No. 785,484. PATENTED MAR. 21, 1905.

O. S. FELLOWS & A. E. HOPKINS.

CAN END SOLDERING APPARATUS.

APPLICATION FILED NOV. 24, 1903.

7 SHEETS—SHEET 1.

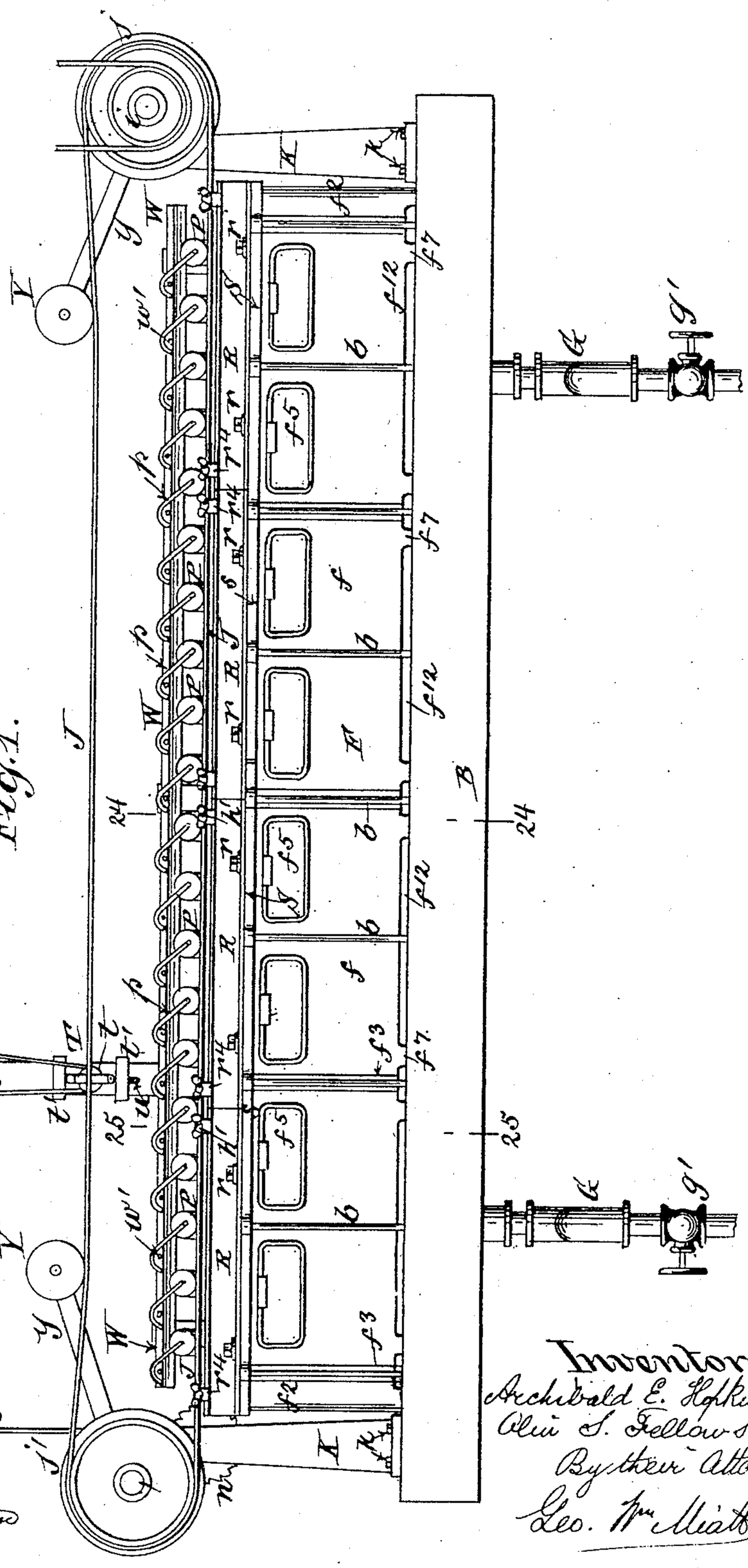

Fig. 1.

Witnesses:
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Inventors:
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By their Attorney
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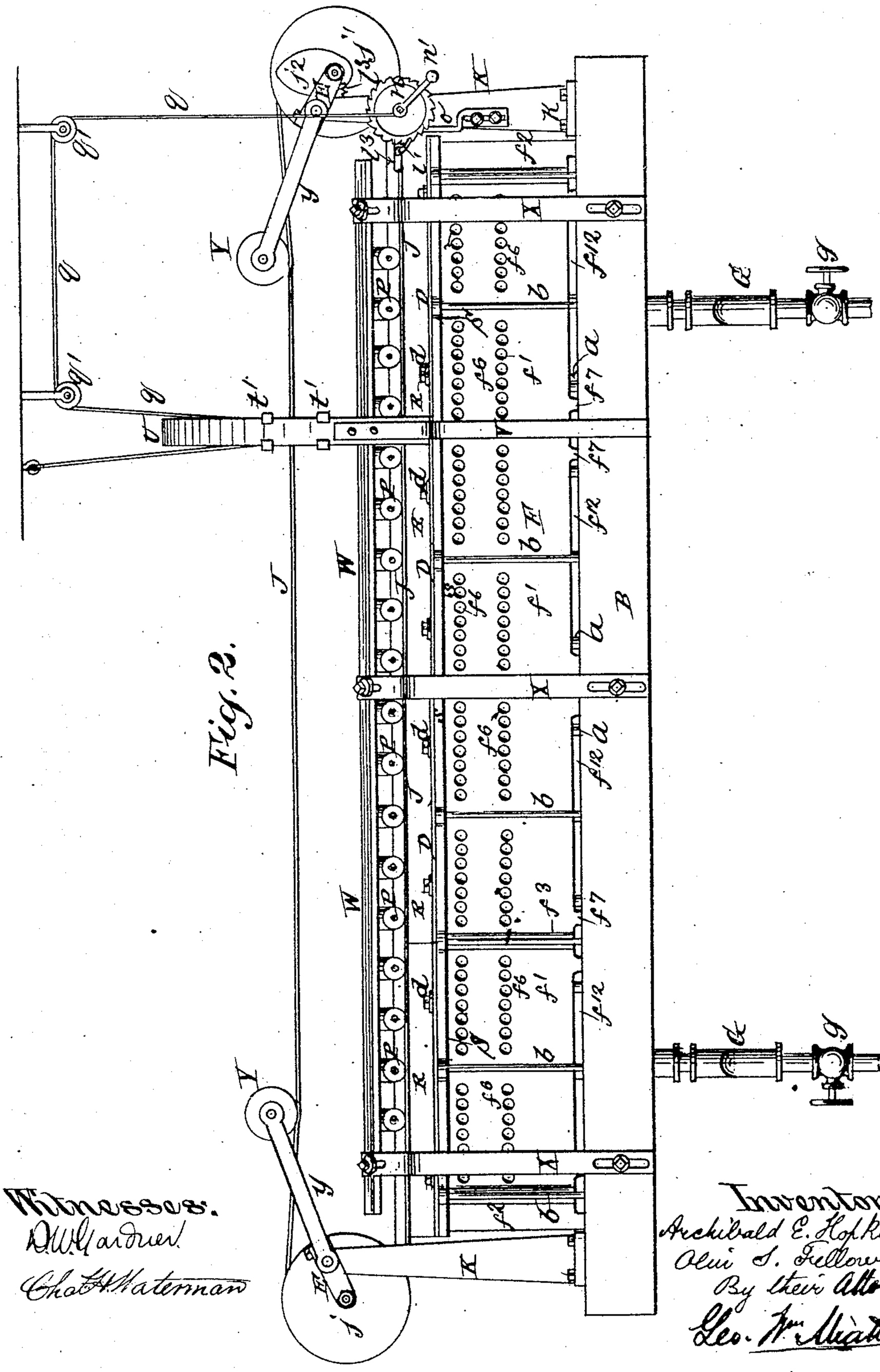

Fig. 2.

Witnesses.
D. W. Gardner
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Leo. F. Miatt

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7 SHEETS—SHEET 3.

Fig. 4.

