April 19, 1938. ERICH-GÜNTHER KÖHLER 2,114,782

APPARATUS FOR TREATING METAL SHEETS IN LIQUIDS

Filed Dec. 23, 1937 2 Sheets-Sheet 1

FIG. 1.

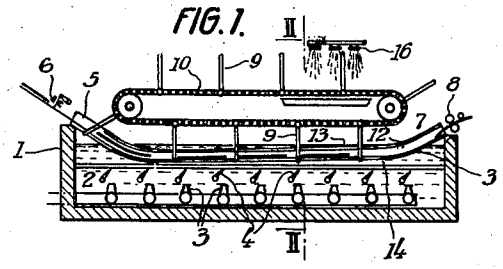


FIG. 2.

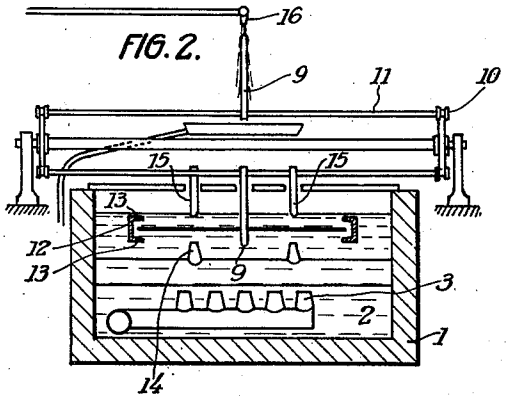


FIG. 3.

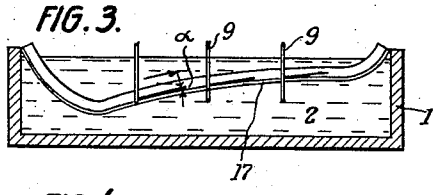
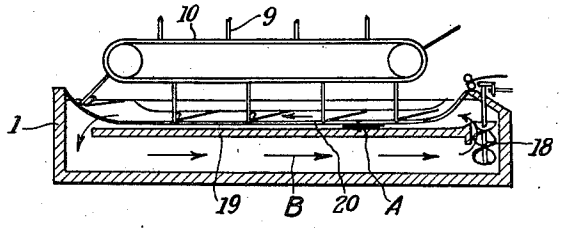


FIG. 4.



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Filed Dec. 23, 1937 2 Sheets-Sheet 2

FIG. 5.

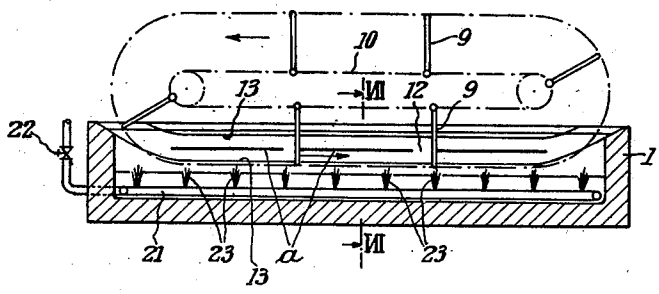


FIG. 6.

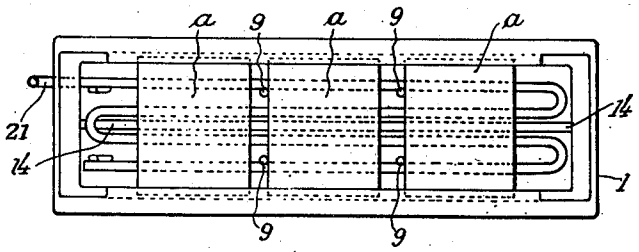
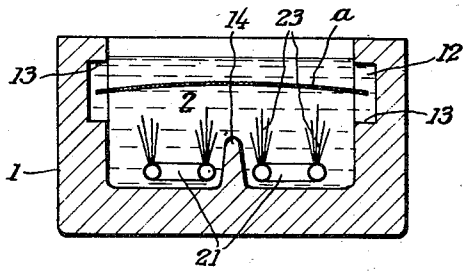


FIG. 7.



