E. G. LINDHE.

APPARATUS FOR JOINING SHEET METAL IN LAYERS.

APPLICATION FILED JUNE 12, 1911. RENEWED MAR. 21, 1914.

1,096,512.

Patented May 12, 1914.

3 SHEETS—SHEET 1.

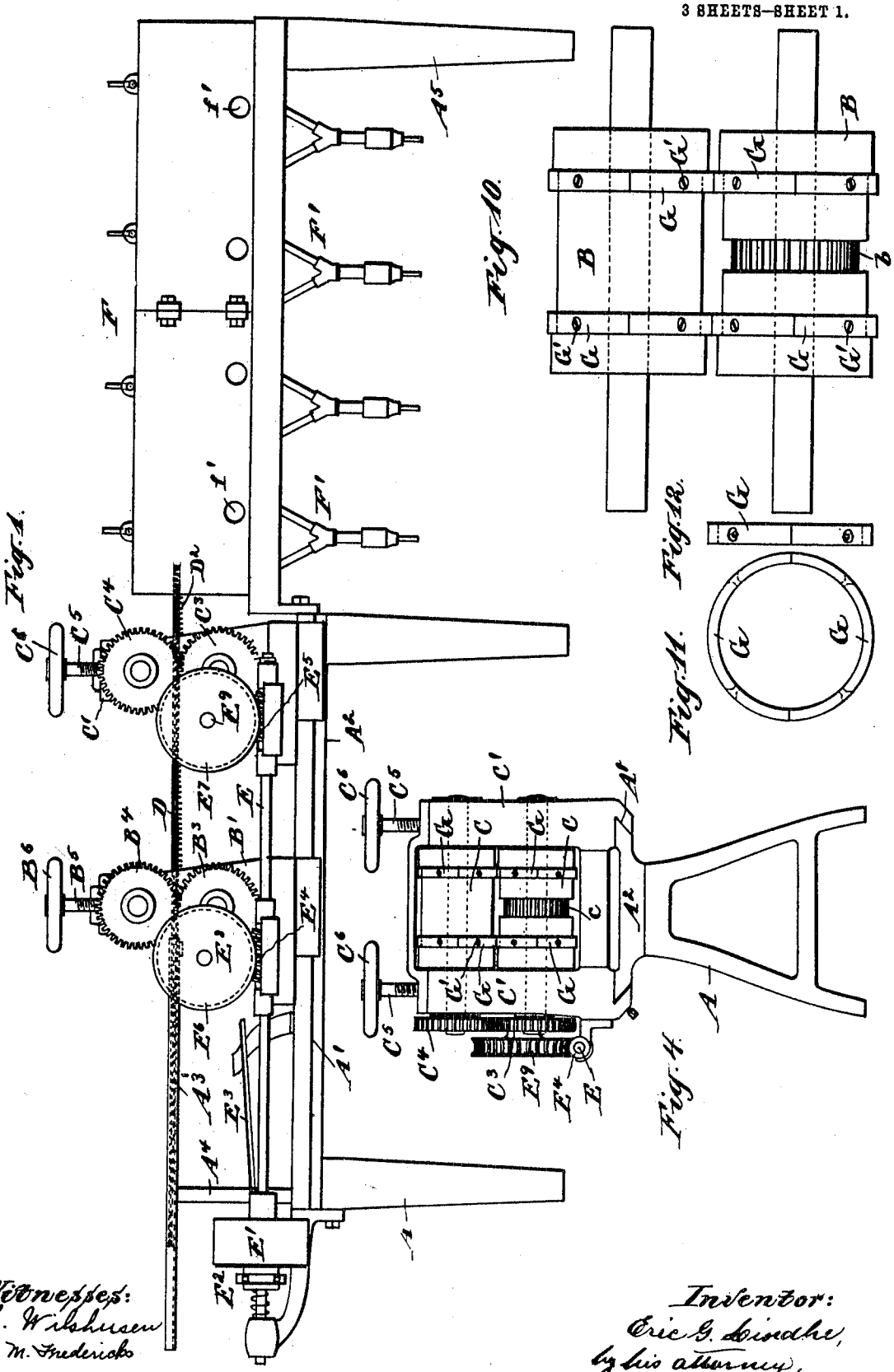


Fig. 1.

Fig. 10.