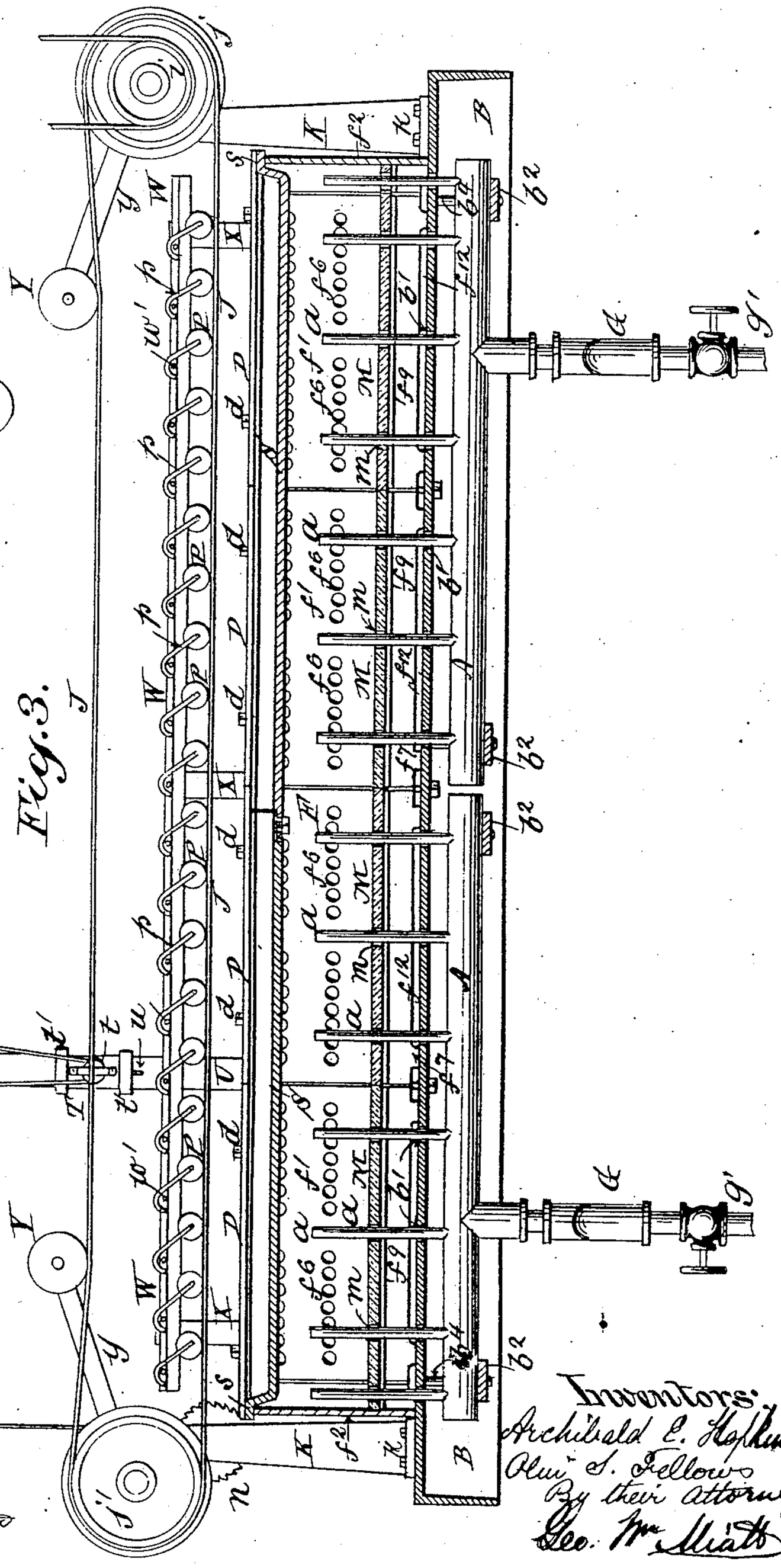

Fig. 3.

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7 SHEETS—SHEET 4.

Fig. 13.

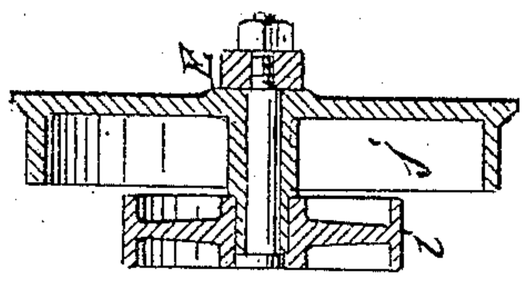


Fig. 12.

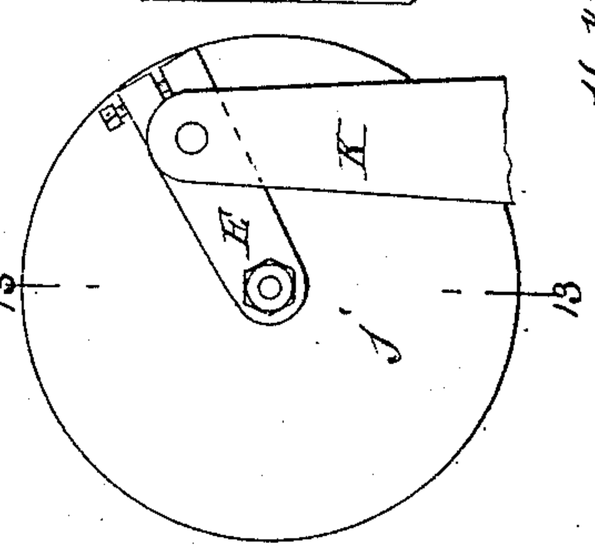


Fig. 8.

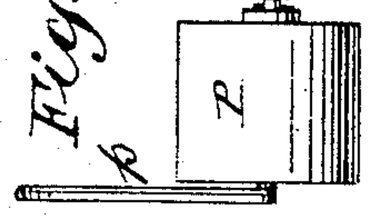


Fig. 7.

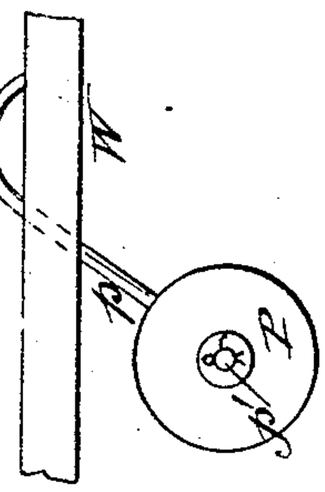


Fig. 6.

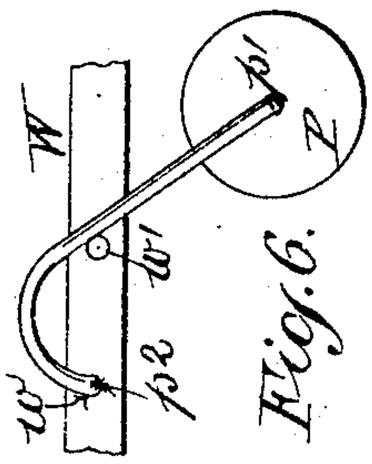


Fig. 5.

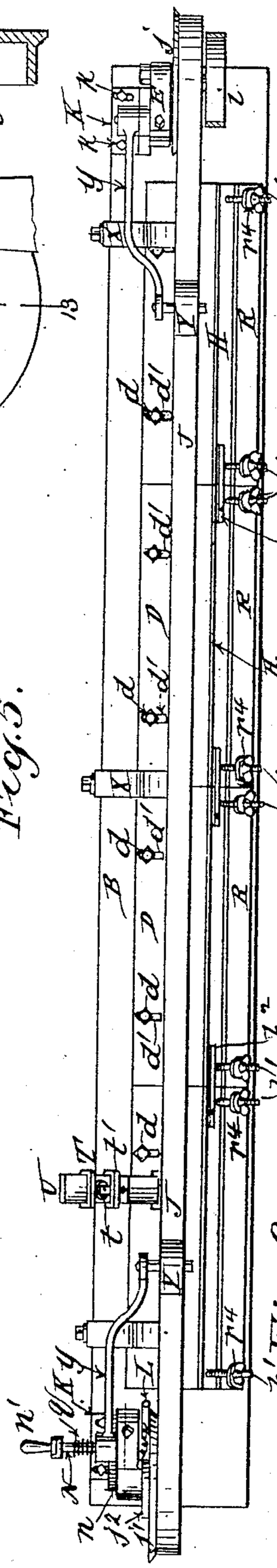


Fig. 11.

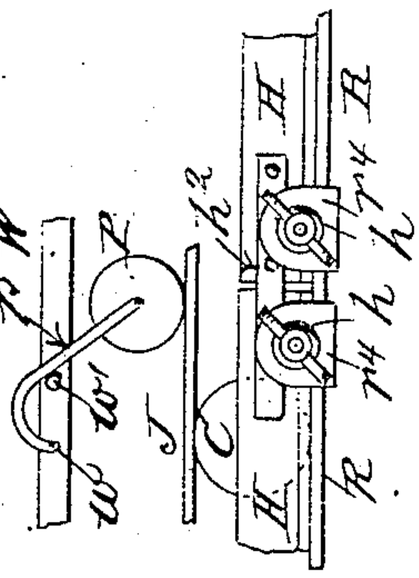


Fig. 10.

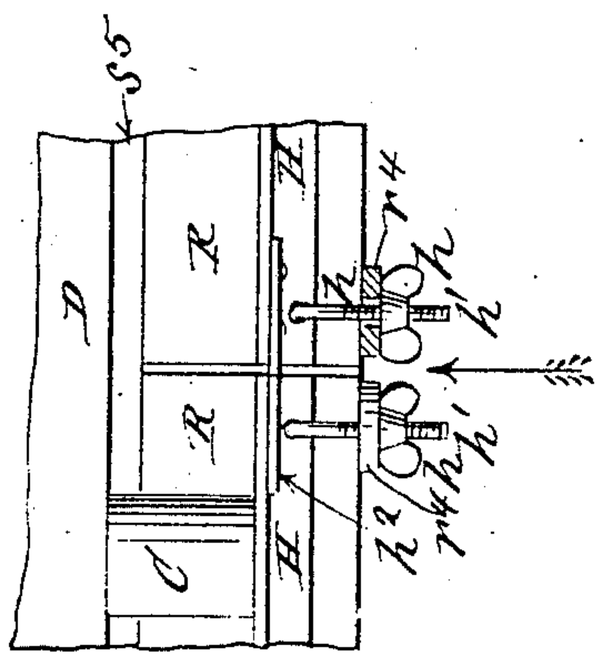
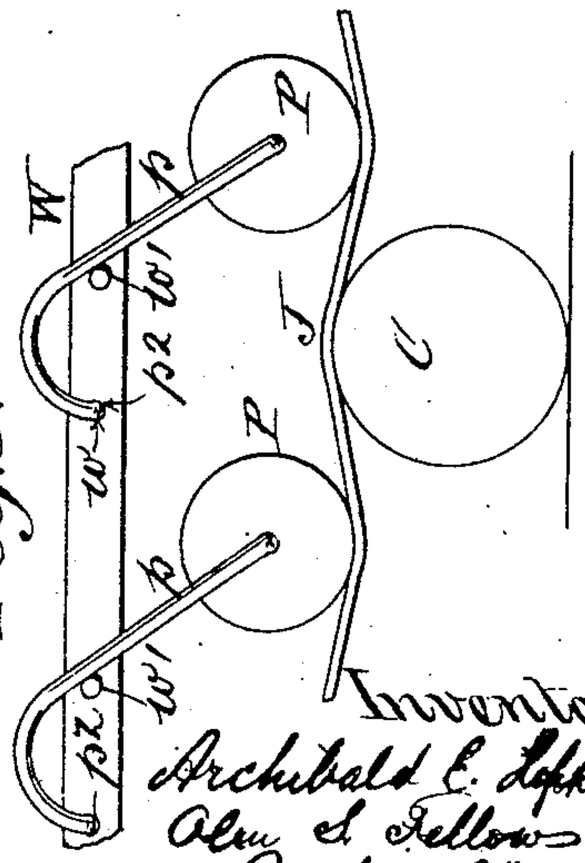


Fig. 9.



Witnesses:

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CAN END SOLDERING APPARATUS.

