Feb. 17, 1953 E. L. HUFF 2,628,627

APPARATUS FOR TREATING CONTINUOUS PRODUCTS

Filed Aug. 9, 1947 4 Sheets-Sheet 1

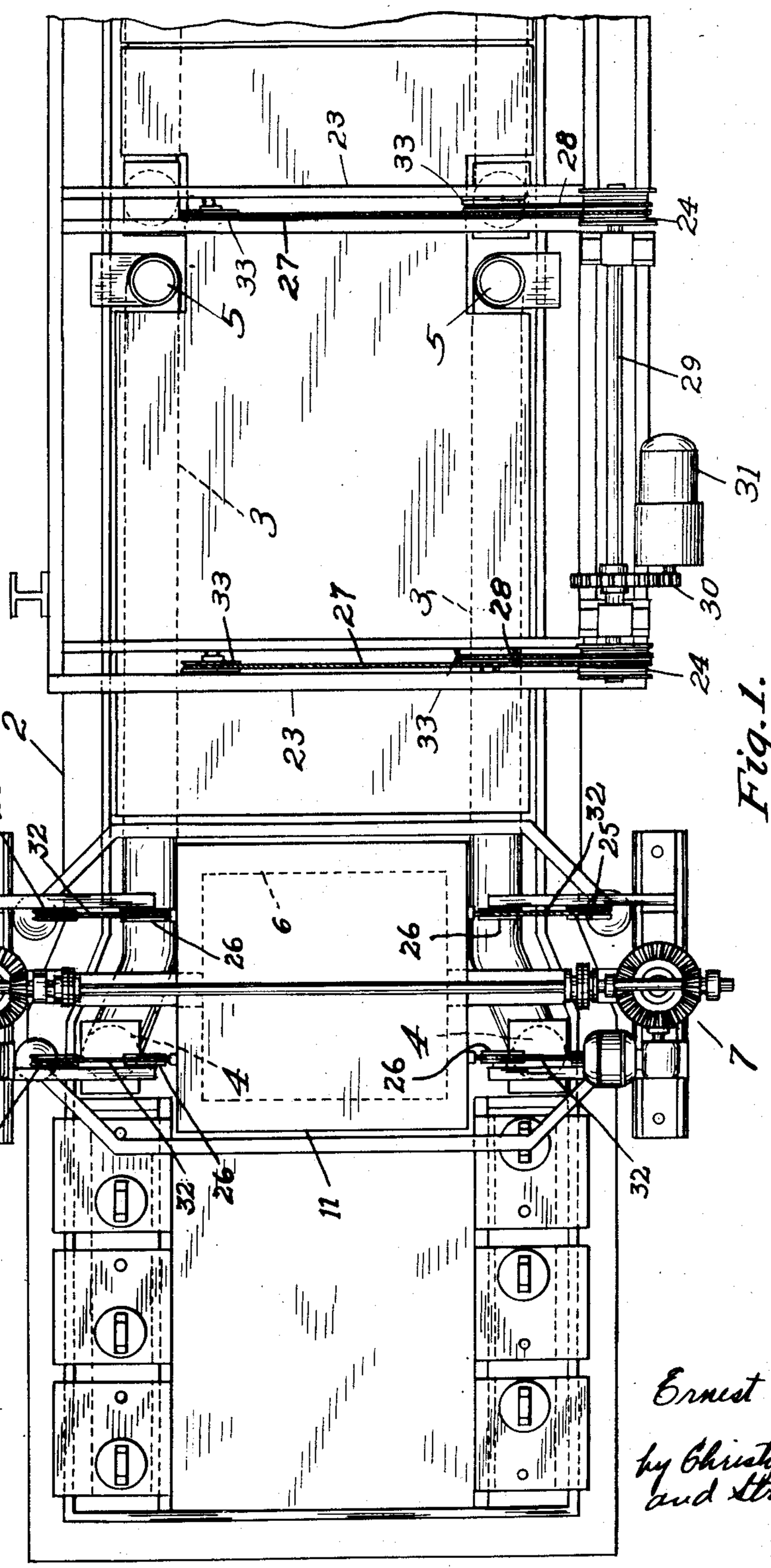

Fig. 1.

