(No Model.) 4 Sheets—Sheet 1.

F. W. KOFFLER.

APPARATUS FOR COATING METALS WITH ZINC OR OTHER METALS.

No. 407,222. Patented July 16, 1889.

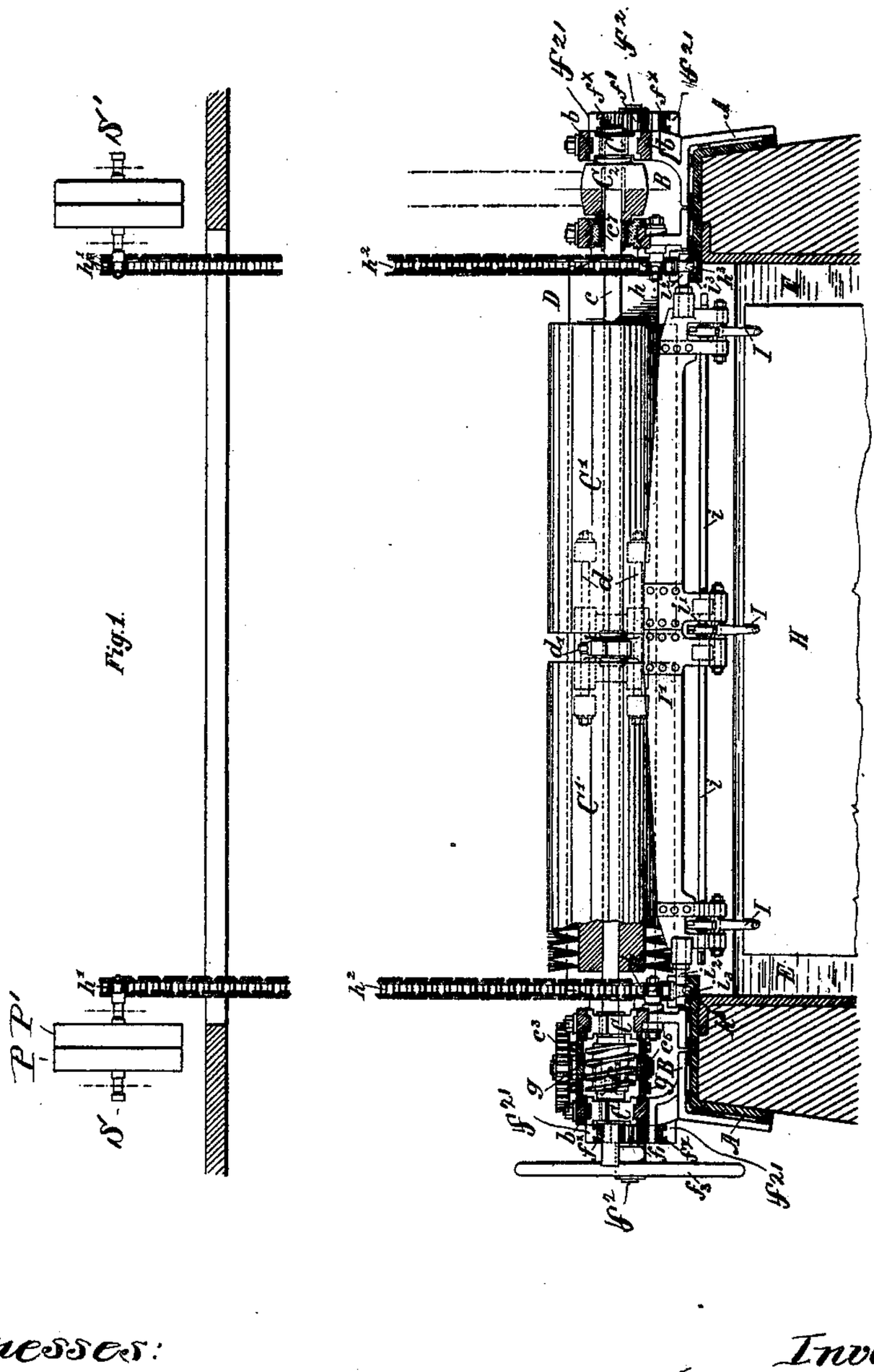


Fig. 1.