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7 SHEETS—SHEET 5.

Fig. 14.

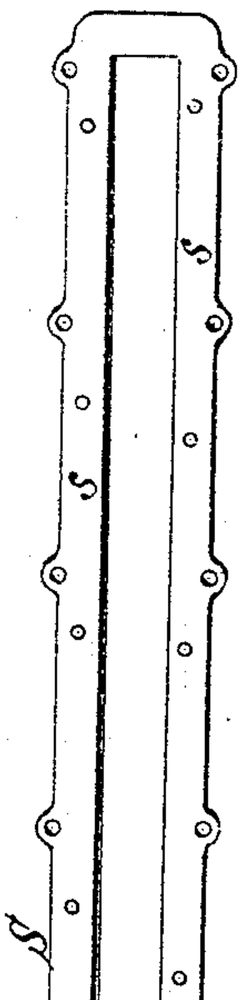


Fig. 15.

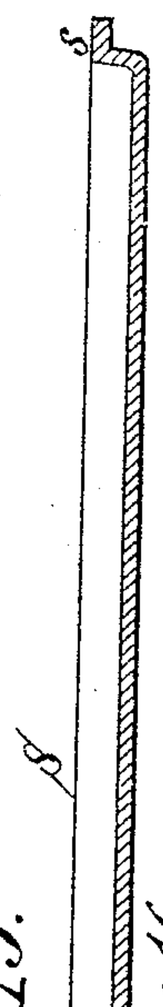


Fig. 16.

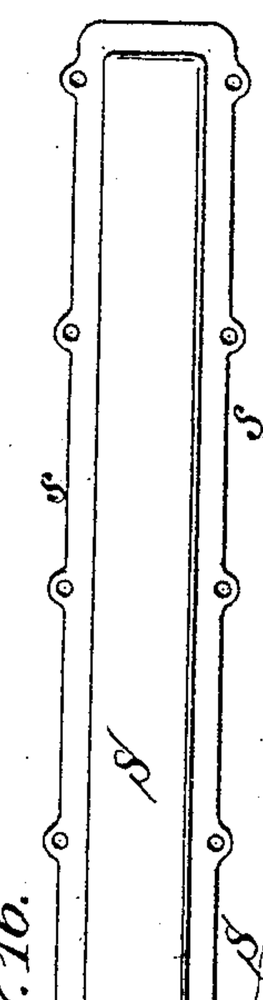


Fig. 17.

Fig. 18.

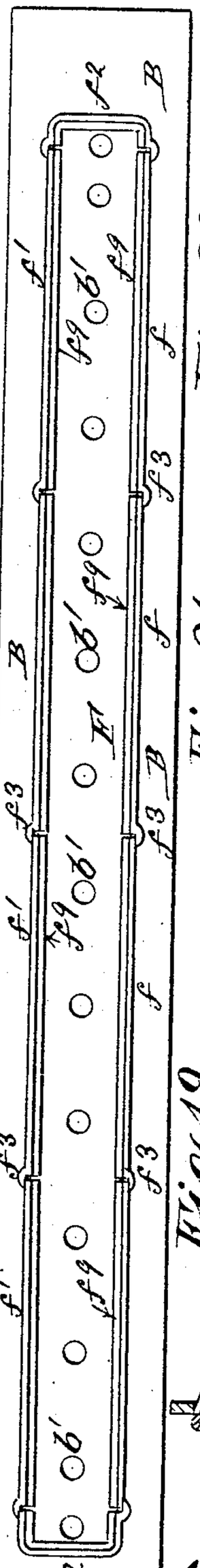


Fig. 23.

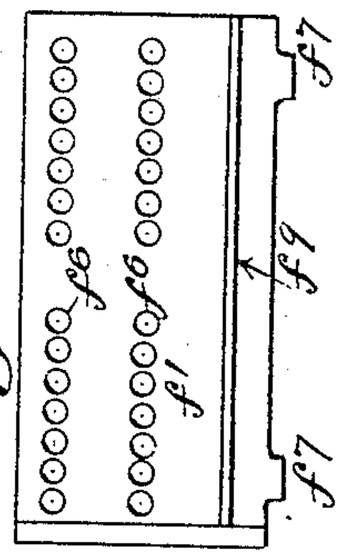


Fig. 21.

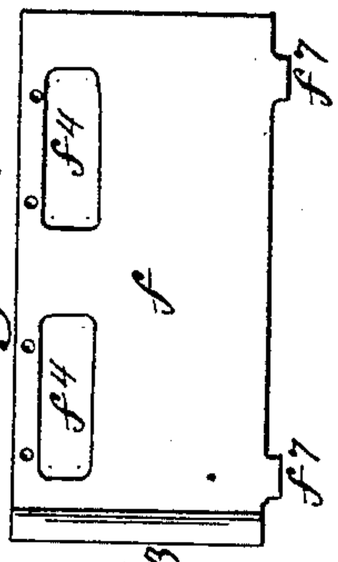


Fig. 19.

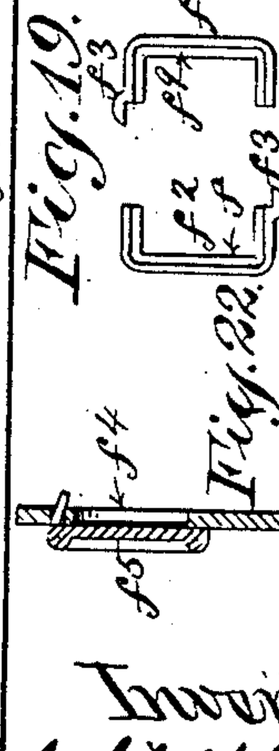


Fig. 22.

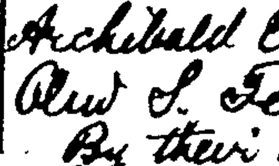
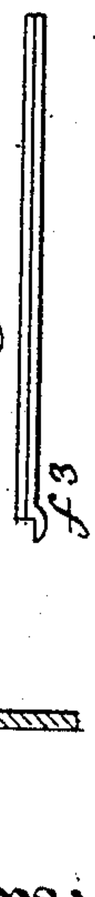


Fig. 20.



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No. 785,484.

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CAN END SOLDERING APPARATUS.

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7 SHEETS—SHEET 6.

Fig. 24.

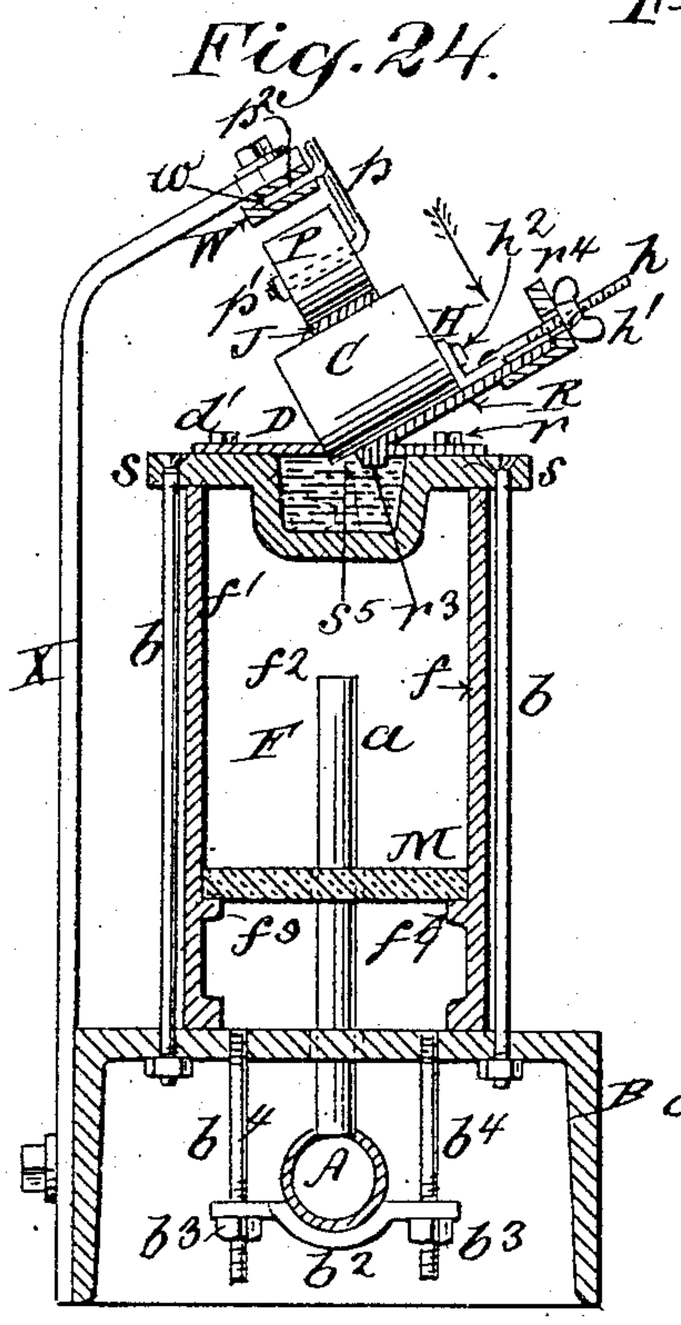


Fig. 28.

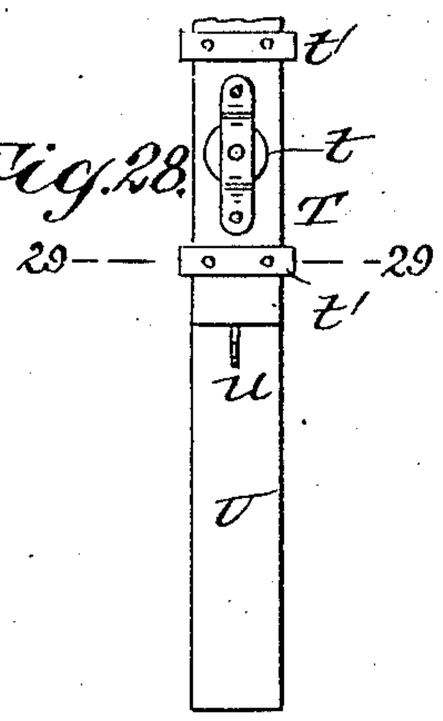


Fig. 29.