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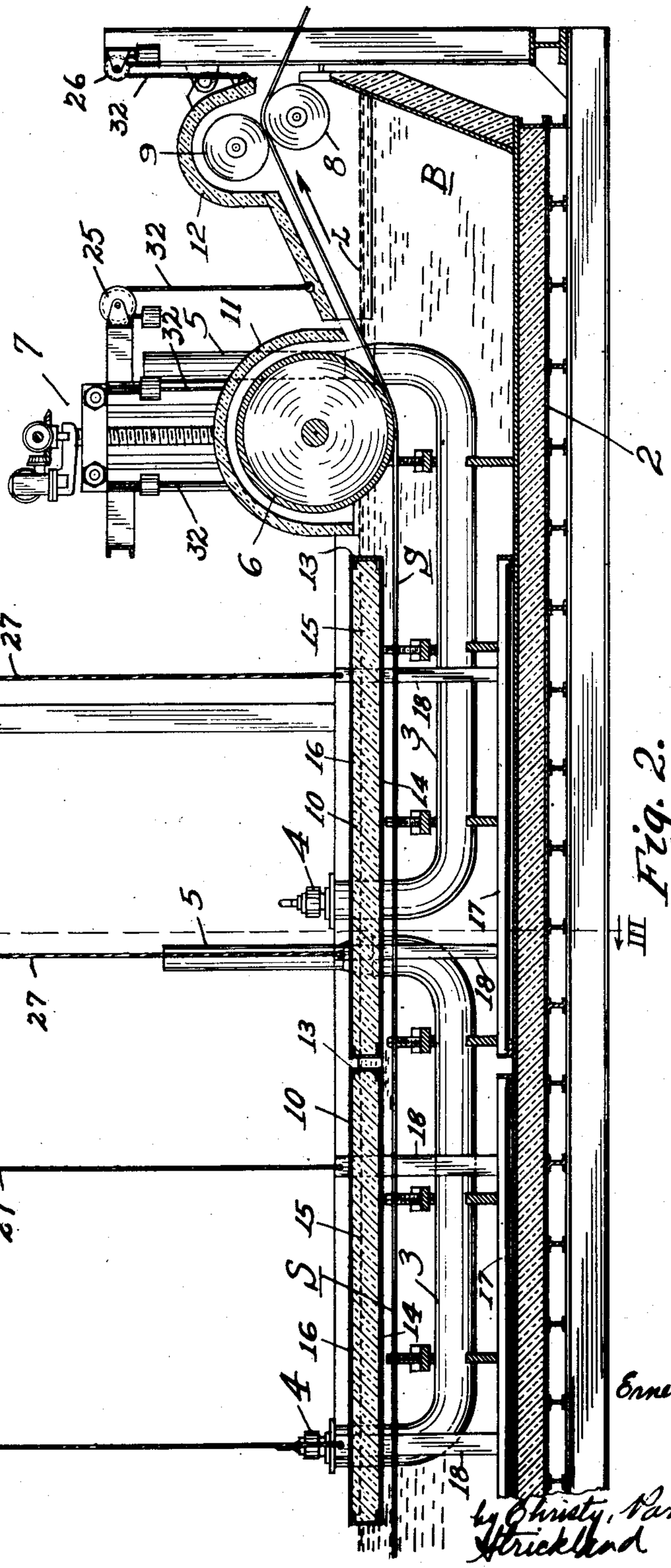

Fig. 2.