Fig. 11.

Fig. 12.

Fig. 4.

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C. M. Fredericks

Inventor:
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by his attorney,
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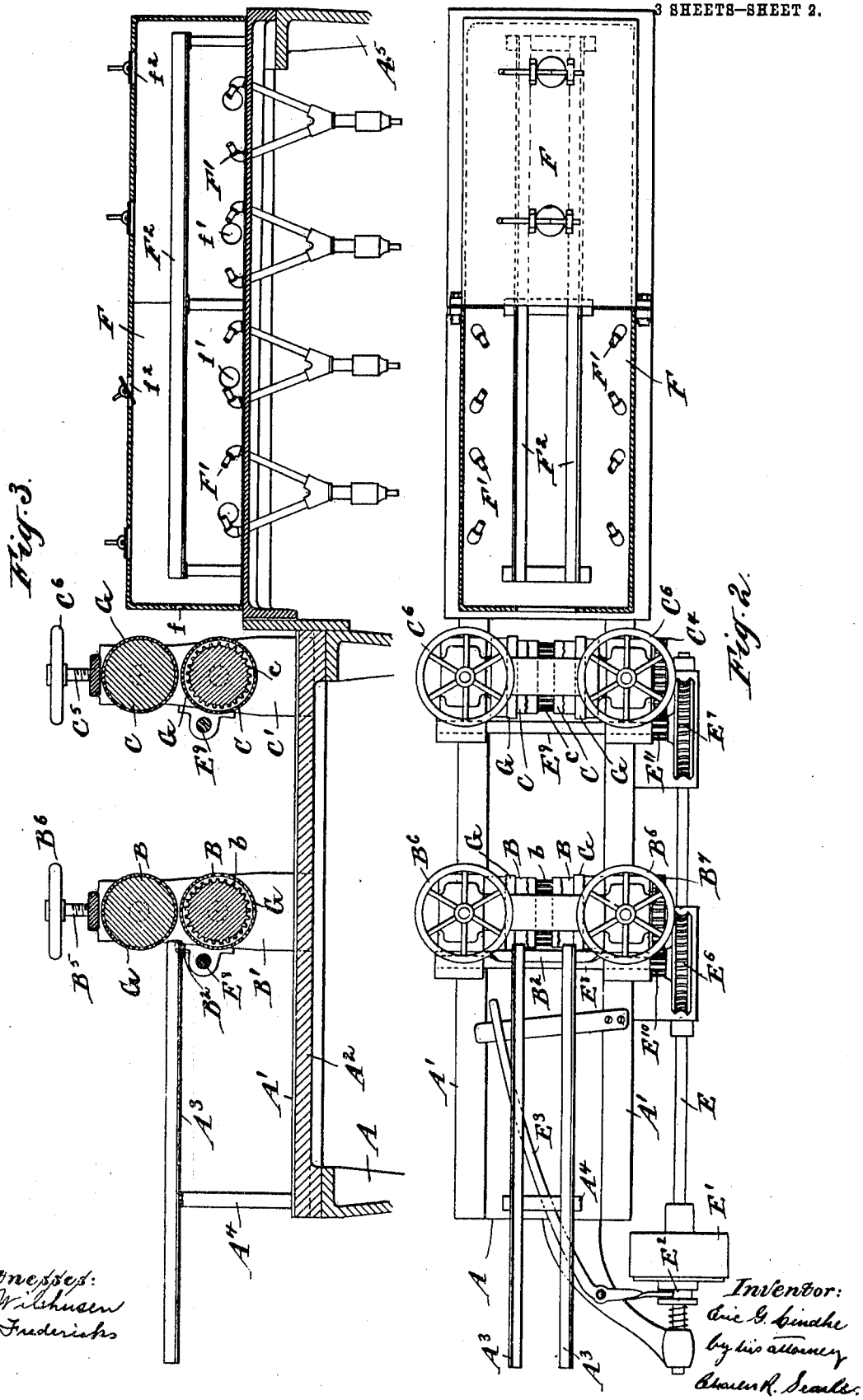


Fig. 3.

Fig. 2.