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UNITED STATES PATENT OFFICE

2,114,782

APPARATUS FOR TREATING METAL SHEETS IN LIQUIDS

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Application December 23, 1937, Serial No. 181,432
In Germany December 24, 1936

10 Claims. (Cl. 266—7)

It is known, when treating metal sheets in a liquid,—for example pickling, washing, and the like,—to move these sheets in some way or other in the liquid. Such lifting, swinging, or other kind of moving was effected by the suspension means, which makes it necessary that these means are dipped into the liquid,—for example an acid,—and is liable to affect the delicate edges of thin metal sheets. In addition, the means of conveyance and of movement, such as pickling baskets and carriers, were exposed to the action of chemicals, resulting in a considerable wear. Costly repairs and interruptions of operations were the consequences.

Continuous chemical treatment of metal sheets is done most advantageously if these sheets have the shape of long strips, which makes it possible to weld the individual strips together. This method can also be applied, if shorter metal sheets are welded together. However, in the case of square-shaped sheets, this is rather complicated, also causing considerable cost of welding the joints, and resulting in losses owing to the necessity of cutting out the welded joints after treatment.

According to the invention, the disadvantages of the various known methods are obviated in a particularly simple manner by causing the metal sheets to float and, therefore, to be lifted off the guiding members, when they are treated in liquids, for the purpose of pickling, washing, or the like, thereby protecting the portions supported by the guiding members, while the metal sheets are passed through the liquid.

This lifting of the metal sheets can be effected in various ways.

Several devices for the application of this method are illustrated, by way of example, in the accompanying diagrammatical drawings, in which:—

Fig. 1 is a longitudinal section through a liquid container with the devices according to the invention,

Fig. 2 is a sectional view, taken on the line II—II of Fig. 1, in enlarged scale,

Fig. 3 is a longitudinal section of a somewhat different embodiment with a conveying device according to Fig. 1 (the conveying arms being shown only),

Fig. 4 is a longitudinal section of another embodiment,

Fig. 5 is a longitudinal section through a liquid container of another type of device according to the invention,

Fig. 6 is a partial top view of same,

Fig. 7 is a section on the line VII—VII of Fig. 5, in enlarged scale.

An object of the invention is to apply the principle of lifting owing to the resistance of a liquid medium, similar to the lifting of aeroplanes by the air resistance, to the passing of metal sheets through the liquid in which they are treated, with analogous gliding or sailing.

Fig. 1 illustrates a trough 1 serving to contain the liquid 2 for treatment. The nozzles 3 are intended, according to the inventon, to cause an upward motion of the liquid, in order to lift the metal sheets. The direction of the current can be regulated by steering planes 4 of suitable material. At the entrance 5 the metal sheets, after being released by the flap 6, are led into the bath by a guide, and then pass through the trough, carried by the current of the liquid, to the outlet 7, where they are received by pressing and conveying rolls 8. For the regulation of the running speed in the bath, trip levers or conveying arms 9 are provided, attached to a conveying device outside the trough, for example a chain 10, by means of transverse members 11. Guiding members 12 are provided, for example with flanges 13. These flanges are arranged in ample distance from each other, giving the metal sheets a certain amount of free play between the guiding members.

In the drawings, Fig. 2 it is shown how the metal sheets are kept floating within the guiding members 12 by the upward current of the liquid. The guidings are made of chemical-proof material. Below the guiding members are longitudinal guides 14 which, in case the current of the liquid should leave off temporarily, prevent the metal sheets from bending downwards and thereby falling out of the guiding members, and which are given a stream-line section, in order to avoid the formation of eddies. In the event of the current of the liquid becoming too strong, safety rods 15 are provided, in order to prevent the metal sheets from bending or escaping upwards, and are suitably attached to the transverse members 11 of the chain 10, together with the conveying arms or trip levers 9. Both means, the safety rods 15 and the longitudinal guides 14, are arranged so that, in normal running, they are not touched by the metal sheets. A washing device is provided at 16, in order to remove the slight residues of chemical liquid settling on the tips of the rods 9, by washing with water.