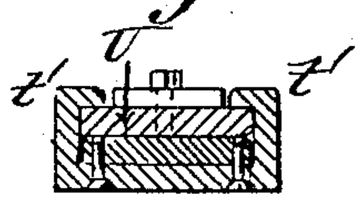


Fig. 30.

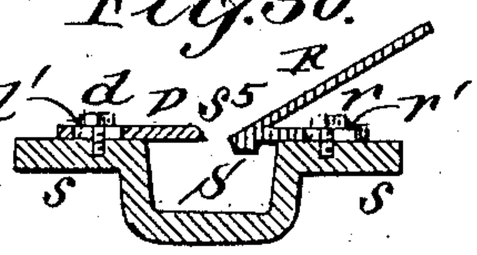


Fig. 25.

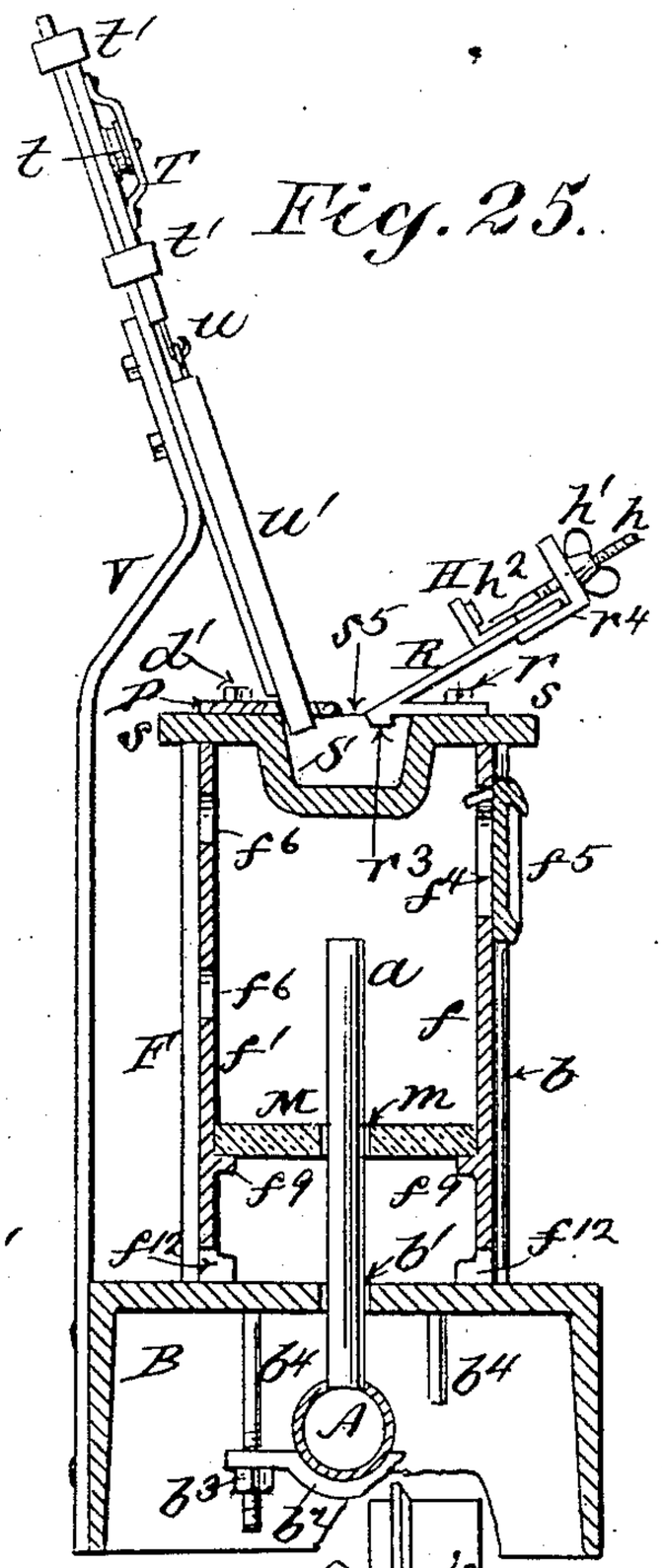


Fig. 26.

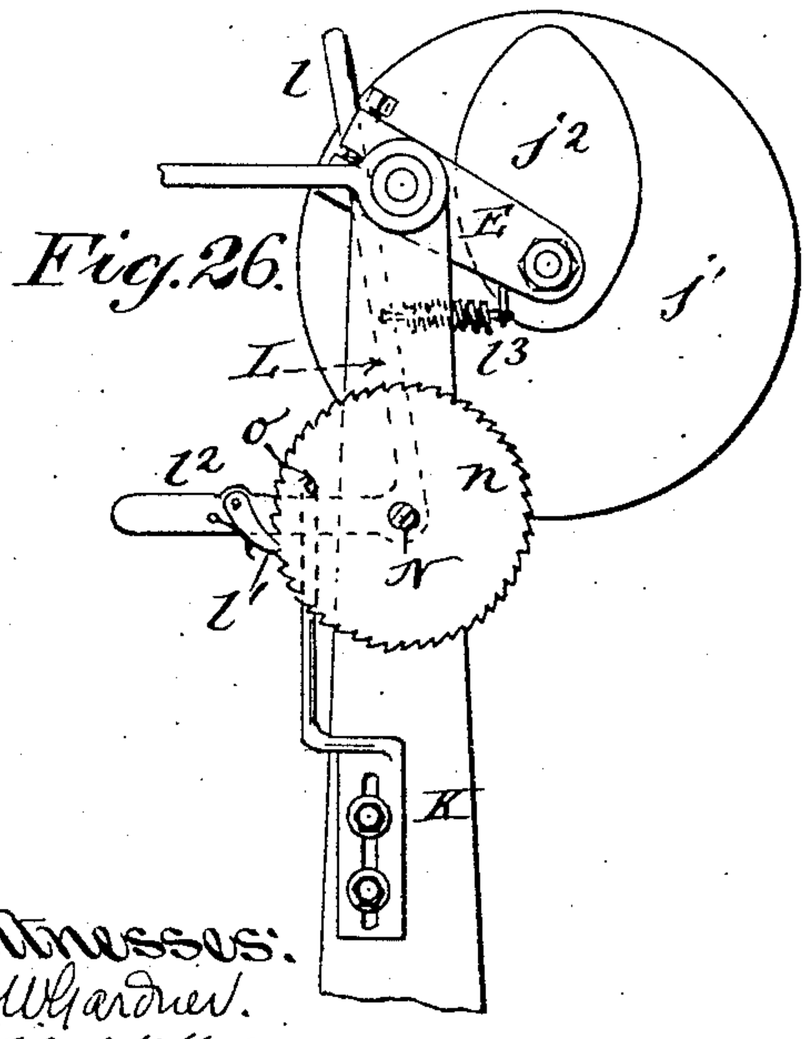
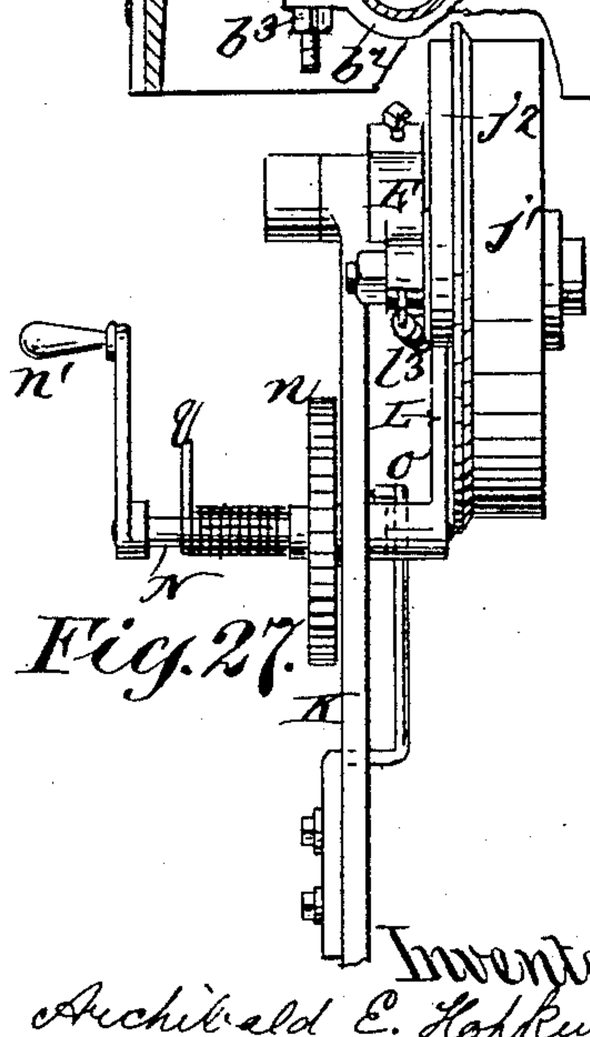


Fig. 27.



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No. 785,484. PATENTED MAR. 21, 1905.

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CAN END SOLDERING APPARATUS.

APPLICATION FILED NOV. 24, 1903.

7 SHEETS—SHEET 7.

Fig. 32.

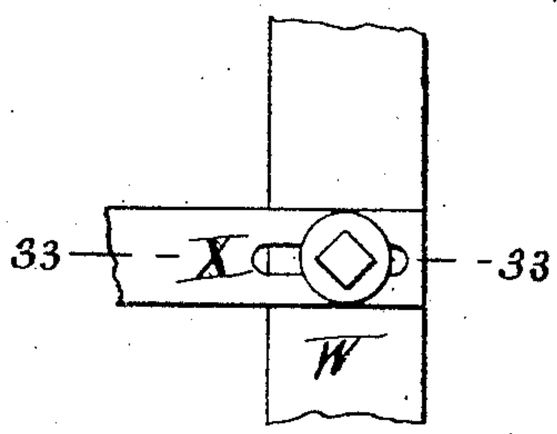
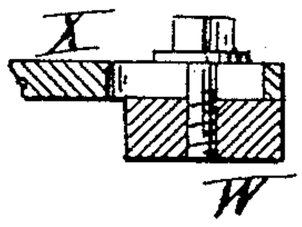


Fig. 33.