Witnesses:
J. Thomson Cross.
Wilh. E. Rouzee

Inventor:
Friederich Wilhelm Koffler
per Henry A. Wise
Atty

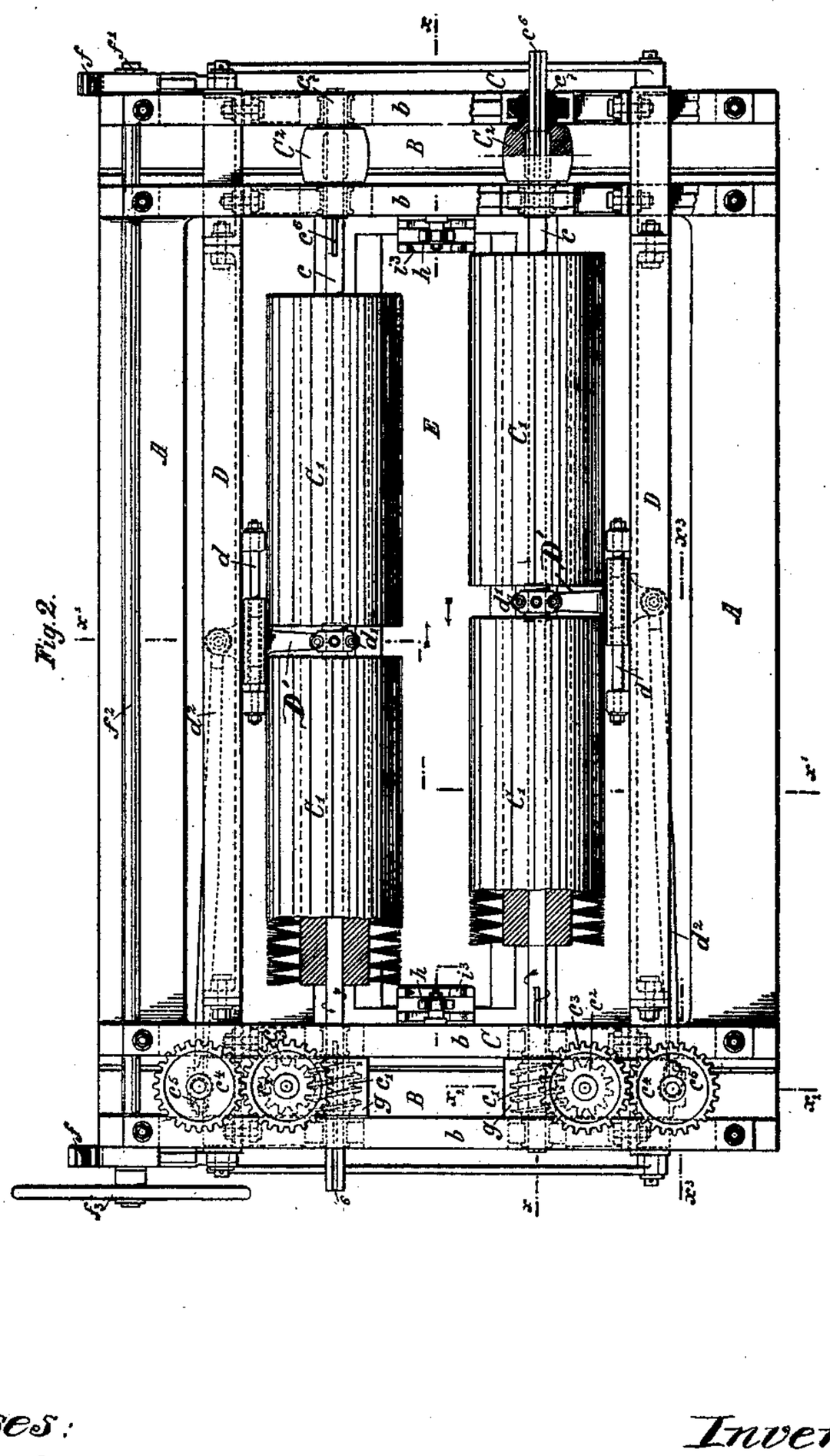
(No Model.) 4 Sheets—Sheet 2.