Fig. 2 shows the trough 1 being wider than required by the guiding members 12, so as to enable the liquid, which rises in the middle, to run

off at the sides and at the ends of the trough, the liquid being induced again by special conveying means and pressed into the nozzles 3.

The advantage of the above described arrangement is quite obvious. The metal sheets are kept floating by the current of the liquid, being forced by the guiding members to follow a certain path, without lying with their full weight at the edges on the flanges of the guiding members and thereby being liable to be damaged or scratched. By means of the trip levers on the conveying chain, arranged outside the bath, they are passed through the liquid for treatment with adjustable speed. If the liquid is to effect a chemical treatment, no moving parts are in the liquid, except the tips of the trip levers and possibly the tips of the safety rods 15. It is easy to make these parts of material which absolutely resists the action of the chemicals. The only moving part which is of complicated construction, the conveying chain 10, is outside the liquid and outside the whole arrangement. The acid trough 1 can also be closed in a simple way with a lid, having longitudinal slits for the passage of the mentioned rods.

Fig. 3 is a diagrammatical illustration, showing how the metal sheets are passed through the bath by specially bent guiding members 17, so as to assume a certain angle α of elevation. By the forward motion of the metal sheets at this angle of elevation, they are lifted from the guiding members. This lifting may be assisted by a gradually decreasing inclination of the guiding members towards the end of the motion, as illustrated.

In the construction, shown in Fig. 4, the liquid 2 of the bath is circulated horizontally by a special device, for example a propeller 18, in the direction of the arrows A, B, for which purpose a partition 19 between the upper and lower portion of the liquid of the bath is provided. As in the first case, the metal sheets are moved through the bath by trip levers and guidings, opposite to the direction of the current of the liquid, and are placed at a certain angle of elevation from the beginning by means of a special arrangement of the trip levers, so as to be kept floating under the action of the counter-current of the liquid and of the forward motion of the trip levers. The metal sheet is then merely held in one point at the trip lever.

In the constructions, shown in Figs. 3 and 4, guiding members 17 and 20 respectively are illustrated by way of example, having only one lower flange, but no upper limitation.

The various constructions show many possibilities of variation. The method permits to keep the metal sheets floating freely through the liquid as well as to limit the supporting pressure on the guiding members to requirement by regulating the lifting of the metal sheets. It may be necessary to have two or more trip levers 9 instead of one, in order to prevent the metal sheets from edging in the guidings, which, however, does not affect the principle. As to the rest, the combinations are pointed out, which can be developed from the various constructions. For example, the partition 19, shown in Fig. 4, may be punched. In this case, the punched holes in the mentioned partition, if the liquid circulating device is arranged at the entrance, will permit the passage of liquid in upward direction, whereby a vertical lifting component force is added to the lifting due to the angle of elevation and the horizontal motion of the liquid, the size and shape of the punched holes in said partition being made correspondingly. In order to obtain an increased capacity, the arrangement can also be made in several stories on the top of each other.

It may be observed with regard to the curved shaping of the guidings 17 in Fig. 3, that the guiding must form a gradually flattening curve, as otherwise a lifting of the metal sheets from the guiding cannot be attained. The angle between the direction of the metal sheets and the tangent of the guiding at the supporting surface is of importance for lifting the metal sheets.

In the construction according to Fig. 4, the provision of a vertical lifting component force can also serve to prevent an interruption of the current. If there is only one horizontal component force, eddies may form behind the metal sheet, according to the direction of the current of the liquid, whereby the guiding of the second and third metal sheet may be endangered or disturbed. This formation of eddies must be avoided, and by supplying fresh quantities of liquid, a fresh current is produced.

In the construction according to Figs. 5 to 7, where the same reference characters are used as in Figs. 1 and 2, the modification consists in that, instead of one pipe for the liquid of treatment with nozzles 3, two serpentine pipes 21, for example made of earthenware or glass with very small holes (not illustrated), are provided, which are connected with a source of air or steam pressure. A regulating device 22 is provided, enabling to finely regulate the air or steam jets 23 emerging from the small holes in the serpentine pipes.

