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VALVE STRUCTURE FOR PASSAGE OF STRIP MATERIAL
THROUGH THE WALL OF LIQUID TREATMENT BATHS
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Fig. 1.

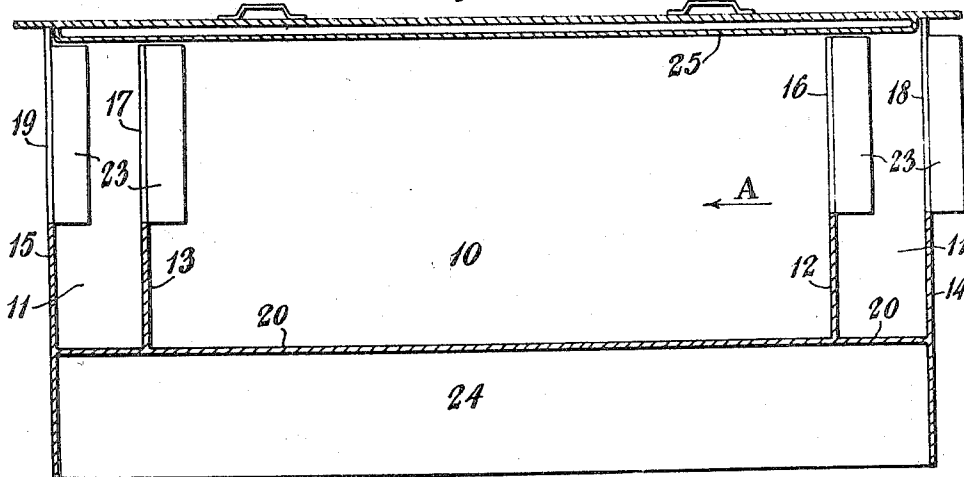


Fig. 2.

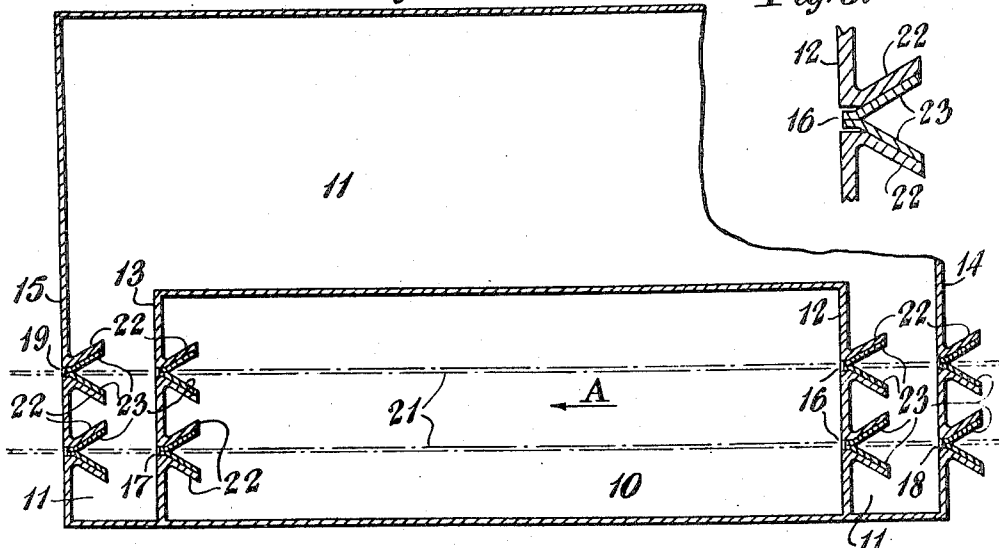


Fig. 3.

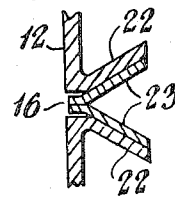
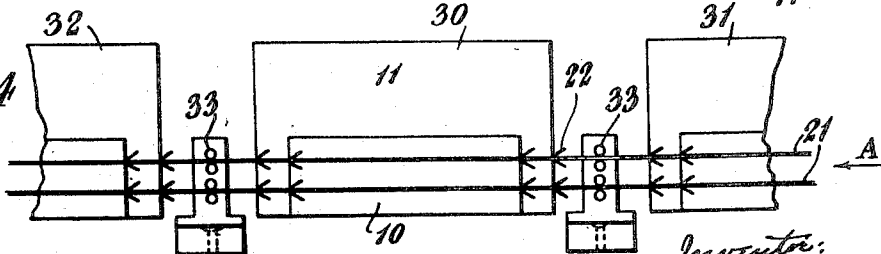


Fig. 4.