F. W. KOFFLER.

APPARATUS FOR COATING METALS WITH ZINC OR OTHER METALS.

No. 407,222. Patented July 16, 1889.

Fig. 2.



Witnesses:
J. Thomson Gross
Fred'k E. Rouzer

Inventor:
Friederich Wilhelm Koffler
per Henry Orth
Atty.

(No Model.) 4 Sheets—Sheet 3.

F. W. KOFFLER.

APPARATUS FOR COATING METALS WITH ZINC OR OTHER METALS.

No. 407,222. Patented July 16, 1889.

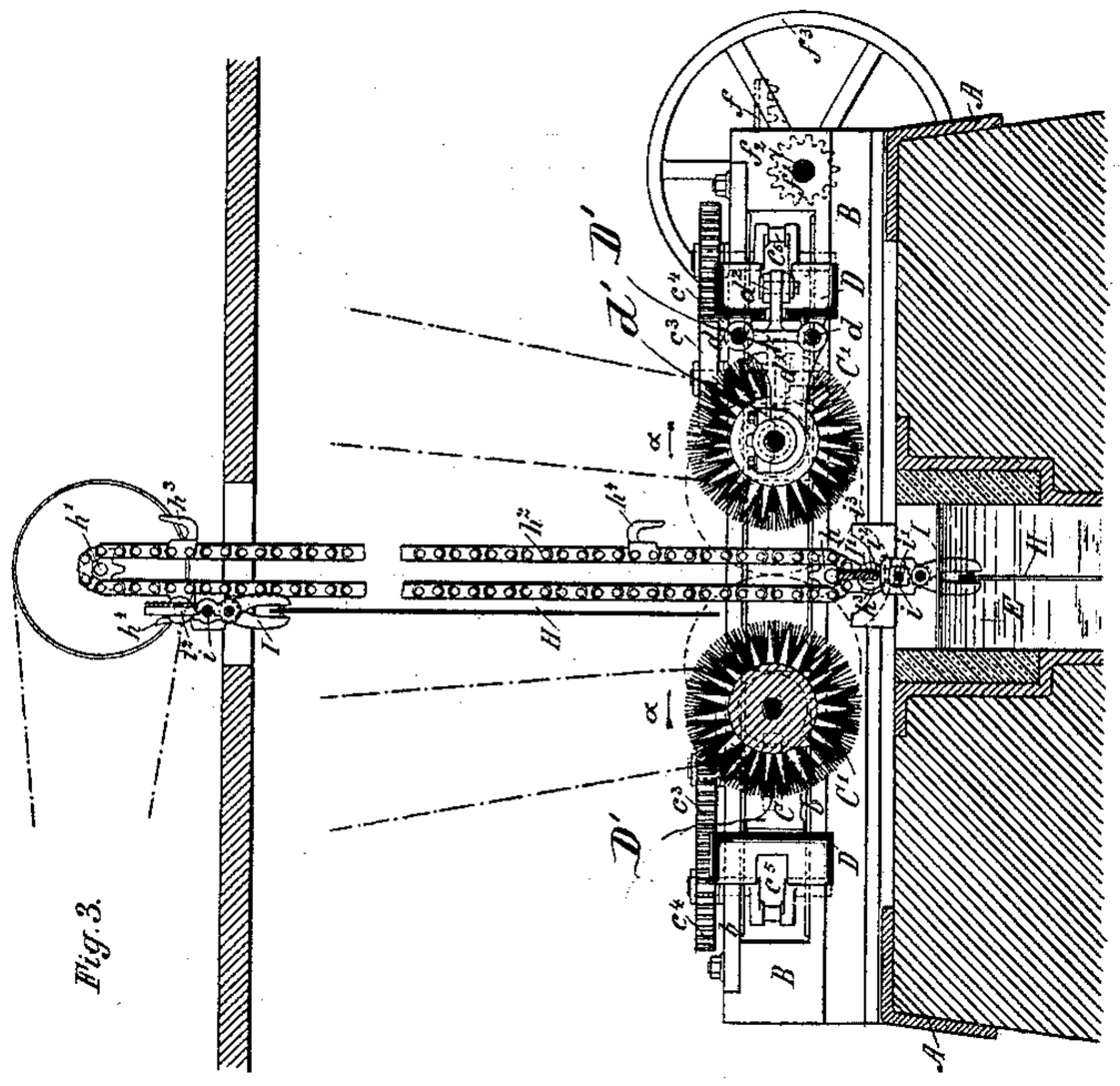


Fig. 3.

Witnesses:

J. Thomson Cross

Philip E. Rouzé

Inventor:

Friederich Wilhelm Koffler

per Henry Orth

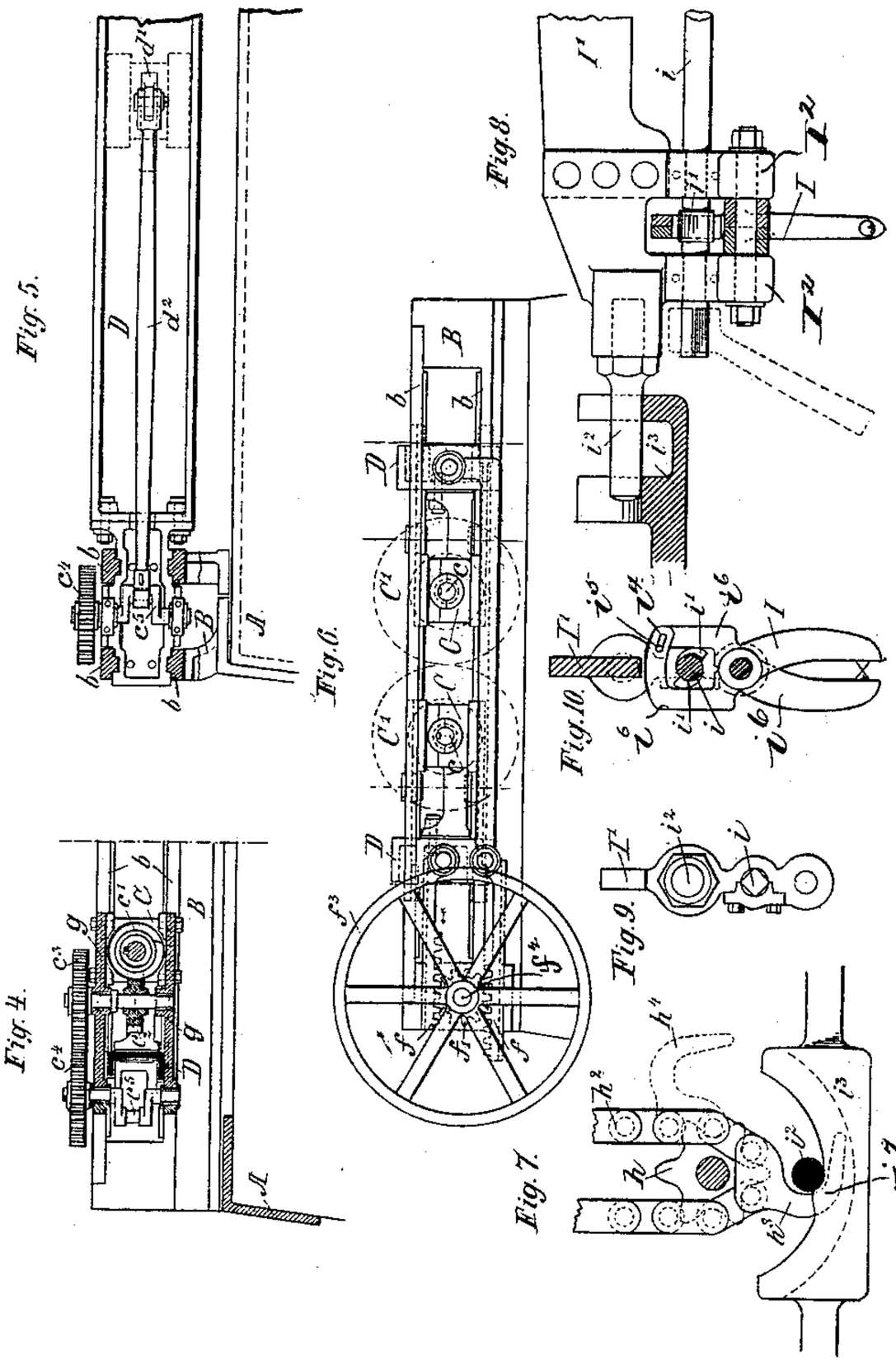
Atty.