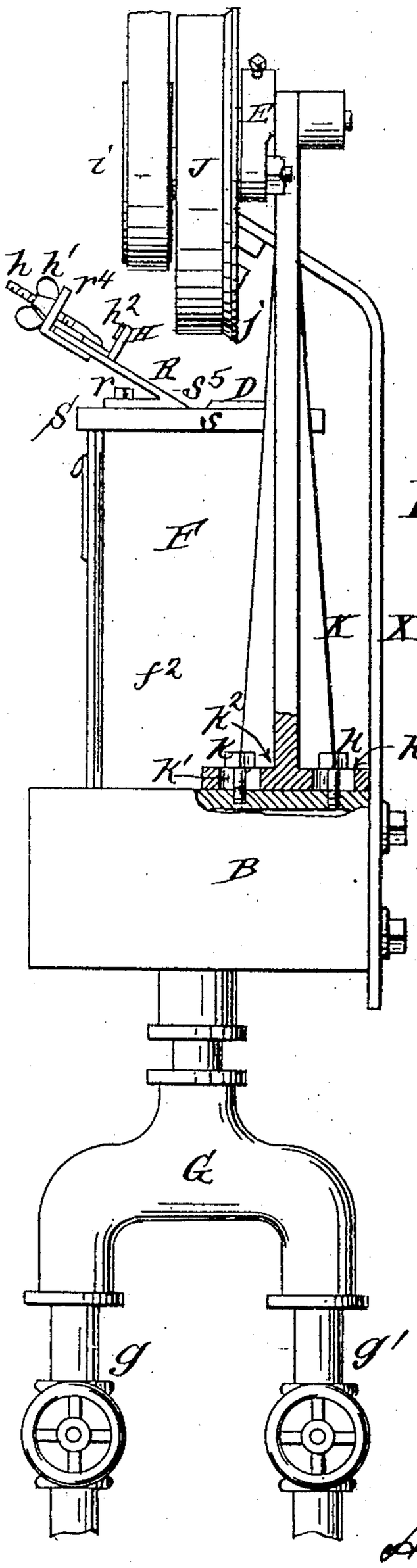


Fig. 31.

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Inventors:
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PHOTO LITHOGRAPHED AT SACKETT & WILHELMS LITHO. & PTG. CO. NEW YORK.

No. 785,484. Patented March 21, 1905.

UNITED STATES PATENT OFFICE.

OLIN S. FELLOWS AND ARCHIBALD E. HOPKINS, OF MIDDLETOWN, NEW YORK.

CAN-END-SOLDERING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 785,484, dated March 21, 1905.

Application filed November 24, 1903. Serial No. 182,469.

To all whom it may concern:

Be it known that we, OLIN S. FELLOWS and ARCHIBALD E. HOPKINS, citizens of the United States, residing at Middletown, Orange county, and State of New York, have invented certain new and useful Improvements in Can-End-Soldering Apparatus, of which the following is a specification, sufficient to enable others skilled in the art to which the invention appertains to make and use the same.

Our invention relates to apparatus for soldering the end plates of sheet-metal cans to the can-bodies; and it consists in the special construction and arrangement of parts hereinafter described and claimed specifically.

One object of our invention is to maintain the alinement of all parts of the apparatus so as to insure a proper immersion of the can for its entire circumference through the entire length of the solder-bath, thereby avoiding imperfections in soldering that have heretofore resulted from the warping of the parts under the relatively high temperature at which the solder-bath has to be maintained. In this connection may be noted our method of regulating the temperature of the solder-bath with accuracy with relation to the requirements of the particular size of can under treatment in the apparatus, the parts of the latter being made adjustable, as hereinafter set forth, to accommodate different sizes of cans. Our fire-box is also of novel form, including a partition arranged to hold the heated gases away from the unyielding base.

Another feature of our invention is the use of a yielding pressure-rail for the upper ends of the cans, so constructed as to adapt itself automatically to any slight variation in the length of the cans and to exert a positive downward pressure against the cans to maintain the contact of the lower ends of the cans with the supporting guide-rail, thereby insuring a proper depth of immersion for all the cans, and consequently a uniform take-up of solder. Heretofore the top guide-rails, even when made adjustable, have been held rigidly in position during use, simply confining the cans within a given space by exerting no pressure thereon excepting upon cans of undue length, which would bind between the upper and lower guide-rails and clog the runway, a difficulty avoided in our apparatus by the yielding pressure-rail.

In order to hold the cans down firmly against the runway as they pass over it, we use a series of gravity-rollers in connection with the can-forwarding belt, said gravity-rollers being pivotally supported in such manner as to be free to adapt themselves to the cans as the latter pass underneath the forwarding-belt while holding the belt taut against and between the cans. We also employ one or more automatic tension-rollers upon the forwarding-belt, acting in conjunction with but in opposition to the gravity-rollers for the purpose of counterbalancing the tendency of the lower or forwarding surface of the belt to sag unduly. Thus the forwarding-belt is not only held against possible contact with the solder-bath, but sufficient frictional contact between the belt and the carrying-pulleys is maintained to insure against slip or irregularity of motion. Thus, also, by using tension-rollers upon the upper or retractile surface of the belt of a weight proportionate to the diameter of the cans to be treated the pressure of the gravity-rollers on the lower or forwarding surface of the belt may be so regulated as to avoid possibility of injury to the can-bodies while affording the requisite degree of tension.

It is obvious that in lieu of a series of tension-rolls of different weights one or more adjustable tension devices may be substituted, if preferred, the essential feature of our invention in this connection consisting in the use of a counterpoise or weight arranged to counteract more or less the downward pressure of the gravity-rollers on the can-forwarding surface and to keep the latter taut and approximately in a straight line parallel to the surface of the solder-bath.

We are aware that pivoted weights have been used in connection with can-forwarding chains; but such weights are not the equivalent of our gravity-rollers used in conjunction

with a flat can-forwarding surface or belt, since by our combination an even uniform pressure is exerted on each can and all danger of injury thereto is avoided. A series of weights extending over a long forwarding-surface, such as herein shown, would create too much frictional resistance and cause the belt to slip on its carriers and would necessitate an increase in the motive power. We are also aware that rollers with fixed journals have been used; but these obviously cannot perform the same function as our freely-suspended gravity-rollers, which can yield to the cans as they pass. Furthermore, we are aware that spring-rollers have been used in connection with forwarding-chains, and we expressly disclaim any such arrangement, which it is our object to avoid. Our rollers are journaled and suspended upon arms pivotally attached to a rigid support, the suspending-arms being of such length that the gravity-rollers trail along the can-forwarding surface and are free to ride over the inclines caused by the cans as they pass underneath, the point of pivotal suspension of each gravity-roller being in the rear of its journal, so as to insure the greatest possible freedom and delicacy of movement of the rollers over the can-forwarding surface.

For the purpose of preventing an excess of solder on the cylindrical sides of the can we form the lower edge of our runway with an antiripple-flange, which projects into the solder-bath and by displacing the solder at a point below the edge of the runway avoids the agitation of the solder-surface that would otherwise be caused by the rapid passage of the cans, resulting in waves or ripples that are apt to carry the solder above the edge of the runway.

We maintain the proper level of solder within the solder-trough by means which are automatic and adjustable to meet the requirements of the different sizes of cans treated in the apparatus. The novelty in this connection consists in actuating the solder-feed mechanism by motion derived directly from the can-forwarding mechanism, so that the rate of feed will be governed by and in proportion to the number of cans passed over the solder-bath under ordinary conditions of use. Furthermore, by providing means for varying the amount of solder thus fed automatically to the bath we are able to regulate the same with relation to the size and requirements of the cans to be treated, so as to compensate with accuracy for the amount of solder taken up by the cans as they pass over the bath.

In the accompanying drawings, Figure 1 is a front elevation of our improved soldering apparatus; Fig. 2, a rear elevation of the same; Fig. 3, a longitudinal section taken upon a vertical plane extending through the center of the solder-trough, certain parts being shown in elevation. Fig. 4 is a view illustrating a modification of the means for automatically maintaining the tension of the can-forwarding belt. Fig. 5 is a plan of the apparatus. Fig. 6 is a front elevation, Fig. 7 a rear elevation, and Fig. 8 a side elevation, of one of the gravity-rollers. Fig. 9 is a diagram illustrating the action of the gravity-rollers. Fig. 10 is a plan taken in the direction of the arrow, Fig. 24, showing the abutting ends of two sections of the inclined runway. Fig. 11 is a detail view looking in the direction of the arrow, Fig. 10. Fig. 12 is a detail view showing the adjustable support for one of the forwarding-pulleys. Fig. 13 is a section on plane of line 13 13, Fig. 12. Fig. 14 is a top view of the solder-trough; Fig. 15, a central longitudinal section thereof; Fig. 16, a view of the under side of the same. Fig. 17 is a sectional view, upon an enlarged scale, taken upon plane of line 17 17, Fig. 16. Fig. 18 is a top view of the fire-box with the solder-trough removed. Fig. 19 is a view of the opposite end pieces of a fire-box. Fig. 20 is an edge view of one of the front plates of the fire-box. Fig. 21 is an elevation of the same. Fig. 22 is a sectional view, upon an enlarged scale, of one of the front plates, showing a damper-plate in position. Fig. 23 is an elevation of the inside of one of the rear plates of the fire-box. Fig. 24 is a transverse section, partly in elevation, of the apparatus, upon an enlarged scale, on plane of line 24 24, Fig. 1. Fig. 25 is a similar view taken upon plane of line 25 25, Fig. 1. Fig. 26 is a rear elevation of the automatic solder-feed. Fig. 27 is a side elevation of the same. Fig. 28 is a detail elevation of the solder-carriage. Fig. 29 is a section upon plane of line 29 29, Fig. 28, on an enlarged scale. Fig. 30 is a transverse section of the solder-trough, inclined runway, and supporting-rail, showing means of adjustment. Fig. 31 is an end elevation of the apparatus; Fig. 32, a top view, upon an enlarged scale, of a portion of the gravity-roller bar; Fig. 33, a section upon plane of line 33 33, Fig. 32.

B is an inflexible base, preferably of channel-iron, to which the fire-box F and solder-trough S are rigidly secured by means of bolts *b* or equivalent means.

