Feb. 12, 1935. F. J. TAYLOR 1,990,761

METHOD OF AND APPARATUS FOR PICKLING OR SWILLING SHEET METAL

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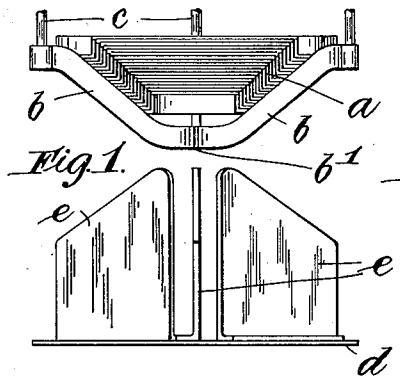


Fig. 1.

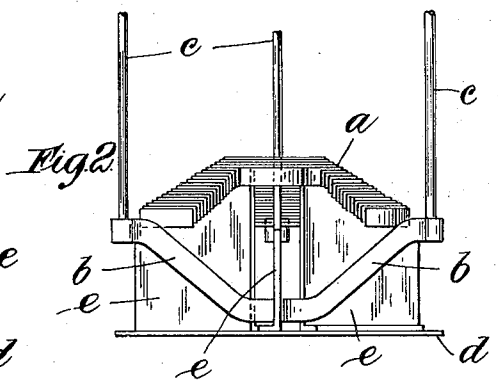


Fig. 2.

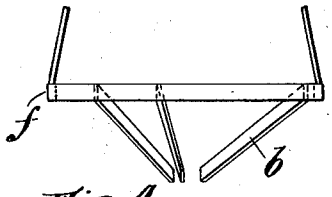


Fig. 4.

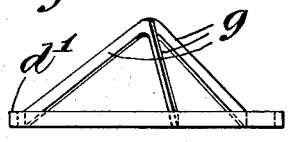
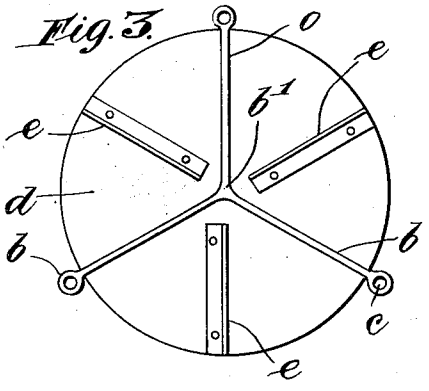


Fig. 3.



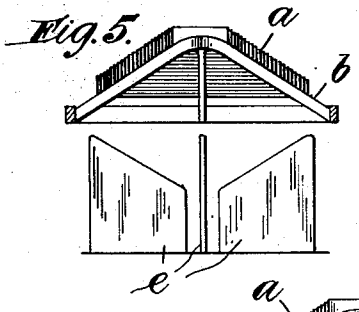


Fig. 5.

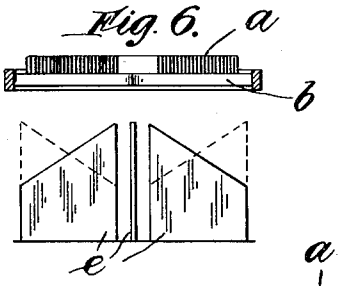


Fig. 6.

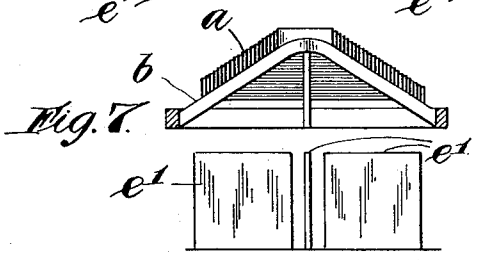


Fig. 7.

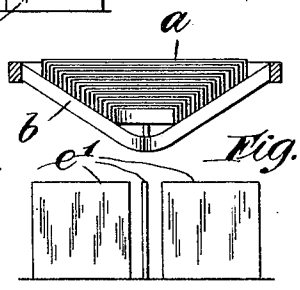


Fig. 8.

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Fig. 9.

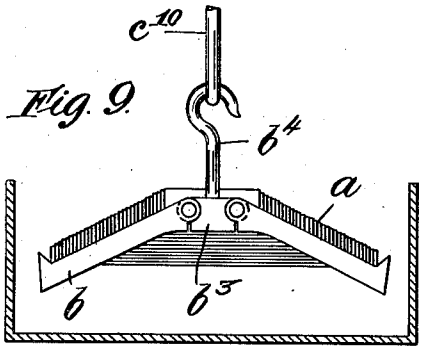


Fig. 10.