(No Model.) 4 Sheets—Sheet 4.

F. W. KOFFLER.

APPARATUS FOR COATING METALS WITH ZINC OR OTHER METALS.

No. 407,222. Patented July 16, 1889.



Witnesses:
J. Thomson Cross
Milo C. Rouzer

Inventor:
Friederich Wilhelm Koffler
per Henry A. Wise
Atty

UNITED STATES PATENT OFFICE.

FRIEDRICH WILHELM KOFFLER, OF UNTER ST. VEIT, NEAR VIENNA, ASSIGNOR OF ONE-HALF TO ADALMAR BREDEN, OF VIENNA, AUSTRIA-HUNGARY.

APPARATUS FOR COATING METALS WITH ZINC OR OTHER METALS.

SPECIFICATION forming part of Letters Patent No. 407,222, dated July 16, 1889.

Application filed June 16, 1888. Serial No. 277,289. (No model.) Patented in Germany December 23, 1884, No. 36,967; in France December 23, 1884, No. 166,100; in Austria-Hungary January 20, 1885, No. 40,949 and No. 2,771, July 9, 1885, No. 15,741 and No. 34,722, December 8, 1886, No. 24,792 and No. 60,501, and September 20, 1887, No. 14,293 and No. 36,753; in Belgium October 16, 1885, No. 70,525, and in England October 19, 1885, No. 12,485.

To all whom it may concern.

Be it known that I, FRIEDRICH WILHELM KOFFLER, a subject of the Emperor of Austria-Hungary, residing at Unter St. Veit, near Vienna, in the Province of Lower Austria, in the Empire of Austria-Hungary, have invented certain new and useful Improvements in Apparatus for Coating Metals with Zinc or with other Metals, (patented in Austria-Hungary January 20, 1885, (Vienna,) No. 40,949 and (Buda-Pesth) No. 2,771, July 9, 1885, (Vienna,) No. 15,741 and (Buda-Pesth) No. 34,722, December 8, 1886, (Vienna,) No. 24,792 and (Buda-Pesth) No. 60,501, and September 20, 1887, (Vienna,) No. 14,293 and (Buda-Pesth) No. 36,753; in Germany December 23, 1884, No. 36,967; in France December 23, 1884, No. 166,100; in Belgium October 16, 1885, No. 70,525, and in England October 19, 1885, No. 12,485;) and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to letters or figures of reference marked thereon, which form a part of this specification.