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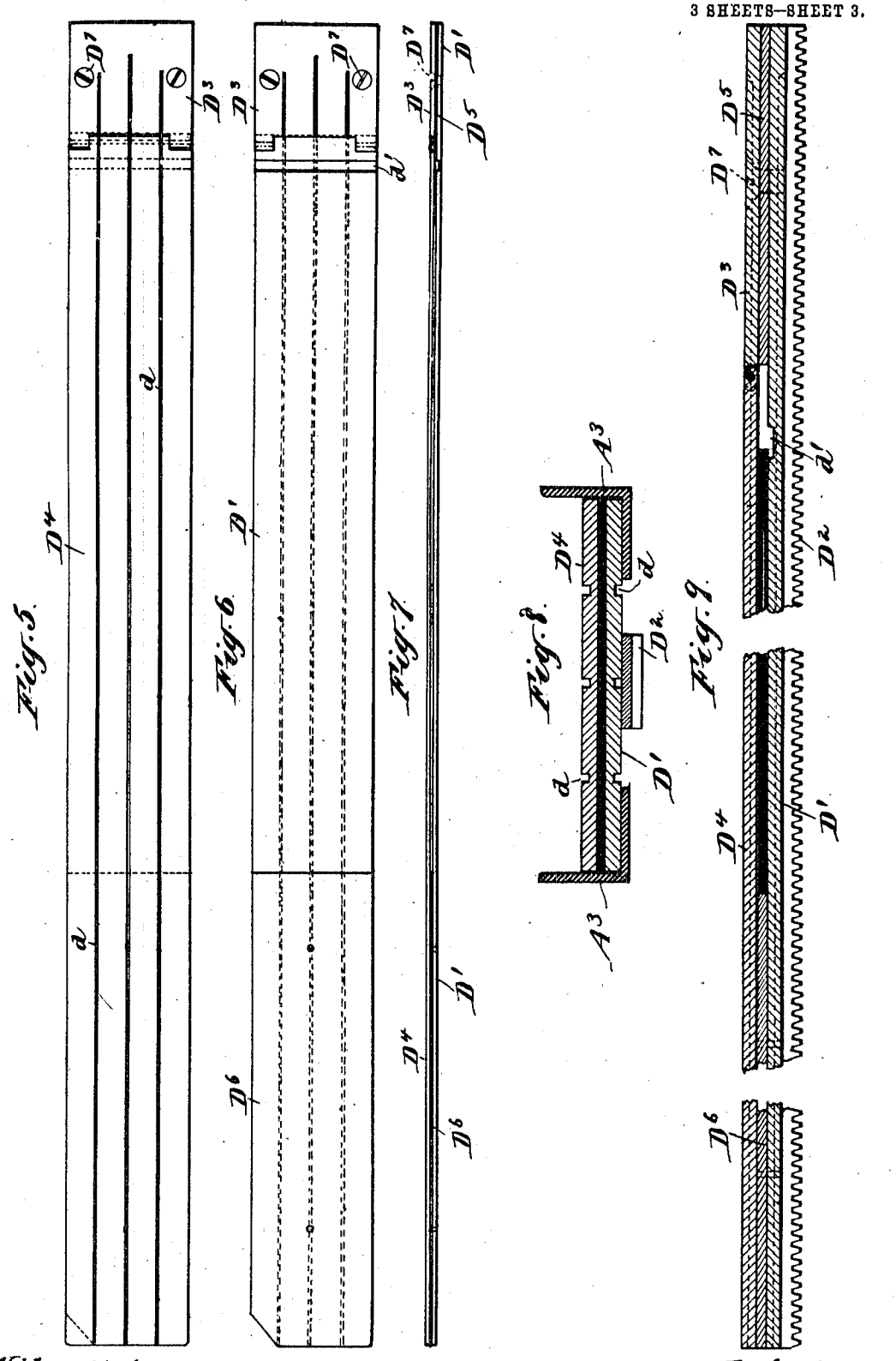
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3 SHEETS—SHEET 3.



Witnesses:
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UNITED STATES PATENT OFFICE.

ERIC G. LINDHE, OF NEW YORK, N. Y.

APPARATUS FOR JOINING SHEET METAL IN LAYERS.

1,096,512. Specification of Letters Patent. Patented May 12, 1914.

Application filed June 12, 1911, Serial No. 632,709. Renewed March 21, 1914. Serial No. 826,443.