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APPARATUS FOR TREATING CONTINUOUS PRODUCTS

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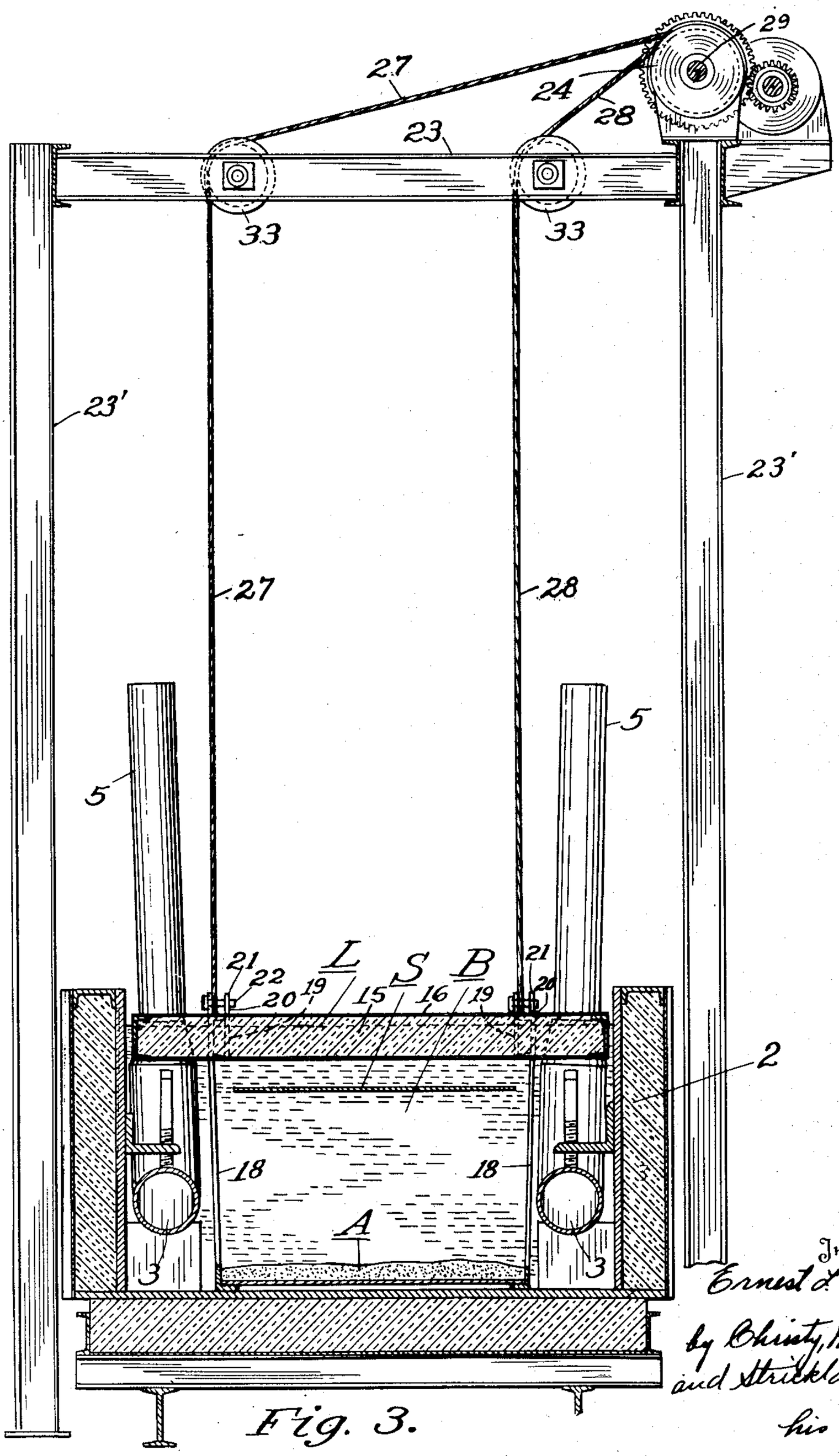

Fig. 3.