The fire-box F is made in sections, consisting of front and rear plates $f\,f'$ and end plates f^2. One vertical edge is formed with a flange f^3, which overlaps the abutting end of the adjoining plate, as will be seen clearly by reference to Fig. 18. The front plates f are formed with damper-openings f^4, over which may be placed plates or covers f^5, as shown in Fig. 22. The plates f may be used to regulate the heat underneath the solder-trough where there is any tendency to overheat and being added at points where there is a tendency to fall below the temperature required. The rear plates f' are formed with perforations f^6 for the escape of the gaseous products of combustion. All the fire-box plates are formed at the bottom with

projections f^7 for contact with the upper surface of the inflexible base B, thereby forming elongated openings f^{12} between the lower edges of said fire-box plates and the upper surfaces of the said base for the admission and circulation of air below the horizontal partition M, which constitutes the bottom of the combustion-chamber. This partition M is supported upon flanges f^9 upon the inner sides of the fire-box plates and is formed with perforations m for the admission of the burners a, the inflexible base B being also in like manner formed with perforations b' for the accommodation of said burner-tubes a.

The solder-trough S rests directly upon the upper edges of the fire-box plates $f\ f'\ f^2$, its flanges s projecting beyond the said fire-box plates, so that the bolts b may be placed external of the fire-box, said bolts thus binding rigidly together the solder-trough, fire-box, and inflexible base B, as will be understood by reference to Fig. 24.

The solder-trough S may be made in two or more sections, the abutting ends being formed with flanges $s'\ s^2$, which overlap, as shown in Fig. 17. These flanges $s'\ s^2$ are secured together, preferably, by the use of screw-bolts s^3, the bolt-holes s^4 in the outer flange s^2 being elongated or enlarged sufficiently to compensate for expansion between the parts, as shown in said Fig. 17.

The burners a project from the horizontal tubes A, which are supplied with air and gas by the pipes g and g' through the medium of the union G. The tubes A are supported by the inflexible base B by any means which will admit of adjustment vertically, so as to regulate the distance between the upper ends of the burners a and the under surface of the solder-trough S. In the drawings the pipes A are shown as resting upon the stirrups b^2, supported by nuts b^3 upon the screw-rods b^4, projecting from the under side of the inflexible base B. It is obvious that other mechanical expedients may be resorted to in effecting the vertical adjustment of the burners, and we do not confine ourselves to the means herein shown, since any contrivance which will regulate the position of said burners with relation to the under side of the solder-trough S will answer the purpose.

R is the inclined runway, over which the cylindrical bodies of the cans C roll with their lower ends in contact with the supporting-rail D. Both the runway R and the supporting-rail D are made in two or more sections, the drawings showing them divided into four sections each, the abutting ends of which rest loosely against each other. The several sections of the runway R and of the supporting-rail D are secured to the flanges $s\ s$ by means which will admit of their lateral adjustment thereon for the purpose of increasing or diminishing the width of the soldering-slot s^5, formed by and between the opposed inner edges of the runway and the supporting-rail. Means for effecting these adjustments may consist of set-screws r, projecting through slots r' in the base-plates r^2 of the runway R, and set-screws d, passing through slots d' in the supporting-rail D, as shown, or of any other preferred form of mechanism.

The extreme lower edge of the runway R is formed on its under side with an antiripple-rib r^3 for the purpose of displacing the solder, which would otherwise be apt to wash up onto the cylindrical bodies of the cans, especially when the latter are traveling at a high rate of speed.

H is the top pressure-rail, suspended upon the runway R by screw-rods h, the lower ends of which are riveted or otherwise secured to said pressure-rail, the upper ends of said screw-rods projecting through flanges $r^4\ r^4$ upon the upper edge of the runway R and engaging with nuts $h'\ h'$, which rest against the upper sides of said flanges $r^4\ r^4$, the screw-rods being thus free to move longitudinally, excepting as limited by the nuts h', which the downward movement of the pressure-rail H adjusts or limits. Thus the position of the top pressure-rail H may be adjusted to any length of can desired, while leaving it free to conform to slight variations or irregularities in length or form of can under treatment—that is to say, we use a free top pressure-rail which, while yielding to the cans, tends constantly by its weight to force the cans downward against the supporting-rail D, and thereby insure the proper immersion of the lower edges of the cans in the solder-bath. This top guard H is made in two or more sections independently and adjustably supported, as before stated. The forward end of each section is formed with an extension or shoulder h^2, which overlaps the rear end of the next preceding section, as shown clearly in Figs. 10 and 11, so that the rear end of one section will lift the front end of the next succeeding section in case a can of irregular shape or length forces the guard-rail upward. By this means the sections are kept in alinement, so that the forward end of a succeeding section can by no possibility protrude into the path of the cans.

J is an endless can-forwarding belt traveling over pulleys $j\ j'$ in the usual manner, except that the said pulleys are adjustable both vertically and horizontally to meet the requirements of the different sizes of cans for which the other parts of the apparatus may be set. The horizontal adjustment of the pulleys $j\ j'$ is preferably effected by making the supporting-standards K adjustable upon the upper face of the inflexible base B by any suitable means, as by the set-screws $k\ k$ passing through the slots k' in the foot-plate k^2 of each of said standards K. Provision is made for adjusting the pulleys $j\ j'$ vertically by mounting them upon arms E, clamped to studs upon the stand-

ards K, these arms E carrying the pulley-journals. The driving-pulley *i* is mounted upon the hub of the belt-pulley *j*.

On the rear of the belt-pulley *j'* is formed or attached a cam j^2, which at each revolution of the pulley *j'* engages the lever-arm *l* of the rock-lever L, which is fulcrumed upon the inner end of the shaft N. This shaft N carries a ratchet-wheel *n*, with which engages a spring-pawl *l'* upon the short arm l^2 of the rock-lever L. The short arm l^2 of the lever L is held against an adjustable stop *o* by a retractile spring l^3, except when the cam j^2 is in contact with the lever-arm *l*, in which case the lever L is rocked so that the spring-pawl *l'* advances the ratchet-wheel *n* a distance prescribed by the stop *o*—that is to say, the stop *o* regulates the length of contact of the cam j^2 with the lever-arm *l*, and therefore the degree to which the lever L is rocked.

A cord *q* is secured to the hollow shaft N, which is utilized as a drum for said cord. The shaft N is provided with a crank-handle *n'*, by which it may be turned in a direction opposite to that in which the shaft is turned by the ratchet-wheel *n* when unwinding the cord *q* from the shaft N, the handle being provided for the purpose of rewinding the cord upon the shaft. The cord *q* extends from the shaft N over pulleys *q' q'*, under a pulley *t* upon the solder-carriage T, and thence to the ceiling or other elevated part to which it is secured. The solder-carriage T is held upon the track or guide plate U by flanges *t'* in such manner that it is free to slide thereon. It is provided with a hook *u* for the support of the bar of solder *u'*. The track-plate is supported upon the standard V or any stationary support.

It will be seen that by the rotation of the belt-pulley *j'* the cam j^2, acting, through the rock-lever L, upon the ratchet *n*, will cause the latter to release or unwind a portion of the cord *q* equivalent to the number of ratchet-teeth moved. This unwinding of the cord *q* allows a corresponding descent of the solder-carriage T and solder *u'*, the pulley *t* reducing the motion one-half and rendering it smooth and uniform. Thus by regulating the position of the stop *o* more or less solder may be fed to the bath, according to the requirements of the size of can under treatment.

P P are a series of gravity-rollers pivotally connected with the horizontal bar W, which is supported adjustably on the standards X, which are themselves adjustable vertically upon the inflexible base B, as will be seen by reference to Fig. 2. This vertical adjustment of the standards X and the lateral adjustment of the horizontal bar W is for the purpose of regulating the position of the gravity-rollers P with relation to the forwarding-surface of the belt J. The journals *p'*, upon which the rollers P rotate, are connected by the arms *p* with the pivots p^2, fitting in the holes *w*, formed for their reception in the horizontal bar W. These arms *p* are of sufficient length to cause the gravity-rollers P to trail along over the forwarding-surface with their journals *p'* considerably in the rear of the pivots p^2, thus insuring freedom and delicacy of movement on the part of the rollers in adjusting themselves to the forwarding-surface as the cans pass successively underneath.

w' represents stops arranged upon the horizontal bar W to limit the downward movement of the gravity-rollers P and to support them in the absence of the cans.

The tendency of the gravity-rollers P is to increase the frictional contact of the forwarding-surface with the cylindrical bodies of the cans by depressing said forwarding-surface more or less between the cans, as indicated diagrammatically in Fig. 9, thus insuring a positive forwarding of each can and preventing bunching.

We are aware that pivotally-supported weights have been used in connection with a can-forwarding chain; but such weights and chains are not the equivalent of our pivotally-supported rollers trailing on a broad flat forwarding-belt. By the use of the rollers in connection with the broad-surfaced forwarding-belt we protect the can against jar and injury by reason of sudden impact and insure a smooth, even, gradual, and uniform pressure of the broad forwarding-surface against the cylindrical bodies of the cans. It will be seen by reference to Fig. 9 that the peripheral surfaces of the rollers travel in the same direction as the peripheral surfaces of the cans, and that consequently the can-bodies encounter the resistance afforded by the rollers gradually and gently and are relieved from such resistance in like manner, so that the bumping, knocking, or pounding of the can-bodies is an impossibility. At the same time the gradual gentle elevation and depression of the rollers successively as the can-bodies pass under the broad surface of the forwarding-belt creates a deflection of the belt between adjacent rollers, as shown in Fig. 9, thereby maintaining the perfect timing and alinement of the cans.

It is obvious that the cans of larger diameter are less able to sustain the pressure of this frictional contact than those of smaller diameter, and as we have designed our apparatus for the soldering of various sizes of cans we provide means for regulating and counteracting automatically the pressure exerted by the gravity-roller P indirectly on the can-bodies. Means which may be employed for the purpose are one or more tension-regulators acting upon the upper or retractile portion of the forwarding-belt J. Thus one or more tension-rolls Y of a desired weight may be used, different weights of tension-rolls being provided for different sizes of cans. By way of illustration two of these are shown in the drawings journaled upon arms *y*, which are pivotally supported on the standards K.