To all whom it may concern:

Be it known that I, ERIC G. LINDHE, a subject of the King of Sweden, residing in the city of New York, borough of Manhattan, in the county and State of New York, have invented a certain new and useful Improvement in Apparatus for Joining Sheet Metal in Layers, of which the following is a specification.

In U. S. Letters Patent No. 969,709, dated Sept. 6, 1910, is described a shim made of superposed plates or sheets joined on adjacent faces to form a unitary whole, and adapted to be reduced in thickness when required by stripping one or more sheets from the mass.

The present invention relates to apparatus for producing the laminated stock from which such shims, washers, and analogous spacing devices are cut or stamped by suitable dies or otherwise, and the object of the invention is to provide a machine or apparatus in which the previously prepared sheets may be piled or assembled, heated, and united by pressure to join each sheet to the next with a binder distributed with the necessary uniformity between the sheets, and which may be operated with ease and certainty of uniform product.

The invention consists in certain novel features and details of construction and arrangement by which the above objects are attained, to be hereinafter described and pointed out in the claims.

The accompanying drawings form a part of this specification and show the invention as it has been carried out in practice.

Figure 1 is a side elevation of the apparatus. Fig. 2 is a plan view. Fig. 3 is a corresponding vertical longitudinal section. Fig. 4 is an end view of the mill for pressing the sheets. Fig. 5 is a plan view on a larger scale of the carrier in which the sheets are held for treatment. Fig. 6 is a similar view with the cover removed. Fig. 7 is a corresponding side view. Fig. 8 is a transverse vertical section through the carrier on a still larger scale, showing the ways in which the carrier is supported. Fig. 9 is a vertical section taken longitudinally of the carrier and corresponding to the preceding figure. Fig. 10 is an elevation of a pair of rolls forming part of the mill and employed for compressing the carrier and its contents. Fig. 11 is a face view of one of the spacing-rings used on such rolls. Fig. 12 is a corresponding edge view.

Similar letters of reference indicate the same parts in all the figures.

The apparatus comprises two essential parts, an oven or heater, and a pressing device or mill shown as pairs of rolls between which the heated sheets are passed.

A is the frame on which the pairs of rolls B B and C C are mounted in vertical standards B^1 C^1 supported on ways A^1 on the side edges of the bed A^2 and held in the desired positions relatively to each other by set-screws.

B^2 is a bar carried by the standards B^1 and extending transversely of the bed below the contact line of the rolls B B and supporting the inner ends of two parallel rails A^3 A^3 of L-section supported at the outer ends on a stand A^4. The rails or way A^3 serve as ways for a carrier D arranged to pass between the pairs of rolls and be subjected to their pressure when desired.

The carrier comprises a long narrow lower plate D^1 having a rack D^2 extending along the center line of its under face, and a short stationary upper plate D^3 at the inner end, continued as a hinged cover D^4 which may be raised to permit of the introduction of the material to be treated between the plate D^1 and cover. The plates D^1 and D^3 D^4 are separated the desired distance by a spacing-plate D^5 at the rear held in position by screws D^7 passing through the three plates D^3 D^5 and D^1, and a spacing-plate D^6 of corresponding thickness secured upon the upper face of the plate D^1 at the front or outer end, thus forming a receptacle with a hinged cover or lid, matching closely between the vertical webs of the rails A^3 A^3. At the mid-width of the lower rolls B C respectively are teeth *b c* matching the rack D^2 and serving when in mesh therewith to move the carrier along the rails.

In the rear of the bed A^2 is a frame A^5 supporting a heater or oven F shown as heated by a number of suitable burners F^1 F^1, and provided with openings f^1 at the sides and valve-controlled openings f^2 at the top, and other heat-regulating devices, not shown. Within the oven is a pair of rails F^2 F^2 similar to and in line with the rails A^3 A^3 at the opposite end, arranged to re-

ceive and support the carrier D which is introduced to and removed from the oven through a narrow opening *f* in the end next the rolls C C.

