conditions and bath composition may be varied within the knowledge of those skilled in this art, a coating of chromium may be deposited on the screen plate from a bath of chromic acid dissolved in water and containing a small amount of sulfate ions. This bath may comprise 100 parts of chromic acid to one part of sulfuric acid. A suitable throwing power for coating the inner faces of the slots may be obtained by using an electrolyte of about 21° Beaumé, made of 32 ounces of chromic acid per gallon of water or 250 grams of CrO_3 per litre of water, together with 2.5 grams of chromium sulfate per litre of water or about $\frac{1}{3}$ oz. per gallon. The current density is held between 100 and 250 amperes per square foot of surface being plated, and the temperature range is preferably between 90 and 130° F. A preferred temperature for plating these inner faces of the slot is 113° F. for a solution containing 1 part of sulfate ion to 100 parts of chromic acid, and where the preferred current density is about 100 amperes per square foot. The current is preferably obtained by a motor generator set giving a direct current of 6 to 15 volts and the anodes are preferably made of lead in which case the voltage may be in the neighborhood of 6 or 7 volts or higher. The temperature of the bath may be increased as high as 130° F. in order to obtain a very wear resistant plating. The anode which is preferably made of lead may be specially shaped to conform roughly to the shape of the screen plate on its ribbed side, if desired, and the anode is preferably perforated to permit ready circulation of the electrolyte as is caused by the bubbling of the gases generated at the electrodes. The current density may be held at a very high point well above the 100 amperes per square foot for a short period of time in order to place the recessed portions or slot faces under high current density conditions, but it is also feasible to plate by means of a lower current density and prolong the operation. One may also plate on the screen successive layers of copper, nickel and chromium or provide other suitable type of under coating, if desired, to insure a satisfactory surface condition. It will, of course, be understood that the screen plate will have been cleaned carefully to free it from grease and oxidation products prior to the operation, and many expedients known to those skilled in the art may be adopted both for cleaning the plate beforehand as well as for washing and pickling the plate afterwards. The electrolytic bath may be

suitably heated, such as by means of a lead coil which carries steam through the cell or by an automatically controlled electric heater.

It will also be appreciated that expedients well known in the art may be employed for producing a coating of nickel or other desired metal. If nickel is to be coated on the screen plate, a solution of nickel sulfate may be used as the electrolyte, and the anode may be of nickel in order that the electrolyte may be replenished automatically. For chromium plating, the electrolyte is replenished by adding chromic acid periodically as needed, and as indicated by an hydrometer or other suitable indicating device.

In accordance with the primary feature of this invention, I propose to coat the screen plate locally with a lacquer or other material which is not soluble in the electrolyte and will prevent electrolytic action beneath the coating. This coating is to be located in those places where the electrolytic deposition of metal takes place rather freely, so that in the first stage of electrolysis only the uncoated portions will be plated. If only the slots are to be plated first, then the whole screen plate may be dipped in a coating bath before the screen slots 16 are made or other provision may be made to coat desired parts of the plate and leave the screen slots uncoated, after the slots have been formed.

Various types of coating compounds which are insoluble in and impervious to the electrolyte and are non-conductors and not affected by the electrolytic operation may be employed. For example, I may use a suitable lacquer, such as a solution of Celluloid in acetone or amyl acetate, or I may use a proxylin lacquer having a filler of lead chromate, or I may employ various types of resins and waxes, such as colophony or carnauba wax or other suitable coating materials on the market. Suitable solvents are used in each case for the subsequent removal of the coating.

According to the method illustrated in Figs. 4 and 5, the whole plate may be coated, after the ribs 12 are formed by milling, by dipping it in a hot wax or resin or in a suitable solution, such as Celluloid in amyl acetate or a collodion solution. After a suitable impervious, non-conductive film has been formed, then the slots 16 may be cut through the plate by means of the metal or abrasive saw 18. The saw cuts through the film 50 as well as the body of the plate 10 and leaves square corners on the film, as illustrated in Fig. 5. Also, the plate may be coated before the ribs 12 are milled, so that the extra plating will cover the spaces between the ribs as well as the slot faces which are also cut after the coating operation. If desired, I may coat selected portions of the plate, as by means of a paint brush, or otherwise treat the plate to leave desired parts exposed, such as the corners between the ribs 12 and the plate, and these will be plated during the first stage electrolytic operation.

Upon placing this coated plate in the electrolytic bath and applying the required current and temperature conditions, the exposed parts of the screen plate and particularly the inner faces of the slot 16 will have a proper plating of required thickness gradually formed thereon. This plating will develop comparatively rapidly, since a high current density may be employed for a short period, but the process may be carried on at a comparatively slow rate to insure the deposi-

tion of a solid plating which will not crack during later use. This metal plating will preferably be developed initially to only a part of its final thickness, so that the second plating operation may be employed to further coat the slot walls. After the first stage plating has been accomplished, the screen plate is removed from the electrolytic cell and washed with water and otherwise treated as desired, after which the Celluloid film is dissolved in acetone or amyl acetate or other similar solvent therefor. After suitable cleansing operations, the plate is returned to the bath for a further plating, at which stage the chromium deposit forms all over the exposed portions of the plate. The plating operation is carried on until the width of the slot is of the predetermined size. It is to be understood that the dimensions are to be accurately determined and that the electroplating operation will be carefully controlled to this end. Upon completion of the second operation, the plate will again be washed, preferably in cold water, and then subjected to other desired cleaning steps.

The shape and structure of the plate is immaterial, insofar as this plating operation is concerned. I, however, prefer to employ a screen plate having supporting and strengthening ribs, and in that case the plate is preferably coated as above described with the lacquer before the slots are sawed through the top of the plate, so that the top surfaces of the plate will be fully protected to the very edges of the slot and there will be no corners or sharp edge exposed to the electrolyte where the current density would tend to build up and thus tend to deposit an excessive amount of chromium and interfere ultimately with the width of the slot. If desired, the lacquer coating may be applied chiefly to the parts of the plate adjacent to the slots, and leaving exposed the corners between the ribs and the plate and other portions that tend to receive an improper coating so that the exposed parts will be plated during both plating stages.

Many other modifications of this invention may be adopted, and it is to be understood that the above disclosure is intended to explain the principles of my invention and the preferred embodiments and procedure and not as limitations on the appended claims.

I claim:

1. The method of making a pulp screen plate comprising the steps of initially shaping metal to provide a metal plate having a set of spaced ribs depending from the bottom of a thin, flat surfaced, imperforate top portion, coating the top surface of the plate with a non-conductive adhesive mask, thereafter cutting a series of parallel elongated narrow slots through the overlying coating and the thin imperforated top part of the plate between said ribs and leaving the top of the plate coated adjacent to the edges of the slots, thereafter electrolytically depositing a metal plating on said inner faces while the mask coating remains in position, then removing the mask and again electrolytically depositing a metal plating on the exposed faces of the plate.

2. The method of making a pulp screen plate comprising the steps of initially cutting an imperforate metal plate to provide a thin, flat surfaced, imperforate plate having spaced ribs depending from the lower side thereof, coating the top and bottom portions of the plate and

the ribs with a non-conductive mask, thereafter cutting a series of narrow, elongated slots through the thin portion of the plate between and parallel with the ribs, while leaving the mask in position on the remainder of the plate, and thereby forming exposed metal slot walls, electrolytically depositing a durable metal plating on the slot walls while the mask remains in position, there-

after removing the mask and exposing the parts previously covered thereby, again electrolytically depositing metal on the exposed parts of the plate and forming a screen plate having a plating of required thickness on said slot walls and covering the adjacent portions of the plate.

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