The invention relates to the art of coating metals with zinc or alloys of zinc, and more especially to the art of coating sheet metal with such.

The manner in which articles of metal have heretofore been zinked leaves much to be desired, especially in the uniformity of the coating, which is not possible to attain by simple immersion of the article into a bath of molten zinc. On the other hand, the coating is liable to become streaky or the zinc is apt to gather in ridges or globules, thus forming accumulations of zinc of undue thickness upon the surfaces coated.

My invention has for its object to provide means whereby these difficulties are overcome; and it consists in an apparatus for attaining the desired results in a simple and expeditious manner, substantially as hereinafter fully described, and as set forth in the claims.

The invention further consists in structural features and combinations of parts of and in the apparatus, substantially as hereinafter described and claimed.

In order to uniformly coat metals with zinc, I remove the surplus zinc from the article immediately after its issuing from the bath of molten zinc, and preferably by means of revolving brushes, so that there will remain upon the surface treated a coating of an alloy of metals—as, for instance, a coating of iron and zinc when articles of iron are treated.

I have found that sheet iron or steel having its surfaces uniformly alloyed with zinc offers such a resistance to cracking or fissuring as to better adapt it for use in the manufacture of articles produced by stamping—such, for instance, as culinary utensils, which may be stamped out of such sheet-iron without weakening the metal in any particular places. Furthermore, such sheet metal will take a high polish without previous scouring, grinding, or rubbing with an abrasive agent, as the removal of the surplus zinc leaves a perfectly homogeneous surface that is capable of taking a high polish. The alloy of iron and zinc formed as described also has a higher melting-point than zinc itself, and articles of metal treated according to my invention can be coated with metals or alloys of metals by immersion in a bath of such, the melting-point of which metals or alloys is higher than that of zinc, a result heretofore not attainable by the hot process, but only by plating or electroplating, for the reason that articles coated with zinc, according to the usual process of immersion, present surfaces holding a comparatively large amount of unalloyed zinc, which burns off when the article is immersed in the bath of metal or alloy, the melting-point of which is higher than that of zinc. The zinc ashes resulting from the combustion of the unalloyed zinc and remaining adherent to the article will effectually prevent a homogeneous and firmly-adhering coating of another metal or alloy to be formed on such article. Thus articles made

of sheet iron or steel zinked according to my process may be nickeled by immersion into a bath of nickel and a uniform homogeneous and firmly-adhering coating of nickel obtained, thereby enhancing their durability as well as their appearance.

In the accompanying drawings, Figure 1 is a vertical longitudinal section, taken on the interrupted line $x\,x$ of Fig. 2, of a machine embodying my invention. Fig. 2 is a top plan view thereof, partly in section. Fig. 3 is a transverse section taken on the interrupted line $x'\,x'$ of Fig. 2. Fig. 4 is a section taken on line $x^2\,x^2$ of said Fig. 2. Fig. 5 is a front elevation, partly in section, of a portion of the mechanism for imparting endwise motion to the brush-shafts. Fig. 6 is a side elevation of a portion of the machine, illustrating the mechanism for moving the brush-shafts toward and from each other; and Figs. 7, 8, 9, and 10 are detail views.

Letters of like name and kind indicate like parts in the above figures of drawings.

E indicates the vessel or pan that contains the molten zinc, to each side of which is secured a base-plate A, that carries the bearers B for the brush-shaft bearings and for the bearings for the mechanism by which the brush-shafts are moved toward and from each other, and to be described hereinafter. To the bearers B are also secured bracket-bearings for the journals of sprocket-wheels or pinions h, a like wheel or pinion h' being journaled each on a short shaft S S', respectively, said shafts being journaled in suitable bearings at a proper elevation above the vessel or pan E and carry a fast and loose pulley for obvious purposes.