Motion is imparted to the rolls by a longitudinally extending shaft E mounted in suitable bearings and carrying a pulley E^1 controlled by a clutch E^2 and lever E^3, to be revolved with the shaft or to rotate idly thereon. On the shaft are worms E^4 E^5 engaged with worm-wheels E^6 E^7 on transverse shafts E^8 and E^9, one for each set of rolls and these shafts carry respectively a pinion E^{10} E^{11} in mesh respectively with the gear-wheels B^3 C^3 on the shaft of each lower roll, which also mesh with the gear-wheels B^4 C^4 on the shafts of the upper rolls. The latter are movable vertically in the standards B^1 C^1 and are supported by strong springs, not shown, exerting their tension in opposition to the screws B^5 C^5 operated by the hand-wheels B^6 C^6, by which the upper rolls may be forced downward and firmly held while the carrier and its contents are subjected to the pressure of the pairs of rolls in its traverse between them.

The material to be treated is thin sheets of metal, previously coated with lead or a suitable solder-alloy, and of a length and width to be received in the carrier, and preferably of the same width as the latter so as to fill the space between and be guided by the rails. The sheets are piled one upon the other to produce the desired thickness of finished product which is the same as the thickness of the spacing-plates D^5 and D^6 in the carrier. The cover D^4 is then lowered inclosing the pile, the rolls are separated to permit the passage of the carrier and its contents without pressure thereon but with the rack D^2 in mesh with the teeth *b* on the lower roll B. By a reversing mechanism, not shown, the rolls are rotated in the direction to move the carrier toward the second set C C, similarly conditioned, and it is thus carried into the oven F and deposited on the rails F^2 F^2 therein to be subjected for the proper period to the proper temperature, both carefully determined, to cause the solder to soften without burning it or the thin sheets. The upper rolls are then forced down by the screws B^5 C^5, the direction of motion reversed, and the carrier re-passed through the rolls which on this traverse press the contained sheets into close contact with each other, and cause the softened solder or other binder to flow over the adjacent surfaces of the sheets in a uniform thin film. The carrier is then allowed to cool and is opened by raising the cover D^4, the united mass of sheets removed, and the operation repeated with another series of sheets.

In order to prevent warping or distortion of the carrier due to repeated heating and cooling, the plates of which it is composed and also the cover D^4 are provided with longitudinal grooves *d* which serve to maintain them in the plane condition.

Any surplus solder squeezed from between the leaves or sheets may flow to the transverse groove d^1 in the lower plate D^1 near the hinge and escape therethrough or be removed therefrom.

The sheets treated are exceedingly thin, two one-thousandths of an inch or less in thickness, with from three to seventy-five sheets in the pile according to the desired thickness to be produced, and unless confined in a carrier or other receptacle can not be successfully treated between rolls by reason of the tendency to crawl longitudinally and laterally one upon the other, and they are too flexible to be handled in guides. Spacing plates of various thickness are supplied to correspond to the thickness of the product. The separation of the rolls may be very exactly adjusted by the screws B^5 C^5 for the effective return movement of the carrier but in practice it is found to be very difficult to secure the required exact opening and pressure and insure uniformity at both sides by this means alone, and in order to effect the desired exact spacing of the rolls the latter are provided with annular ridges or rings G G made in semicircles applied together about the rolls and secured by screws G^1. The rings are supplied in sets of different thicknesses to correspond with the spacing-plates D^5 D^6 and the material to be produced, and as they are placed opposite to and roll upon each other it is only necessary in adjusting the rolls for the pressure movement, to turn the screws B^5 C^5 down until the rings of the upper rolls are in close contact with the rings of the lower rolls. Thus conditioned the space will be exactly that desired.

The thickness of the pile of sheets when placed in the carrier is somewhat greater than that of the finished product, due to slight curvatures or irregularities of surface and also to the presence of air between the sheets. The hinged cover exerts its pressure on the pile and when subjected to heat in the oven acts as a weighted follower in expelling the air and inducing close contact of the surfaces as the solder softens, thus preparing the pile for the action of the pressure rolls while the solder is still fluid, and the carrier itself by reason of its mass retains sufficient heat to insure the sheets against too rapid cooling in the rolling process, while permitting the heat to radiate fast enough to insure complete adhesion of the surfaces when the carrier has again arrived on the ways A^3 A^3.

The apparatus provides means for accomplishing successfully the several steps found by experiment to be necessary in uniting extremely thin sheets, first by affording a

receptacle or confining means in which the piled sheets are held in proper relation to each other and so constructed as to permit heat to penetrate to the pile uniformly, next, heating while the pile is under the light pressure of a follower, and finally subjecting the pile uniformly to heavy pressure while still confined or maintained in position.