It is obvious that other forms of tension devices may be substituted for the tension-rolls shown—such, for instance, as one or more spring tension devices Y′, (illustrated in Fig. 4,) in which provision is made for increasing or diminishing the pressure exerted upon the belt J—and we do not, therefore, limit ourselves in this respect, the essential feature of our invention in this connection being the combination and use, in conjunction with the gravity-rollers acting upon the lower or forwarding portion of the belt, of means for exerting a counterbalancing pressure upon the upper or retractile portion of the belt.

Heretofore more or less difficulty has been experienced in soldering-machines by the warping of the parts, especially of the soldering-trough, causing unevenness in the dip and in the amount of solder taken up by the cans. It is desirable that the run of the cans should be absolutely level for the full length of the soldering-bath in order to attain uniform results with a minimum of heat and solder. When the parts are level and accurate, the cans can be effectually soldered with less heat and less solder and with a shorter run than where the latter is rendered irregular and uneven by reason of the warping or buckling of the parts. It will be seen that, as herein set forth, we provide for the natural expansion of the parts by means which obviate all danger of warping and buckling, and we are thus enabled to attain better results with a shorter run or solder-bath.

Another feature that contributes to the general result is the maintenance automatically of the level of the solder within the soldering-trough by the feed actuated indirectly by the forwarding-surface, since the parts can be so regulated and adjusted that a prescribed amount of solder may be added to the bath for a given length of forwarding-surface, and thus the feed of solder may be proportioned to the size of the can to be treated.

Our yielding top-pressure rail is of importance in that it is the first top-pressure rail arranged to press the cans downward positively against the supporting-rail, thereby insuring the same degree of immersion for each run of cans whether above or below the normal length, as well as for a run of cans that are of normal length, such variations, though slight and caused only by difference in thickness of metal composing the end plates, being sufficient in the case of a run of shorter cans to afford a looseness or play between the supporting-rail and upper guard-rail when the latter is fixed rigidly in position to admit of such cans passing over the surface of the solder without contact with the supporting-rail, and therefore without the prescribed degree of immersion.

The adjustment of the burners with relation to the under side of the solder-trough is also of especial importance in an apparatus designed like ours for the treatment of several sizes of cans, since the larger the cans treated the more heat and solder required, and vice versa.

What we claim as our invention, and desire to secure by Letters Patent, is—

1. In can-end-soldering apparatus, the combination of a rigid metallic base, a solder-trough formed with lateral flanges extending longitudinally on either side above the bottom of the trough, a fire-box interposed between the flanges of said solder-trough and said rigid metallic base, and means for securing the parts named rigidly together, substantially as set forth.

2. In can-end-soldering apparatus, the combination of a rigid metallic base, a solder-trough formed with lateral flanges extending longitudinally on either side above the bottom of the trough, a fire-box formed in sections interposed between the flanges of said solder-trough and said rigid metallic base, and means for securing the parts named rigidly together, substantially as set forth.

3. In can-end-soldering apparatus the combination of a rigid metallic base, a solder-trough formed with lateral flanges extending longitudinally on either side above the bottom of the trough, a fire-box interposed between the flanges of said solder-trough and said rigid metallic base, and bolts connecting the flanges of the solder-trough with said metallic base whereby the parts named are rigidly secured together as and for the purpose set forth.

4. In can-end-soldering apparatus the combination of a rigid metallic base, a solder-trough formed with lateral flanges extending longitudinally on either side above the bottom of the trough, a fire-box formed in sections interposed between the flanges of said solder-trough and said rigid metallic base, and bolts connecting the flanges of the solder-trough with said metallic base, whereby the parts named are rigidly secured together as and for the purpose set forth.

5. In can-end-soldering apparatus, the combination of a rigid metallic base of channel-iron, a flanged solder-trough, a fire-box interposed between said solder-trough and the web of the channel-iron, bolts connecting the flanges of the solder-trough with the web of the channel-iron whereby the parts named are secured rigidly together, and a series of burners supported on and under the web of the channel-iron and between its flanges and projecting up through the said web into the fire-box, for the purpose set forth.

6. In can-end-soldering apparatus, the combination of a rigid metallic base, a flanged solder-trough, a fire-box formed in sections interposed between the flanges of said solder-trough and said rigid metallic base, bolts connecting the flanges of the solder-trough with said rigid metallic base, a series of burners in said fire-box, and a supply and supporting

tube for said burners mounted upon said rigid metallic base, substantially as and for the purpose described.

7. In can-end-soldering apparatus the combination of a rigid metallic base, a flanged solder-trough, a fire-box formed in sections interposed between the flanges of said solder-trough and said rigid metallic base, bolts connecting the flanges of the solder-trough with said rigid metallic base, a series of burners in said fire-box, a supply and supporting tube for said burners mounted upon said rigid metallic base, and means for effecting the adjustment of said supporting-tube vertically upon said metallic base for the purpose described.

8. In can-end-soldering apparatus, the combination of a rigid metallic base, a flanged solder-trough, a fire-box formed in sections interposed between the flanges of the said solder-trough and said rigid metallic base, bolts connecting the flanges of the solder-trough with said rigid metallic base, a series of burners in said fire-box supported upon a common supply-pipe, said common supply-pipe supported upon the said rigid metallic base, and a partition of refractory material in said fire-box interposed between the said solder-trough and the said rigid metallic base for the purpose set forth.

9. In can-end-soldering apparatus, the combination of a rigid metallic base of channel-iron, a flanged solder-trough, a fire-box interposed between the said solder-trough and the web of the channel-iron, bolts connecting the flanges of the solder-trough with the web of the channel-iron whereby the parts named are secured rigidly together, a series of burners supported on and under the web of the channel-iron and between its flanges and projecting up through the said web into the fire-box, and means for adjusting said burners vertically with relation to the solder-trough.

10. In can-end-soldering apparatus, the combination of a rigid metallic base of channel-iron, a flanged solder-trough, a fire-box interposed between the said solder-trough and the web of the channel-iron, bolts connecting the flanges of the solder-trough with the web of the channel-iron whereby the parts named are secured rigidly together, a series of burners supported on and under the web of the channel-iron and between its flanges and projecting up through the said web into the fire-box, and a partition of refractory material interposed between said web of the channel and the combustion-chamber, of the fire-box for the purpose set forth.

11. In can-end-soldering apparatus, a soldering-bath trough consisting of a plurality of sections formed with overlapping flanges secured together by bolts engaging the inner flanges and passing through bolt-holes formed in the outer flanges, said bolt-holes being formed of larger area than the area of the bolts in cross-section, for the purpose of compensating for the expansion and contraction of the sections of the trough.

12. In can-end-soldering apparatus, the combination with a soldering-trough, and inflexible supporting-base of a fire-box made in sections, clamped rigidly between the said soldering-trough and the said inflexible base for the purpose set forth.

13. In can-end-soldering apparatus, the combination of a flanged solder-trough, a rigid base of channel-iron, a fire-box formed in sections, said sections of the fire-box being interposed between the flanges of the solder-trough and the web of the channel-iron, and bolts passing through the flanges of the solder-trough and through the web of the channel-iron for the purpose of securing the parts rigidly together.

14. In can-end-soldering apparatus, the combination of a flanged solder-trough, a rigid base of channel-iron, a fire-box formed in sections with overlapping edges, said sections of the fire-box being interposed between the flanges of the solder-trough and the web of the channel-iron, and bolts passing through the flanges of the solder-trough and through the web of the channel-iron for the purpose of securing the parts rigidly together.

15. In can-end-soldering apparatus, the combination of a flanged solder-trough, a rigid base of channel-iron, a fire-box formed in sections interposed between the flanges of the solder-trough and the web of the channel-iron and recessed to form openings above said web of the channel-iron, and bolts passing through the flanges of the solder-trough and through the web of the channel-iron for the purpose of securing the parts rigidly together.

16. In can-end-soldering apparatus, the combination of a flanged solder-trough, a rigid base of channel-iron, a fire-box formed in sections interposed between the flanges of the solder-trough and the web of the channel-iron, the front plates of said fire-box being formed with damper-openings, removable covers for said damper-openings, and bolts passing through the flanges of the solder-trough and through the web of the channel-iron for the purpose of securing the parts rigidly together.

17. In can-end-soldering apparatus, the combination of a flanged solder-trough, a rigid base of channel-iron, a fire-box formed in sections interposed between the flanges of the solder-trough and the web of the channel-iron, the rear plates of said fire-box being formed with a series of apertures for the escape of the products of combustion, and bolts passing through the flanges of the solder-trough and through the web of the channel-iron for the purpose of securing the parts rigidly together.

18. In can-end-soldering apparatus, the combination of a flanged solder-trough, a rigid base of channel-iron, a fire-box formed in sec-

ions with internal shoulders for the support f a partition, and between the flanges of the older-trough and the web of the channel-iron, aid partition supported on said internal shoulers and thereby interposed between the fire-hamber and the web of the channel-iron, and olts passing through the flanges of the solder-rough and through the web of the channel-ron for the purpose of securing the parts rigdly together.

19. In can-end-soldering apparatus, the ombination with the solder-trough and inlexible base of a fire-box formed of a series f plates held rigidly in position between said older-trough and said inflexible base, said lates being formed with internal shoulders or the support of a partition of refractory naterial, together with said partition of reractory material, for the purpose set forth.

20. In can-end-soldering apparatus, the ombination of a solder-trough, an inclined unway consisting of a plurality of sections rranged longitudinally and successively in the ame plane parallel to the solder-bath with heir adjoining ends abutting each other oosely for the purpose of compensating for ongitudinal expansion and contraction and to revent the warping and buckling of the runway, and means for forwarding cans over said unway for the purpose set forth.

21. In can-end-soldering apparatus, the ombination of a solder-trough, an inclined unway consisting of a plurality of sections rranged longitudinally and successively in he same plane parallel to the solder-bath with heir adjoining ends loosely abutting to comensate for longitudinal expansion and conraction and prevent warping or buckling, neans for adjusting each section independntly with relation to the solder-bath, and neans for forwarding cans over said runway or the purpose set forth.