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VALVE STRUCTURE FOR PASSAGE OF STRIP MATERIAL THROUGH THE WALL OF LIQUID TREATMENT BATHS

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4 Claims. (Cl. 134—122)

1

2

This invention relates to a method and apparatus for continuous treatment of strip in liquid.

The usual method of treating strip in liquid is to pass the strip through baths containing the liquid. For example, when strip is to be plated it is passed successively through baths containing cleaning, rinsing, pickling and plating solutions, looping the strip in a vertical plane in and out of the baths by means of conducting or conveying rollers. This process is only fully satisfactory for thin strip, which can be easily curved around reasonable size rollers at angles which do not make it necessary to employ large baths and wide separations between them. With thicker strip the process is far less satisfactory because of the necessity, due to increased stiffness of the strip, of having a sufficient separation between the baths to accommodate the more gradual curve of the looping, and such separation of the baths is so great that there is a tendency for the strip to dry off between successive operations unless special precautions are made to keep it damp. The process also suffers from the disadvantage that because the strip, whether thick or thin, is in a substantially horizontal plane whilst in the bath, it is difficult to treat the strip with equal efficiency on both top and bottom faces, as there is always a tendency for gas bubbles to form on the under side, and for any dust or other foreign particles floating in the liquid to settle on the upper side, resulting in the production of pits or thin spots on the surface of the strip.

According to the present invention the method consists in passing the strip edgewise through a bath through valves whilst maintaining the strip always substantially in a vertical plane. The strip may thus be kept perfectly straight. The apparatus for effecting this is provided with slots or apertures in the vats or baths which are substantially sealed by the use of flexible flaps or valves.

The flaps or valves may be made of flexible material such as rubber and are designed to close snugly on to the strip of their own accord. It is not necessary for the slots or apertures to be perfectly sealed by these flaps or valves as this would be an expensive, difficult and complicated matter. Therefore the apparatus is designed to work even when considerable leakage from the baths occurs. In one form the baths are provided with troughs or other convenient receptacles to catch the escaping liquid from the slots or apertures, and one or more pumps, which may be constantly running, is

or are provided to return the spillage to the respective baths. At the same time, if desired, filters may be provided in the circuit so that spillage is filtered before being returned to the bath which gives the advantage of a continuous filtering of the electrolyte. The flaps or valves are made of resilient material, which may also be insulating, and have curved lips pointing in the direction of movement, their resilience tending to hold them closed on the strip.

When current is to be conducted to the strip the preferred method of doing so is by means of rollers or brushes or similar gear placed in contact with the strip as it passes between the baths. With the process and apparatus above described there is no necessity to bend or loop the strip. The baths can be smaller and may be placed close together, thereby avoiding the possibility of the strip drying between the different operations. Since the strip is not curved through the baths, the power required to pull it through the sequence of operations is small and there is not the danger of serious damage to the plant or strip due to seizure of rollers or other mechanical details affected by the solution in the baths.

The method of plating in a vertical plane enables the electrodes for the plating or electrolytic cleaning or pickling baths to be distributed evenly on either side of the strip so as to obtain where desired uniform plating on the two sides of the strip without the tendency for gas bubbles or particles to collect on its surface. On the other hand, should it be desired to plate substantially on one side only, this may be easily attained by disposing the anodes in the plating tank on one side only of the strip. There is the added advantage that the strip to be plated does not pass through the upper surface of the liquid. There is always a tendency, in plating or cleaning solutions, for foreign matter such as grease, or light particles, or froth, or the like, to gather on the upper surface of the plating, or cleaning liquid. If the strip of metal to be plated passes through the said surface it is likely to pick up some of this foreign matter, which is undesirable. In the process according to the present invention the strip leaves the bath through the end walls of the tank and without passing through the upper surface of the liquid, so that there is no danger of picking up foreign matter in this way. Further advantages may be cited. Firstly, the flaps or valves of rubber or other flexible material act as wipers and wipe off mechanically any loose particles, such as