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4 Sheets-Sheet 4

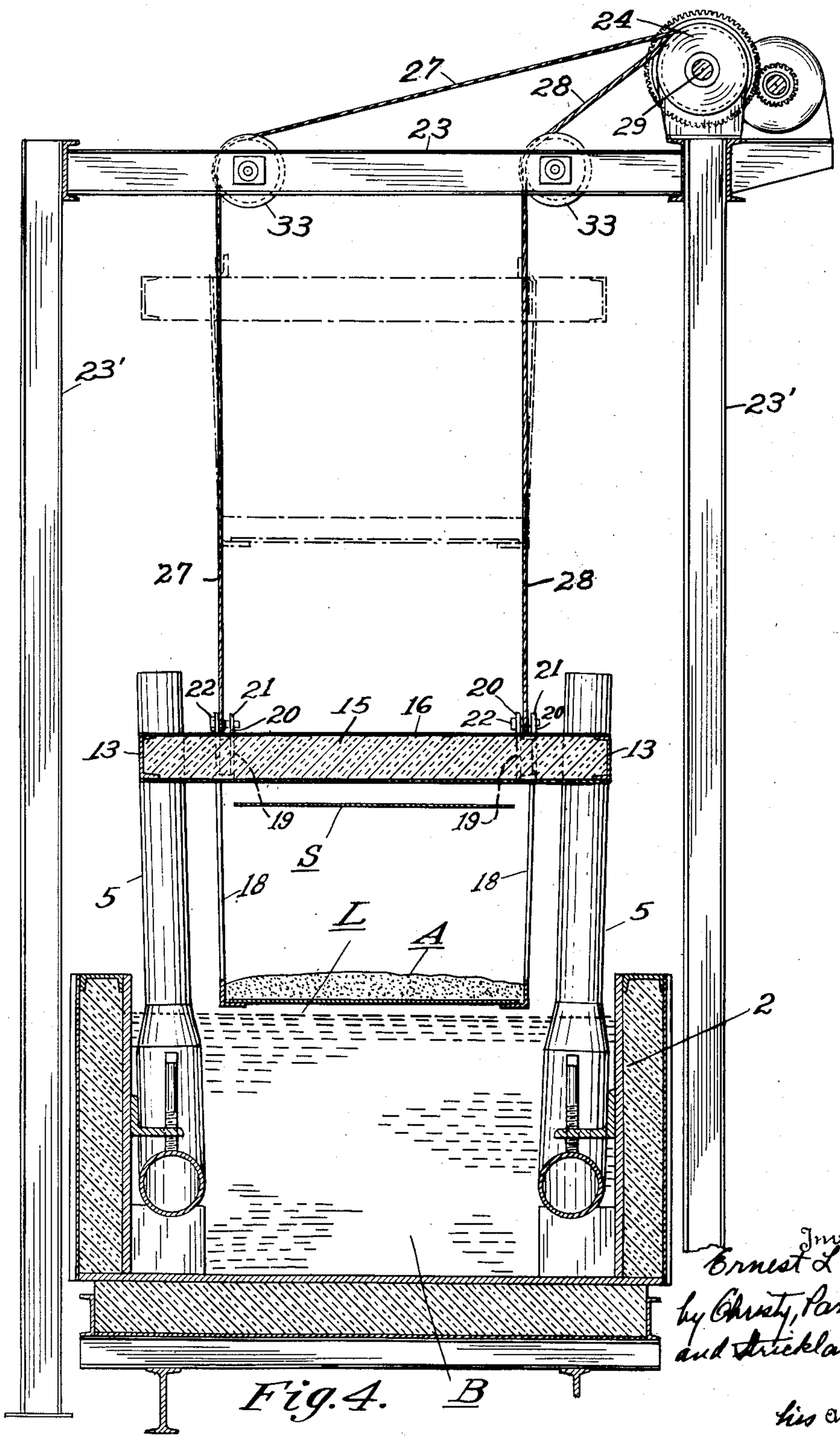

Fig. 4.

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UNITED STATES PATENT OFFICE

2,628,627

APPARATUS FOR TREATING CONTINUOUS PRODUCTS

Ernest L. Huff, Tarentum, Pa.

Application August 9, 1947, Serial No. 767,712

7 Claims. (Cl. 134—104)

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My invention relates to apparatus for the processing of products in liquid baths, and more particularly relates to the treatment of continuous products (such as rolled steel sheet or strip, wire, rods and the like) in cleansing, pickling, annealing, tinning, galvanizing baths, and the like.

The invention has been developed for use with molten salt baths employed in descaling steel strip, and in such association it will in exemplary way be described, reference being had to the accompanying drawings, in which:

Fig. 1 is a fragmentary view in plan of a molten salt bath apparatus, in which the invention has been embodied;

Fig. 2 is a view in medial longitudinal section of the apparatus; whereas Fig. 1 shows a plan view of the apparatus at the end thereof where the continuous strip is advanced into the molten bath, Fig. 2 is a sectional view of the opposite end of the apparatus, the end at which the strip leaves the bath;

Fig. 3 is a view of the apparatus in transverse section, on the plane indicated at III—III in Fig. 2; and

Fig. 4 is a view of the apparatus in transverse section, on the same plane as Fig. 3, but showing certain parts of the apparatus in alternate positions.