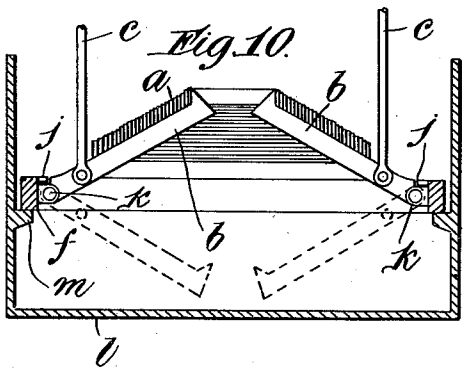


Fig. 11.

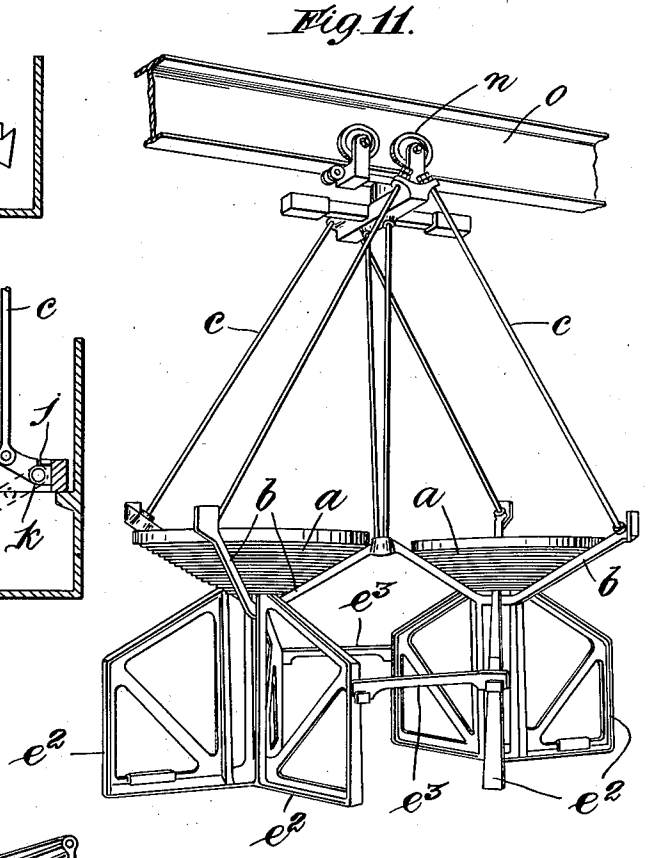
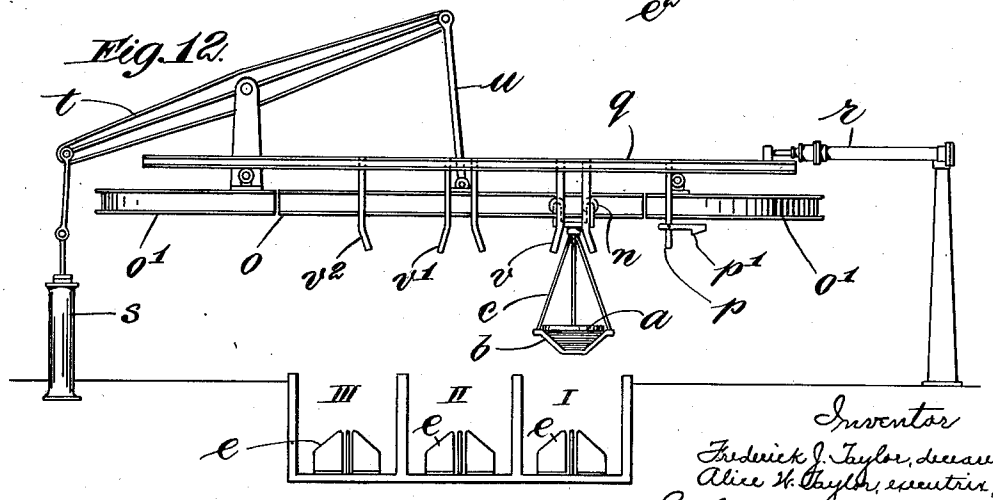


Fig. 12.