22. In can-end-soldering apparatus, the ombination of a solder-trough, an inclined an-runway, an opposed can-end support conisting of a plurality of sections arranged lonitudinally and successively in the same plane arallel to the solder-bath with their adjoining ends loosely abutting for the purpose of ompensating for longitudinal expansion or ontraction and to prevent warping or buckling of the can-end support, and means for orwarding cans over said inclined runway and n contact with said can-end support.

23. In can-soldering apparatus, the combiation of a solder-trough, an inclined runway, n opposed can-end support consisting of a lurality of sections arranged longitudinally nd successively in the same plane parallel to he solder-bath with their adjoining ends oosely abutting for the purpose of compenating for longitudinal expansion and contracion and to prevent warping and buckling, neans for adjusting each section of the can-end support independently with relation to the solder-bath, and means for forwarding cans over said inclined runway and in contact with said can-end support.

24. In can-end-soldering apparatus, the combination of the solder-trough, a can-supporting rail formed in sections independently secured to said solder-trough, a runway formed of sections independently secured to said solder-trough, means for adjusting the sections of the runway with relation to the sections of the can-supporting rail, means for adjusting the sections of the said can-supporting rail with relation to the sections of the runway, and means for forwarding cans over said supporting-rail and runway.

25. In can-end-soldering apparatus, the combination with the solder-trough, of an inclined runway the lower edge of which is formed on its under side with an antiripple flange projecting into the solder-bath for the purpose set forth, and means for forwarding cans over said inclined runway.

26. In can-end-soldering apparatus, the combination with the solder-trough S of the inclined runway R formed with the antiripple flange r^3, upon its lower edge, for the purpose set forth, and means for forwarding cans over said runway.

27. In can-end-soldering apparatus, the combination with the solder-trough, can-supporting rail and inclined runway, of a top-pressure rail on the runway, said top-pressure rail being made in sections for the purpose set forth, and means for forwarding cans over said runway.

28. In can-end-soldering apparatus, the combination with the solder-trough, can-supporting rail and inclined runway, of a top-pressure rail made in sections independently secured to said runway, means for adjusting said sections independently on said runway, and means for forwarding cans over said runway.

29. In can-end-soldering apparatus, the combination with the solder-trough, can-supporting rail and inclined runway, of a top-pressure rail on said runway, said top-pressure rail being suspended upon said runway by means which will allow it to yield under pressure, together with means for forwarding cans over said runway.

30. In can-end-soldering apparatus, the combination with the solder-trough, can-supporting rail and inclined runway, of a top-pressure rail upon said runway arranged to act as a weight to force the cans against the can-supporting rail, together with means for forwarding cans over said runway.

31. In can-end-soldering apparatus, the combination with the solder-trough, can-supporting rail, and inclined runway, of a top-pressure rail formed in sections, the forward edges of which are formed with projections

which overlap the adjoining edges of the preceding plates, for the purpose set forth.

32. In can-end-soldering apparatus, the combination with a solder-trough, can-supporting rail, inclined runway, and broad flat can-forwarding belt and connections, of a plurality of pivotally-supported gravity-rollers arranged to trail upon the broad inner surface of the side of the forwarding-belt in contact with the cans, and by their rotation insure a gradual increase and decrease of pressure upon the passing can-bodies and means in position to be engaged by the arms of the rollers to support the latter in absence of cans for the purpose set forth.

33. In can-end-soldering apparatus, the combination with a solder-trough, can-supporting rail, inclined runway, and broad flat can-forwarding belt and connections, of a plurality of pivotally-supported rollers arranged to trail upon the broad inner surface of the side of the forwarding-belt in contact with the cans, and a series of stops, one for each roller, arranged to limit the downward thrust of said rollers and in position to be engaged by the arms of the rollers to support the latter in the absence of cans for the purpose set forth.

34. In can-end-soldering apparatus, the combination of the solder-trough, can-supporting rail, inclined runway, can-forwarding belt and connections, a series of gravity-rollers pivotally connected with a horizontal bar common to all and arranged to trail upon the side of the forwarding-belt in contact with the cans, and means in position to be engaged by the arms carrying the rollers to support the latter in the absence of cans and means for adjusting said horizontal roller-supporting bar both horizontally and vertically for the purpose set forth.

35. In can-end-soldering apparatus, the combination of the solder-trough, can-supporting rail, inclined runway, can-forwarding belt and connections, a series of pivotally-supported gravity-rollers arranged to trail upon the side of the forwarding-belt in contact with the cans, and means in position to be engaged by the arms carrying the rollers to support the latter in the absence of cans and an automatic tension device for bearing against the upper portion of the forwarding-belt and arranged to act in opposition to said series of gravity-rollers for the purpose set forth.

36. In can-end-soldering apparatus, the combination of the solder-trough, can-supporting rail, inclined runway, can-forwarding belt and connections, a series of pivotally-supported gravity-rollers arranged to trail upon the side of the forwarding-belt in contact with the cans, and means in position to be engaged by the arms carrying the rollers to support the latter in the absence of cans and one or more tension weights or rolls arranged to bear against the upper portion of the forwarding-belt to counteract in part th weight of the said series of gravity-rollers for the purpose set forth.

37. In can-end-soldering apparatus, th combination of the solder-trough, can-sup porting rail, inclined runway, can-forwardin belt and connections, of means, substantiall as herein described, for automatically feedin solder to the bath, and means for actuatin said automatic solder-feed through the medi um of the can-forwarding mechanism, where by the feed of solder is governed by and ren dered proportionate to the speed of said can forwarding mechanism, substantially in th manner and for the purpose set forth.

38. In can-end-soldering apparatus, th combination of the solder-trough, can-sup porting rail, inclined runway, can-forwardin belt and connections, and means actuated b the can-forwarding mechanism for automat ically feeding solder to the bath, whereby th feed of solder is governed by and rendere proportionate to the speed of the can-forward ing surface for the purpose of compensatin for the solder taken up by the cans passin over the bath under ordinary conditions o use, together with means for varying th amount of solder so fed automatically to th bath with relation to the size and require ments of the cans to be treated.

39. In can-end-soldering apparatus, th combination of the solder-trough, can-sup porting rail, inclined runway, can-forwardin belt and connections, and means for adjustin the pulleys which support the forwarding belt both vertically and horizontally, for th purpose described.

40. In can-end-soldering apparatus, th combination with the solder-trough, can-sup porting rail, inclined runway, can-forwardin belt and connections, of a cam carried by th shaft of one of the forwarding-belt-supportin pulleys, a rock-lever interposed in the pat of the said cam, a spring-pawl on said rock lever engaging a ratchet-wheel, said ratchet wheel attached to a windlass-shaft, said wind lass-shaft, a cord or equivalent attached t said windlass-shaft and connected with a sol der-carrier, together with said carrier, where by at each rotation of the forwarder-belt pul ley, a prescribed amount of solder is fed t the bath, substantially as set forth.

41. In can-end-soldering apparatus, th combination with the solder-trough, can-sup porting rail, inclined runway, can-forwardin belt and connections, of a cam carried by th shaft of one of the forwarding-belt-supportin pulleys, a rock-lever interposed in the pat of said cam, a spring-pawl on said rock-leve engaging a ratchet-wheel, said ratchet-whee attached to a windlass-shaft, said windlass shaft, a cord or equivalent attached to sai windlass-shaft and connected with a solder carrier, said solder-carrier, and an adjustabl stop arranged to limit the retractile move

ment of the said rock-lever for the purpose and substantially in the manner set forth.

42. In can-end-soldering apparatus, the combination with the solder-trough, can-supporting rail, inclined runway, can-forwarding belt and connections, of a cam carried by the shaft of one of the forwarding-belt-supporting pulleys, a rock-lever interposed in the path of said cam, a spring-pawl on said rock-lever engaging a ratchet-wheel, said ratchet-wheel attached to a windlass-shaft, said windlass-shaft, a cord or equivalent attached at one end to the said windlass-shaft and at the other to a stationary support, a solder-carrier provided with a pulley, and one or more supporting-pulleys mounted upon fixed supports, the cord or equivalent means of suspension passing over the pulleys named, for the purpose and substantially in the manner described.

43. In can-end-soldering apparatus, the combination with the solder-trough, can-supporting rail, inclined runway, can-forwarding belt and connections, of the belt-pulley j'', cam j^2, rock-lever L spring-pawl l', retractile spring l^3, ratchet-wheel n, shaft N, cord or equivalent q, one or more supporting-pulleys q', and solder-carriage T connected with and actuated by said cord or equivalent, for the purpose and substantially in the manner described.

44. In can-end-soldering apparatus, the combination with the solder-trough, can-supporting rail, inclined runway, can-forwarding belt and connections, of the belt-pulley j'', cam j^2, rock-lever L, spring-pawl l', retractile spring l^3, ratchet-wheel n, shaft N, cord or equivalent q, means for winding said cord or equivalent upon the windlass-shaft N, one or more supporting-pulleys q', and solder-carrier T connected with and actuated by said cord or equivalent, for the purpose and substantially in the manner described.

45. In can-end-soldering apparatus, the combination with the solder-trough, can-supporting rail, inclined runway, can-forwarding belt and connections, of the belt-pulley j'', cam j^2, rock-lever L spring-pawl l', retractile spring l^3, adjustable stop o, ratchet-wheel n, shaft N, cord or equivalent q, means for winding said cord or equivalent upon the windlass-shaft N, one or more supporting-pulleys q', and solder-carriage T connected with and actuated by said cord or equivalent, for the purpose and substantially in the manner described.

46. In can-end-soldering apparatus, the combination of a flanged solder-trough, a rigid metallic base, a fire-box formed in sections, said sections of the fire-box being interposed between the flanges of the solder-trough and the said rigid metallic base, and bolts passing through the flanges of the solder-trough and securing it and the said sections of the fire-box to the said rigid metallic base for the purpose set forth.

47. In can-end-soldering apparatus, the combination of a flanged solder-trough, a rigid metallic base, a fire-box formed in sections with overlapping edges, said sections of the fire-box being interposed betwen the flanges of the solder-trough and the said rigid metallic base, and bolts passing through the flanges of the solder-trough and securing it and the said sections of fire-box to the said rigid metallic base for the purpose described.

OLIN S. FELLOWS.
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Witnesses:
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