In the treatment of many products in liquid baths, a precipitate, dross, sludge, or other particulate refuse material is produced in the bath. This material settles to the bottom of the bath, and from time to time must be removed. As noted, I am particularly concerned with the treatment of metal strip in molten salt baths, and to those familiar with the problems encountered in the operation of such baths, the unique features of the invention will be appreciated.

In the operation of the well-known sodium hydride descaling process with the bath at 700° F., scale is dislodged from the strip and forms a sediment at the bottom of the bath, while in the operation of the caustic soda process at 900° F. scale and sludge are deposited. The removal of this scale, or scale and sludge, from the bottom of the molten bath presents a serious problem.

Molten baths of the type mentioned are usually screened from the effects of the open atmosphere by means of covers, preferably covers of thermal insulating material, and my invention consists in the effective organization with such covers of a tray that is normally arranged in the lower depths of the bath to receive the accumulations of scale and other sediment. The cover and tray are interconnected in such way that the cover and tray are movable together to the top of the molten bath, and the cover is sustained at an interval above the tray, whereby workmen have free access to remove the accumulations of sediment from the tray then exposed at or above the surface of the bath. And in elaboration the apparatus preferably, if not essentially, includes special hoisting mechanism for the operation of the cover and tray assembly.

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In accordance with prior practice the covers of the baths have been removed entirely from the apparatus, and the sediment has been ladled out manually, resulting in hazards to the workmen, and in the loss of substantial quantities of the useful salt. Sometimes individual trays have been used in the baths, and after the covers have been removed and set aside, the trays are lifted and cleaned. This practice results in a great loss of time and labor, while withholding the apparatus from production and exposing the molten bath to the cooling and oxidizing influences of the open atmosphere. These objections are minimized in the practice of my invention.

Referring to the drawings, apparatus for the treatment of strips may consist in a tank or container 2 of conventional structure, equipped along its two sides with combustion tubes 3, into which jets of burning fuel are delivered by burners 4, while the products of combustion find escape to the outer atmosphere through stub-stacks 5. The heat thus developed in the system of tubes 3 maintains a bath B of the desired salt in molten condition and at desired temperature.

The strip S to be treated is caused to advance through the bath in a submerged course of travel, as may be understood upon considering Figs. 2 and 3 of the drawings. Guides in the form of hold-down rolls 6 (Fig. 2), rotatably mounted adjacent to the opposite ends of the bath B, and arranged immediately inward from the usual strip-supporting rolls 3 at the ends of the container 2, serve to maintain the strip submerged at the desired distance below the bath surface L. The strip is maintained taut, under the tension of the reels or driving rolls that draw the strip through the apparatus, such reels or driving rolls being conventional instrumentalities which are not illustrated in the accompanying drawings. The guides or rolls 6 are vertically adjustable, as by means of screw mechanisms 7. For an understanding of the general arrangement of

supporting and grinding rolls, driving rolls and screw mechanisms reference may be had to my co-pending application Serial No. 731,662, filed February 28, 1947. By the vertical adjustment of the guiding rolls 6, the extent and depth of the submerged course of travel of the strip is regulated, and by the control of the speed of rotation of the driving rolls or reels (not shown), the duration of exposure of the strip to the bath may be determined. These adjustments of the course and speed of travel of the strip in the bath may be understood upon reference to my said co-pending application, and it is needless unduly to involve this specification with further consideration of such matters. Suffice it to say that the strip S is caused to advance continuously at desired speed through the desired course of travel in the molten bath B, and as the strip rounds the guide roll 6 at the delivery end of the apparatus (Fig. 2), a "wiper" roll 9, cooperating with roll 8, squeezes adhering bath material from the emerging strip.