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UNITED STATES PATENT OFFICE

1,990,761

METHOD OF AND APPARATUS FOR PICKLING OR SWILLING SHEET METAL

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Application July 15, 1933, Serial No. 680,644
In Great Britain July 15, 1932

3 Claims. (Cl. 148—8)

This invention comprises improvements in and connected with apparatus for pickling, swilling, neutralizing or washing sheet metal, such as, for example, material to be used in the manufacture of galvanized or other coated sheet metal. The pickling, swilling or washing of coils of sheet metal strip presents particular problems. Such strip is used in large quantities as, for example, for the production of welded tubing and other objects and is delivered in the from of a flat coil with the convolutions more or less tightly coiled. Thus, it is a matter of difficulty to ensure the action of the treatment liquid on the surfaces of the numerous convolutions, unless the expensive procedure of uncoiling is adopted, or unless some other expedient is adopted for opening out or expanding the convolutions so as to allow the liquid to gain access to all surfaces of the coiled strip.

An important object of these improvements is to enable coils of sheet metal strip to be treated not only expeditiously and effectually but also in a simple and economical manner, whereby all surfaces of the convolutions are subjected to the action of the treatment liquid.

According to this invention, a coil carrier is adapted for co-operating with the bath, or with means in the bath, in such a manner that axial deformation of the coil is produced thereby effecting liquid treatment of the whole of the strip surfaces within the coil. The carrier may be a shaped frame adapted for deforming the coil from a flat to a shaped condition when the coil is placed upon such carrier, the latter being adapted so that when cooperating with the bath, or with means in the bath, the coil is again deformed from the shaped to a flat condition or to a reversely shaped condition. Or the carrier may be adapted for supporting the coil in a flat condition and for co-operating with means in the bath for deforming the flat coil to a shaped condition. The axial deformation aforesaid is generally conical deformation but it is obvious that the convolutions of the coil need not be displaced so as to produce a regular cone shape as any concave or convex shape may be produced by such deformation. In every case, such deformation will produce an exposure of portions of the surfaces of individual convolutions, and although in the course of deforming and reversely deforming the coil the whole of the surfaces of the convolutions may not be exposed, nevertheless the resultant working of the convolutions one against another and up and down in relation to the liquid is effective for causing treatment liquid to have access to every portion of such surfaces. Usually, the most effective operation is to lower the carrier into the bath to produce an initial coil deformation and thereafter to jig the carrier up and down for the production of a series of deformations and reverse deformations, thereby ensuring access of the treatment liquid to all parts of the coil. By these improvements, any necessity for unwinding or loosening the coil is completely avoided and the coil is delivered from the liquid treatment apparatus in the same coil form in which it was originally supplied.

In order to enable the invention to be readily understood reference is made to the accompanying drawings illustrating examples of constructions in accordance with these improvements in which drawings:—

Figure 1 is an elevation showing a carrier device supporting a coil immediately above a co-operative device adapted for being placed on the bottom of a pickling, swilling or washing tank.

Figure 2 is similar to Figure 1 but shows the carrier lowered for the transfer of the coil to the co-operative device.

Figure 3 is a plan view of the devices seen in Figures 1 and 2 but with the coil removed.

Figure 4 is an elevation of a modified construction.

Figures 5, 6, 7 and 8 are elevations illustrating other modifications.

Figures 9 and 10 are sectional elevations of yet other modifications operating in appropriate tanks.

Figure 11 is a perspective view of twin carriers suspended from an overhead carriage and in operative relation with a twin device adapted for being placed on the bottom of a treatment tank.

Figure 12 is a diagrammatic elevation of a plant comprising tanks, overhead track for trolleys supporting the improved carriers, and power devices for moving the trolleys along the track and for lowering the carriers into the tanks.

Referring to Figures 1 to 3, the carrier for a coil *a* of sheet metal strip is in the form of an inverted hollow conical frame consisting of three arms *b* spaced 120° apart and rising upwardly and outwardly from a hub or centre b^1. The carrier is supported by rods *c* connected with the outer ends of the arms *b* and suspended from any suitable cross-head or bridle device. The co-operative device, adapted for standing upon the bottom of a tank or treatment bath, comprises a circular base plate *d* upon which are erected three blades or plates *e*, the latter being disposed radially at 120° apart but so as not to meet at the centre.