Over each pair of sprocket-wheels travels a carrier-chain h^2, that is provided at suitable distances apart with hooks h^3 h^4, arranged alternately in reversed position on the chain to which said hooks are secured, so that a support for the article to be zinked, when supported at opposite ends from hooks h^3, will be lowered into the pan E and left there to be taken up by a pair of reversed hooks h^4.

Any suitable support for the articles to be zinked may be provided. In Figs. 8, 9, and 10 of the drawings I have shown this support I' constructed especially for zinking sheet metal, and it consists of a bar that has a journal i^2 at each end. Underneath the bar is arranged a cross-shaft i, that has its bearings in straps I^2, secured to said bar at each end thereof, in which straps are also formed the bearings for the pivot-pin of a pair of tongues I, for holding a sheet of metal. The extensions or arms of the jaws of the tongues form a rectangle, the upper members of which overlap each other, one of said members being provided with a longitudinal slot i^4 and the other with a pin i^5, to limit the extent of motion of the arms toward and from each other, and consequently the extent of motion of the jaws i^6 of the tongues.

The cross-shaft i is squared at one end for the application thereto of a hand-lever, (shown in dotted lines in Fig. 8,) and said shaft passes through the rectangular opening of the extensions or arms of the jaws i^6 of the tongues I and carries a double cam, or has two cam-faces i' i' formed thereon, that lie within said rectangular opening, so that when a partial rotation is imparted to the shaft i the arms of the jaws will be forced apart, thereby closing the jaws i^6, as more plainly shown in Figs. 8, 9, and 10.

To the bearers B on opposite sides of the pan, immediately below the sprocket or chain wheels h, and within reach of the hooks h^3 h^4, are secured bearings i^3 of curvilinear form, on the curved upper face of which is a projection i^7. (See Fig. 7.)

It will be seen that when a sheet of metal is held by the tongues I, as above described, and the support I' is connected with the carrier-chains by placing the journals i^2 in a hook h^4 on each chain, and said chains are caused to travel downwardly, the sheet of metal will be carried down into the pan E until the support I' reaches the bearings i^3, when the hooks h^4 will be disengaged from the support and the sheet of metal held suspended from the bearings i^3, thus remaining immersed in the bath of zinc until a pair of hooks h^3 take the support I' up again to lift the sheet of metal out of the bath. In Fig. 7 I have shown the hooks h^3 about to take up the support I', left in the bearings i^3 by the hooks h^4. (Shown in dotted lines in said figure.)

The object of making the bearings i^3 curvilinear is to facilitate the depositing and the taking off of the supports I', the arc of the circle described by the curved upper face of said bearings corresponding to the sweep or arc of the circle described by the bight in hooks h^3 h^4 as they travel around the lower chain-pulley h, the projection i^7 being so located as to hold the supports in a plane passing through the vertical axis of the chain-pulley h.

The time during which the sheet of metal will remain immersed in the bath will therefore depend on the distance between hooks h^4 h^3 on the chains, and this distance may be varied within certain limits, according to the nature of the article to be zinked.

As the sheet of metal is being lifted out of the bath of zinc, the brushes C', which are arranged on opposite sides of the endless carriers, are moved toward each other and caused to revolve to remove the surplus zinc from the surfaces of the zinked sheet as it rises from the bath, this being effected by the following instrumentalities.

The bearings C C of the brush-shafts c, to which shafts the brush-cylinders are keyed, are capable of sliding in guideways $b\,b$ on the bearers B toward and from each other, the bearing C, for the front brush-shaft, being connected with a rack-bar $f^{\times}$, and the like bearing of the rear brush-shaft is connected

with a rack-bar f immediately above rack-bar $f^{\times}$, said rack-bars sliding in guideways f^{21}, formed on the bearers B, this arrangement of rack-bars being duplicated on the opposite sides of the machine. Between the two rack-bars $f\,f^{\times}$ is a pinion f' on a cross-shaft f^2, that also has its bearings on the bearers B at the rear end of the machine, and said shaft carries a hand-wheel f^3, by means of which the shaft f^2 is rotated. It is obvious that when the shaft f^2 is rotated in the direction of the arrows, Fig. 6, the bearings C will recede from each other, while, when said shaft is rotated in a reverse direction, the bearings will move toward each other. Each brush-shaft carries a belt-pulley C^2, Figs. 1 and 2, belted to and driven from a prime motor in any suitable manner.