The surface of the bath is protected by means of a plurality of rectangular covers 10, and shields 11 and 12 over the rolls 6, 8 and 9. Each cover 10 is formed of a frame 13 of structural steel, to the bottom of which a steel plate 14 is welded, forming a pan which is filled with thermal insulation 15. Over the top of this structure a closure 16 of sheet steel is secured. The surface of the bath between the hold-down rolls or guides 6 adjacent to the opposite ends of the tank 2 is covered by a series of such covers 10; the covers rest upon and are partially submerged in the surface of the molten bath, and those covers which are abreast of the stub-stacks 5 are marginally recessed, as at 16, to clear the stacks.

With each cover 10 a tray 17 is provided, the trays comprising pans constructed of structural steel. In this case the pans are arranged to rest on the floor of the tank 2, at the bottom of the bath contained therein, and in any case the pans will be positioned at an interval below the course of submerged travel of the strip S through the bath, while the covers 10 are positioned in the surface of the bath at an interval above such course of travel. The several trays extend at the floor area of the bath where sediment accumulates in service, and from time to time, as the accumulation becomes excessive, the covers 10 and trays 17 are lifted from the bath and the trays cleaned.

In accordance with my invention means are provided for interconnecting the covers and trays, pair by pair, so that each cover and tray assembly may be lifted to the top of the bath and sustained, as shown in full lines in Fig. 4, with the cover vertically spaced above the tray so that the accumulated sediment A may be rapidly removed by workmen.

The means for interconnecting the cover and tray of each cover and tray assembly comprise four vertical supporting members 18, arranged astraddle or laterally of the course of travel of the strip S. The four members 18 are in this case welded at their lower ends to the body of the tray, and at their upper ends they extend through and are welded to the body of the cover. At the points where the members 18 extend through the cover, reinforcing channels 19 are embodied integrally in the cover structure, and straps 20 of metal are welded thereto, forming with the upwardly extending ends of the members 18 U-brackets 21, through which bolts or pins 22 are pressed, to provide means whereby

the cover and tray assembly may be engaged by hoisting means.

Advantageously, the hoisting means are provided as a stationary component of the strip-processing apparatus, although a mobile hoist of the types known to industry is held in contemplation. The stationary hoist illustrated herein comprises a superstructure 23 supported well above the tank 2, as by means of structural legs 23' that stand on the mill floor apart from and independently of the tank structure, whereby the hoist may be termed a gantry. On the superstructure 23 a pair of winch drums 24, 24 is provided for each cover and tray assembly, and on each drum a pair of cables 27, 28 is wound and secured at one end. The free reaches of the four cables of the two drums are severally trained upon pulleys 33, 33 that are rotatably mounted in the superstructure 23, each pulley being in vertical alignment with one of the four U-brackets of the cover. The otherwise free ends of the four cables are secured one to each of the four U-brackets of the cover and tray assembly. The two drums 24, 24 are secured on a common shaft 29 geared, as at 30, to a reversible electric motor 31, and by energizing this motor in one direction or the other the drums may be rotated and the four cables wound in or paid out, to lift or lower the cover and tray assembly.

Each cover and tray assembly is provided with such a hoist mechanism on the superstructure 23, and manifestly each assembly may be raised or lowered at the will of the attendant, to permit of the required scavenging of sediment.

It is important to note the particular cooperation between the vertically adjustable guide rolls 6 and the reciprocable cover and tray assemblies described. When the cover and tray assemblies are raised into elevated position, the guide rolls 6 may, by the operation of the adjusting mechanisms 7 (described in my said copending application Serial No. 731,662), be also raised. This complementary raising of the rolls 6 with the cover and tray assemblies causes the strip S, under the reeling tension imposed upon it, to rise substantially to the level of the supporting rolls 8 at the opposite ends of the tank, with the effect that the strip remains spaced above the trays when they are positioned at the top of the bath, as shown in Figure 4. Needless to say, the clearance between the strip and the elevated trays facilitates the work of the attendants in removing the accumulations A.

This adaptability of the apparatus to the complete removal of the sediment or accumulations from the bath, without the necessity of withdrawing or "unthreading" the strip, is a feature of notable value. And thus it is that the dangerous and costly operation of cleansing a molten salt bath is no longer a problem.