The upper portions of the plates *e* are cut away so that their edges conform to the surface of a hollow cone. This device is disposed upon the bottom of a bath so that, in plan, the plates *e* would be angularly displaced with reference to, and thus lie in the segmental spaces between, the arms or limbs *b* of a carrier descending upon it, as will be understood from Figure 3. In the modification illustrated in Figure 4, the arms *b* of the carrier extend downwardly and radially inwardly from a supporting ring *f* but do not meet at the centre. The co-operative device comprises a base plate or ring d^1 and radial arms or spokes *g* rising upwardly and inwardly thereof and meeting at the centre. This device d^1 *g* would be disposed on the bottom of a bath, with the arms *g* disposed in the same circular relation to the arms *b* of the carrier as that of the blades *e* to the arms *b* in Figure 3.

With the construction illustrated in Figures 1 to 3, or with that illustrated in Figure 4, a coil *a* in a flat condition is placed on the carrier arms *b* and, due to the inclination of the latter, the coil *a* comes to rest thereon in a condition in which it is deformed to a concave or hollow inverted cone shape, as seen in Figure 1. This deformation causes portions of the individual convolutions of the coil to become exposed. If the carrier be now lowered over the blades *e* or arms *g* of a co-operative device placed at the bottom of a liquid treatment bath the arms *b* pass between the blades *e* or arms *g*. Thus, the coil *a* is removed from the arms *b* and comes to rest on the inclined edges of the blades *e* or arms *g* so that its concave or conical shape is reversed, as will be understood from Figure 2. The coils are shown partly broken away in Figures 1 and 2 for purposes of illustration. In lowering the coil *a* to the bottom of the bath, therefore, the surfaces firstly exposed are wetted and then other surfaces which become exposed by the reverse deformation are wetted. In raising the carrier from the position seen in Figure 2 so that it lifts the coil *a* from the blades *e*, or arms *g*, the originally exposed surfaces are again exposed to the treatment liquid. As regards the surfaces of the coiled strip which are not exposed either by the first or by the reverse deformation, the submerged deformation of the coil produces circulation of the treatment liquid by the resultant movement of the convolutions so that such surfaces are wetted. To enhance this action and make the liquid treatment as effective as possible, the carrier may be jigged up and down in the bath before being finally withdrawn, thereby causing the coil *a* to be transferred on to the blades *e* or arms *g* and deformed a number of times. Such jigging motion may be performed by either manually or power operated means in either a regular or intermittent manner.

According to the modifications illustrated in Figure 5, the carrier arms *b* and the edges of the co-operative device, such as *e*, may be reversely inclined, as compared with Figure 1, whereby the coil *a* is firstly deformed to a conical shape and is reversely deformed to an inverted cone shape when transferred on to the co-operative device *e*.

In the construction seen in Figure 6, the carrier is flat, so that it receives and supports the coil in a flat condition. The blades *e* may be like those seen in Figures 1 and 2, or, as indicated by the dotted lines, they may be like those seen in Figure 5. Thus, the lowering of the flat coil *a* on to the blades *e* will cause it to be deformed to a conical or inverted conical shape, which one-way deformation may be sufficient for some purposes.

According to Figures 7 and 8, the blades e^1 have horizontal edges for receiving the coil *a* and supporting it in a flat condition when the carrier arms *b* are lowered. In Figure 7 the arms *b* of the carrier are inclined so as to produce an initial conical deformation of a flat coil placed upon them and in Figure 8 they are reversely inclined so as to produce an initial inverted conical deformation of such coil. The operations of the modifications shown in Figures 7 and 8 will be the reverse of those described with reference to Figure 6.

In Figure 9, the arms *b* of a carrier are hingedly supported by a centre piece b^3 fitted with a suspension hook b^4. As will be seen, the arms or limbs *b* can rise about their hinges on the piece b^3 but they cannot descend about such hinges beyond the downwardly inclined position in which they are seen in Figure 9. To load this carrier, the hook b^4 must be detached from the suspension rod or cable c^{10}, whereupon the coil *a* can be placed on the carrier in a flat condition. Upon suspending the carrier by attaching the hook b^4 to the rod or cable c^{10}, the loaded arms *b* take the downwardly inclined position shown and the flat coil is deformed to the conical shape illustrated. When this carrier is lowered on to the bottom of a bath, the arms *b* move upwardly about their hinges and the coil *a* re-acquires its flat condition but is again deformed as soon as the carrier is lifted from the bottom. The use of this construction in the liquid treatment operations hereinbefore described will now be apparent without further description.