loosened rust or smut from pickling, from the surface of the strip as it passes through them. In a similar manner the flaps through which the strip emerges from each tank act as wipers and remove excess cleaning, pickling or plating solutions, so that only a minimum of these solutions has to be rinsed from the strip after each processing tank. Secondly, the fact that the strip is in a vertical plane allows water rinsing of the strip at each stage to be performed by spray rinses confined to a very short space, for the rinse water can flow rapidly off the strip and does not tend to be dragged forward into each successive bath, as it does tend to do where the strip is substantially in a horizontal plane.

Due to the small tanks and close spacing possible, the whole plant can be made compact and efficient.

One form of apparatus for carrying out the invention is illustrated in the accompanying drawings, wherein:

Fig. 1 is a sectional elevation of a tank.

Fig. 2 is a sectional plan of a tank of a type illustrated in Fig. 1, the section being taken on a plane passing through valves comprising the invention.

Fig. 3 is an enlarged sectional plan of a detail.

Fig. 4 is a diagrammatic plan of a portion of the apparatus.

Referring to Figs. 1, 2 and 3 the tank comprises an inner bath 10 partially surrounded by an outer bath 11, both of the baths 10 and 11 being adapted to contain cleaning or coating liquid. Portions of the outer bath 11 are disposed at each end of the inner bath 10.

The end walls 12, 13 of the inner bath, and 14, 15 of the outer bath are provided with comparatively narrow vertical slots 16, 17, 18 and 19, extending down from the upper edges of the walls to approximately midway between the said upper edges of the walls and the floor 20 of the baths, the said slots being in longitudinal alignment. In the form shown, two series of slots are provided so that two strips may be passed simultaneously through the baths parallel to each other. The strip 21 is adapted to lie edgewise in the slots 16-19 so as to be disposed in a vertical plane, and is adapted to travel through the bath in the direction of the arrow A.

Each of the end walls 12, 13 of the inner bath 10 are provided on their sides facing the direction from which the strip is to be fed through the bath, and at both vertical edges of each of the slots 16, 17, with shields or flanges 22, the two shields disposed at each slot being inclined outwardly from each other to form substantially a V in plan with the slot at the apex of the V, the angle of divergence of the flanges being such, as shown in Fig. 3, that the flap will be subjected to a maximum bending by said strip material of less than about 45 degrees. Flaps 23 of a flexible material, for example, rubber, are fixed to the inner faces of the shields and project slightly into or through the slots at the ends of the bath so that they meet as resilient lips, e. g. the lips of the flaps are end portions normally in contact with and parallel to each other over an area adjacent the end and side edges of the flaps (Fig. 3), and normally spaced apart from and parallel to the vertical edges of the wall forming the slot when no strip material is disposed within the slot. The said flexible flaps are adapted by reason of their flexibility to press on the sides of the strip 21 as it passes through the bath and

substantially seal the slots 16, 17 against leakage of liquid therethrough.

The level of the liquid in the bath 10 is such that the strip may be completely immersed therein, and it will follow that the valves formed by the shields 22 and flexible flaps 23 will not completely seal the slots 16, 17, especially immediately above the upper edges of the strips where there must inevitably be a small gap where the flaps do not touch each other. Consequently, a certain amount of liquid will leak from the bath 10 through the slots 16, 17, and such spillage will be collected in the outer bath 11.

In the apparatus shown in the drawings the slots 18, 19 in the outer bath 11 are also provided with similar flexible V lips 22, 23, which are put in as a precautionary device to prevent rinse water from sprays situated outside the tank from passing into the liquids in the baths on the one hand, and on the other hand to prevent any overflow of liquids from the inner bath 10 from passing beyond the outer bath 11 where it should collect.

Suitable pumps (not shown in the drawings) are provided to recirculate this spillage back from the outer bath 11 to the inner bath 10 and so maintain the level of the liquid in the bath 10 above the level of the upper edge of the strip passing through. Along the top of the plating tank, and along the top of the cleaning tanks should it be desired to have electrolytic cleaning of the strip, there are provided anode or electrode bars (not shown in the drawing) from which anodes for plating or electrodes for cleaning can be hung into the baths in any desired positions. Loose covers, as indicated at 25, may be placed over the inner or outer baths, or both.