The shields 11 and 12 are suspended on counterweighted cables 32 trained on sheaves 25, 26, whereby the shields may be manually raised and lowered as desired. It will be perceived that the superstructure 23 is located at a sufficient height above the tank 2, to permit the cover and tray assemblies to be raised to the position illustrated in dotted lines in Fig. 4, thus entirely clearing the tank of the covers and trays when such a condition is desired for making repairs on the tank, or for other reasons.

Various modifications and departures from the structure described herein may be practiced without departing from the essence of the invention defined in the appended claims.

I claim:

1. Metallurgical apparatus comprising in combination, a container including a liquid bath for treating a continuous product, with an incidental accumulation of sediment in the bath, means for guiding said continuous product in an immersed course of travel through said bath, a bath cover above said course of travel, a tray positioned in said bath below said course of travel for the reception of sediment, and means straddling said course of travel and extending between said cover and tray, whereby the cover and tray may be lifted in vertically spaced relation above said bath to provide for the removal of accumulated sediment from the tray.

2. Metallurgical apparatus comprising in combination, a container including a liquid bath for treating a continuous product, with an incidental accumulation of sediment in the bath, means for guiding said continuous product in an immersed course of travel through said bath, a bath cover above said course of travel, a tray positioned in said bath below said course of travel for the reception of sediment, members arranged astraddle of said course of travel for interconnecting said cover and tray in vertically spaced relation, and means for connecting such cover and tray assembly to a hoist, whereby the assembly may be lifted above the bath to provide for the removal of accumulated sediment from said tray.

3. Metallurgical apparatus comprising in combination, a container including a liquid bath for treating a continuous product, with an incidental accumulation of sediment in the bath, means for guiding said continuous product in an immersed course of travel through said bath, a bath cover above said course of travel, a tray positioned in said bath below said course of travel for the reception of sediment, members arranged astraddle of said course of travel for interconnecting said cover and tray in vertically spaced relation, and hoist means arranged above said container for lifting said cover and tray assembly, to bring said tray into a position at the top of said bath for removal of accumulated sediment therefrom.

4. Apparatus comprising in combination a container including a liquid bath for treating a continuous or strip product, means for guiding said product through a submerged course of travel through said bath, a bath cover above said course of travel, a tray positioned in said bath below said course of travel for the reception of sediment, means straddling said course of travel and interconnecting said cover and tray, a gantry straddling said container, a hoist mounted on said gantry, and means connecting said cover and tray assembly to said hoist, whereby the cover and tray may be elevated in vertically spaced relation above said bath to provide for the removal of accumulated sediment from the tray.

5. Apparatus comprising in combination a container including a liquid bath for treating a continuous or strip product, raisable means for guiding said product through a submerged course of travel through said bath, a bath cover above said course of travel, a tray positioned in said bath below said course of travel for the reception of sediment, means straddling said course of travel

and interconnecting said cover and tray, a gantry straddling said container, a hoist mounted on said gantry, and means connecting said cover and tray assembly to said hoist, whereby the cover and tray may be elevated in vertically spaced relation above said bath to provide for the removal of accumulated sediment from the tray, together with means for raising said product-guiding means, whereby when said cover and tray assembly is elevated the guided product is sustained in a position below the elevated cover and at an interval above the elevated tray.

6. Apparatus comprising in combination a container including a liquid bath for treating a continuous or strip product, means for guiding said product through a submerged course of travel through said bath, a bath cover above said course of travel, a tray positioned in said bath below said course of travel for the reception of sediment, supporting means uniting said cover and tray, a gantry straddling said container, a hoist mounted on said gantry, and means connecting said cover and tray assembly to said hoist, whereby the cover and tray may be elevated in vertically spaced relation above said bath to provide for the removal of accumulated sediment from the tray.

7. Apparatus comprising in combination a container including a liquid bath for treating a continuous or strip product, raisable means for guiding said product through a submerged course of travel through said bath, a bath cover above said course of travel, a tray positioned in said bath below said course of travel for the reception of sediment, supporting means uniting said cover and tray, hoist means mounted in position to be effective above said container, means extending upward from the united cover and tray for connecting the same to said hoist means, whereby said cover and tray may be elevated and supported in a position above said bath, and means for raising said product-guiding means, whereby when said cover and tray are elevated the guided product is sustained in a position below the elevated cover and at an interval above the elevated tray.

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