I claim:—

1. In an apparatus of the character set forth, a movably mounted carrier mounted for horizontal longitudinal movement and constructed to hold and confine against movement laterally and longitudinally a pile of superposed sheets of thin metal placed in direct contact with each other throughout their entire surfaces, a cover therefor, a gage for determining the thickness of the completed article, means for heating said carrier and contained sheets, and means for applying pressure to said carrier and its contained sheets to unite said sheets into a unitary mass of a thickness determined by said gage.

2. In an apparatus of the character set forth, a movably mounted carrier mounted for horizontal longitudinal movement and constructed to hold and confine against movement laterally and longitudinally a pile of superposed sheets of thin metal placed in direct contact with each other throughout their entire surfaces, a gage for determining the thickness of the completed article, means for heating said carrier and contained sheets, means for applying pressure to said carrier and its contained sheets to unite said sheets into a unitary mass of a thickness determined by said gage, said gage being movable with said carrier, and a movable cover to said carrier.

3. In an apparatus of the character set forth, a movably mounted carrier mounted for horizontal longitudinal movement and constructed to hold and confine against movement laterally and longitudinally a pile of superposed sheets of thin metal placed in direct contact with each other throughout their entire surfaces, a gage for determining the thickness of the completed article, means for heating said carrier and contained sheets, and means for applying pressure to said carrier and its contained sheets to unite said sheets into a unitary mass of a thickness determined by said gage, said carrier comprising a bottom plate with a rack and an upper plate with a movable cover.

4. In an apparatus of the character set forth, a carrier mounted for horizontal longitudinal movement and comprising a bottom plate and movable upper plate attached thereto, adapted to receive a pile of superposed sheets of metal between them, said sheets being arranged in direct contact with each other throughout their entire surfaces, spacing-plates separating said bottom and upper plates and having a thickness corresponding to such pile, means for heating said carrier and contained sheets, and means for applying pressure to said carrier and its contents to compress and unite said sheets into a unitary mass.

5. In an apparatus of the character set forth, a carrier comprising a bottom plate and a hinged upper plate, said bottom plate having longitudinal grooves in its lower face, and said upper plate having longitudinal grooves in its upper face, said plates adapted to receive and hold between them a pile of superposed sheets of metal, means for heating said carrier and its contained sheets, and means for applying pressure to said carrier and its contents.

6. In an apparatus of the character set forth, a carrier adapted to receive and hold a pile of superposed sheets of metal, an oven constructed to supply heat to said carrier and its contained sheets, and rolls arranged to apply pressure to said carrier and contents.

7. A carrier adapted to receive and hold a pile of superposed sheets of metal, a pair of rolls, an oven adapted to receive said carrier, a rack on said carrier and teeth on one of said rolls arranged to mesh with said rack and move said carrier to and from said oven, and means for applying pressure through said rolls to said carrier and its contents on the movement of said carrier from the oven.

8. A carrier adapted to receive and hold a pile of superposed sheets of metal, supporting ways in which said carrier is movable, an oven constructed to receive said carrier, two pairs of rolls between said ways and oven, a rack on the lower face of said carrier, teeth on the lowermost of each of said pairs of rolls, arranged to mesh with said rack and move said carrier to and from said oven, means for permitting the passage of said carrier to said oven without pressure in said rolls and for applying pressure to said carrier through said rolls on the return movement of said carrier.

9. In an apparatus of the character set forth, a carrier comprising a bottom plate and a movable upper plate attached thereto, a pair of pressure rolls, means for moving one of said rolls toward and from the other, and spacing rings on each of said rolls arranged to contact one with the other to limit the approach of the roll-surfaces to correspond with the thickness of the material.

10. In an apparatus of the character set forth, a carrier comprising a bottom plate and a movable upper plate attached thereto, a pair of pressure rolls, means for moving one of said rolls toward and from the other, spacing rings on each of said rolls and comprising semicircular members and means for

holding said members on said rolls, said rings of one roll arranged to contact with the rings of the other roll and limit the approach of the roll-surfaces to correspond with the thickness of the material.

In testimony that I claim the invention above set forth I affix my signature, in presence of two witnesses.

ERIC G. LINDHE.

Witnesses:
CARLTON N. ABORN,
CHARLES R. SEARLE.