The particularly fine regulation of the lifting force, acting upon the metal sheets *a*, by means of said regulating device, serves to prevent with certainty that the lifting force is too great and that the metal sheets touch with their top edges 13 the guiding 12, or are lifted out of the liquid 2. The application of steam or heated air possesses the additional advantage of at the same time heating the liquid 2 for treatment.

I claim:—

1. A device for treating metal sheets in liquids, e. g. pickling, washing, or the like, comprising in combination: a container for the treating liquid, guiding members for guiding the metal sheets while passing through said container, conveying means for moving the metal sheets through said container, and means for lifting the metal sheets off said guiding members in order to protect the delicate edges of the metal sheets.

2. A device for treating metal sheets in liquids, e. g. pickling, washing, or the like, comprising in combination: a container for the treating liquid, guiding members for guiding the metal sheets while passing through said container, conveying means for moving the metal sheets through said container, means for producing an upward motion of the liquid in said container and for lifting the metal sheets off the lower portion of said guiding members.

3. A device for treating metal sheets in liquids, e. g. pickling, washing, or the like, comprising in combination: a container for the treating liquid, guiding members for guiding the metal sheets while passing through said container, conveying means for moving the metal sheets through said container, pressure pipes with nozzles, producing upward currents of the treating liquid and thereby lifting the metal sheets off the lower portion of said guiding members.

4. A device for treating metal sheets in liquids, e. g. pickling, washing, or the like, comprising in combination: a container for the treating liquid,

guiding members for guiding the metal sheets while passsing through said container, conveying means for moving the metal sheets through said container, pressure pipes with nozzles, containing a gaseous medium under pressure, producing upward currents of this medium and eventually also of the treating liquid, and thereby lifting the metal sheets off the lower portion of said guiding members.

5. A device for treating metal sheets in liquids, e. g. pickling, washing, or the like, comprising in combination: a container for the treating liquid, guiding members for guiding the metal sheets while passing through said container, conveying means for moving the metal sheets through said container, pressure pipes with nozzles, producing upward currents of the treating liquid and thereby lifting the metal sheets off the lower portion of said guiding members, and steering planes for specially steering the upward currents of the treating liquid.

6. A device for treating metal sheets in liquids, e. g. pickling, washing, or the like, comprising in combination: a container for the treating liquid, guiding members for guiding the metal sheets while passing through said container, conveying means for moving the metal sheets through said container, pressure pipes with nozzles, containing a hot gaseous medium under pressure, producing upward currents of this medium and eventually also of the treating liquid, and thereby lifting the metal sheets off the lower portion of said guiding members.

7. A device for treating metal sheets in liquids, e. g. pickling, washing, or the like, comprising in combination: a container for the treating liquid, guiding members rising in the direction of the motion of the metal sheets, and conveying means for moving the metal sheets through said container, the inclined position of the metal sheets owing to said rising guiding members producing a force to lift the metal sheets off said guiding members while passing through the treating liquid.

8. A device for treating metal sheets in liquids, e. g. pickling, washing, or the like, comprising in combination: a container for the treating liquid, guiding members for guiding the metal sheets while passing through said container, conveying means for moving the metal sheets through said container, means for lifting the metal sheets off said guiding members, and supporting members in the lower portion of said container for holding the metal sheets and preventing same from deflecting in the event of a failure of said means for lifting the metal sheets off said guiding members.

9. A device for treating metal sheets in liquids, e. g. pickling, washing, or the like, comprising in combination: a container for the treating liquid, guiding members for guiding the metal sheets while passing through said container, an endless chain, arranged above the treating liquid, said endless chain being provided with arms immerging in the treating liquid and serving to move the metal sheets through said container, and means for lifting the metal sheets off said guiding members.

10. A device for treating metal sheets in liquids, e. g. pickling, washing, or the like, comprising in combination: a container for the treating liquid, guiding members for guiding the metal sheets while passing through said container, a horizontal partition in said container directly below said guiding members, means for moving the metal sheets through said container, and a device for circulating the treating liquid, producing above said partition a liquid current in opposite direction of the motion of the metal sheets and lifting the latter.

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