In use, the leading edge of the strip is manually threaded through the flexible lips 23 in the slots 16-19 from the entrance ends 14 of the tanks in the first place. This is preferably done with the pumps out of action and with the levels of the liquids in the inner baths 10 a little below the bottom edge of the strip. The pumps are then put in action to raise the levels of the liquids in the inner baths 10 and the strip is then drawn through the baths in the direction of the arrow A by suitable means and is thereby cleaned and coated. In practice, to run the machine continuously and so at maximum efficiency, we prefer to join successive strips end to end to form one continuous length.

A portion of a complete plant is shown diagrammatically in Fig. 4, wherein a complete tank 30 with fragments of two adjoining tanks 31 and 32 are shown. After passing through one tank, the strip 21 passes between a set of rollers 33 before passing on to the next tank; the rollers may serve the purposes of supporting the strip between the tanks and of acting as one of the conductors of current to the strip. Other auxiliary apparatus may be disposed as and where desired, for example, cold and hot water spraying devices.

Heating devices of any suitable type may be accommodated in a chamber 24 below the floor 20 for the purpose of retaining the liquid in the inner bath 10 and the outer bath 11 at the required temperature.

It will be obvious that the invention may be adapted for use in any form of liquid treatment of metallic or other strip; for example, for degreasing, pickling, acid dipping or brightening, electrolytic polishing of steel or other metallic or other strip, whether or not these operations

5

are to be followed by plating. The invention can also be applied to a number of proofing processes, such as bonderising, anodising, or chromate treatment, and substantially all treatments of strip in aqueous or non-aqueous liquids, the tanks and flexible flaps being constructed of suitable materials.

What I claim and desire to secure by Letters Patent is:

1. In a liquid bath container apparatus for the treatment of continuous strip material moved therethrough in a constant direction while disposed in a vertical plane, said apparatus comprising at least two substantially vertical parallel end walls having aligned vertical slots disposed oppositely and normally beneath the surface of the liquid, each of said walls presenting leading and trailing sides to the strip material moved therethrough, at least one of said slots being provided with liquid sealing valve means having two oppositely disposed substantially solid flaps of resilient material which provide the valving action for passage of said strip material therebetween, the improved structural arrangement for said valve means comprising a rigid flange extending from adjacent each edge of said slot, both flanges extending from the leading side of the wall and each flange diverging away from the plane of said slot which is perpendicular to said wall and from the adjacent wall surface, a horizontal section through the pair of flanges associated with the slot being substantially V-shaped with the slot at the apex and said resilient flaps being supported on the adjacent faces of said flanges and with portions extending into the slot, the edges of said portions normally in contact with each other, the angle of divergence of said flanges away from the adjacent wall surfaces being such that the flexible sealing

6

members supported on said flanges will be subjected to a maximum bending by said strip material of less than about 45 degrees.

2. Apparatus as defined in claim 1 wherein opposed faces of said portions within the slot normally are in contact with each other over an area adjacent their end and side edges.

3. Apparatus as defined in claim 2 wherein the total thickness through said portions in the area over which they are in contact is substantially equal to the width of said slot minus the mean thickness of said strip material.

4. Apparatus as defined in claim 2 wherein said portions normally are parallel to each other and to the vertical faces of the edges of the wall forming said slot, and said portions normally are spaced apart from said vertical faces.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
900,169	Hollis	Oct. 6, 1908
1,072,705	Destribats	Sept. 9, 1913
1,191,386	Battle	July 18, 1916
1,768,358	Harrison	June 24, 1930
1,864,490	Harrison	June 21, 1932
2,212,588	Csanyi	Aug. 27, 1940
2,271,736	Hall	Feb. 3, 1942
2,377,550	Hall	June 5, 1945
2,378,002	Drummond et al.	June 12, 1945
2,384,660	Ward	Sept. 11, 1945

FOREIGN PATENTS

Number	Country	Date
467,019	Great Britain	June 9, 1937