In the construction illustrated in Figure 10 the arms *b* are hingedly mounted at their outer ends on a ring *f* and are pivotally connected with the suspension rods *c*. When the carrier is freely suspended, the arms *b* are upwardly inclined from the ring *f*, this inclination being limited by the butting surfaces *j* at the hinges *k*. As will be seen, a flat coil *a* placed on the carrier arms *b* is deformed into a conical shape when the carrier is freely suspended. Upon then lowering the carrier into a bath *l* the ring *f* encounters and is arrested by a ledge or stops *m*, whereas the suspension rods *c* continue to descend. This permits the arms *b* to turn downwardly about their hinges *k* to the position indicated in dotted lines thereby reversely deforming the coil *a* with the result hereinbefore described. The arms *b* may be worked a number of times up and down by the rods *c*, whilst the ring *f* rests upon the ledge or stops *m*, in order to ensure access of liquid to all parts of the coil.

In Figure 11, two carriers, similar to that described with reference to Figure 1 are shown suspended as a pair by means of rods *c* from an overhead trolley *n* running on a track section *o* which is capable of being raised and lowered as hereinafter described. The blades e^2 of co-operative devices to be placed on the bottom of a bath are open frames instead of plates as in Figure 1. These devices are held by spacing bars e^3 in correct disposition to suit the twin carriers *b b*. It will be apparent that rising and falling movements of the track section *o* will produce deformations of the coils *a* in the manner hereinbefore described.

Referring to Figure 12, the rising and falling track section *o* is shown forming part of an endless track o^1. A single carrier *b* is shown sus-

pended by rods c from a trolley n. The carrier b is loaded with a coil a at a suitable point along the track o^1 and is then wheeled around the track o^1 so as to approach the section o from right to left in Figure 12. Its progress is arrested by a stop arm p depending from a reciprocable bar q and backward movement is prevented by a detent p^1 on the arm p. The bar q is then moved from right to left by a ram r, the stroke of which is equal to the travel required for bringing the carrier on to the track section o and over the first bath I. The carrier is moved by the detent p^1. The track section o is then lowered, by means of a ram s, beam t and suspension rod u so that the carrier enters the bath I and deposits the coil a on the co-operative device e. The ram s may then be given a number of short strokes to perform the jigging hereinbefore described. During this descent of the carrier, the ram r makes its return stroke, bringing the bar q back to the position seen in Figure 12 in which the stop arm p is ready for a fresh carrier and a guide fork v depending from the bar q is immediately above the carrier in the bath I. Upon the ram s being operated to raise the track section o into alignment with the track o^1, a bridle of the carrier b rises into the guide fork v as shown in Figure 12. At the next outward stroke of the ram r the carrier b is shifted by the fork v from its position over the bath I to a position over the bath II, the detent p^1 of the arm p then bringing a fresh carrier over the bath I. When a carrier is raised from bath II it engages with a guide fork v^1 which later shifts it over bath III. When it is raised from bath III it comes in front of a single prong v^2 depending from the bar q so that on the next outward stroke of the ram r it is propelled by the prong v^2 on to the track o^1 along which it runs to an unloading position.

It will be apparent that any one of the forms of carrier hereinbefore described can be suspended from a trolley n and be operated in the manner described. The devices such as e on the bottom of the baths may be removably mounted in the event of the baths being required for the treatment of plates or other objects. In practice, two or more coils may be placed on a carrier, one over the other, using suitable separators which allow the deformation.

What is claimed is:

1. Method of pickling, swilling or liquid-treating a closely wound coil of metal strip comprising subjecting the coil to alteration of its formation in the axial direction whilst submerged in the treatment liquid.

2. Method of pickling, swilling or liquid-treating a closely wound coil of metal strip comprising subjecting the coil to a number of alterations of its formation successively in opposite axial directions whilst submerged in the treatment liquid.

3. Apparatus for pickling, swilling or liquid-treating a closely wound coil of metal strip, comprising a coil carrier frame adapted for lowering the coil axially into a bath and means in the bath operative to cause said coil to acquire a different formation in the axial direction during submergence in the bath.

ALICE WINIFRED TAYLOR,
Executrix of Frederick John Taylor, Deceased.