To more effectually remove the surplus zinc from the sheet of metal, I impart to the brush-shafts, in addition to their rotary motion, a simultaneous endwise movement, so that said brushes will not only revolve but reciprocate with their shafts, said endwise movement being preferably so timed that when one of the brush-shafts moves in one direction the other will move in a reverse direction. This I effect in the manner and by the instrumentalities, as follows:

The belt-pulleys C^2 have tubular bearings c^7, through which the brush-shafts pass loosely, said pulleys being connected with their shafts by a spline or feather, to allow the shafts to move endwise and be rotated by the pulleys. At their opposite ends each of said shafts passes through a worm or endless screw c', likewise connected with such shafts by a spline or feather, and said worm gears with a worm-wheel c^2 on a vertical shaft, which latter carries a gear-wheel c^3, that meshes with a like wheel c^4 on a vertical crank-shaft c^5. The crank and transmitting shafts have their bearings in plates g, that are bolted to the bearings C of the brush-shafts and to the transverse bars D, that serve to rigidly connect the two bearings for a brush-shaft together, so as to cause them to move simultaneously toward and from each other, as hereinbefore described, and carry with them the mechanism for translating the rotary motion of the brush-shafts into reciprocating motion through the medium of their crank-shafts c^5. These shafts c^5 are connected to an arm D′, that slides freely on a guide-rod d, connected to the cross-bar D, the outer end of said arm being provided with a bearing d' for the brush-shaft. This bearing d' is applied about midway of the length of the brush-shaft, and not only serves to brace the same, but, as stated, to impart to it a longitudinal reciprocating motion.

It will be readily understood that when the brush-shafts are rotated through the medium of the belt-pulleys C^2 the worms or endless screws c' are likewise rotated, thereby rotating the crank-shaft c^5 through the medium of the worm-wheel c^2 and the gear-wheels c^3 c^4, and, as said crank-shaft is connected by a rod d^2 with the arm D′, a longitudinal reciprocating motion is imparted to the brush-shafts. In this manner the motion of rotation of the brush-shafts is made available to reciprocate the same.

As shown, the brush-cylinders are formed in two parts, between which the bearing d' of arm D′ is located, and, as said cylinders are rigidly secured to their shaft c, they form abutments for said bearing, and thus hold the arm D′ against reciprocating motion independently of said shaft. This mechanism is shown in Figs. 1, 2, 3, 4, and 5.

From the above description the operation of the machine will be readily understood and need not be further described.

Having described my invention, what I claim is—

1. In a machine of the class described, the combination, with the pan for containing the molten zinc and a support for the article to be zinked, of vertically-movable endless parallel chain carriers arranged above the pan and provided with hook-bearings for said support, and supporting and driving pulleys for said chain carrier, substantially as and for the purposes specified.

2. In a machine of the class described, the combination, with the pan for containing the molten zinc and a support for the article to be zinked, of vertically-movable endless parallel chain carriers arranged above the pan and having hook-bearings for said support of alternately-reversed position arranged above the pan, and supporting and driving pulleys for said carriers, substantially as and for the purposes specified.

3. In a machine of the class described, the combination, with the pan for holding the molten zinc, of a parallel endless chain carrier provided with hook-bearings a, a support for the article to be zinked provided with journals fitting into said hook-bearings, and brushes arranged on opposite sides of the endless carriers, substantially as and for the purposes specified.

4. In a machine of the class described, the combination, with the pan for containing the molten zinc, of a parallel endless chain carrier provided with hook-bearings of alternately-reversed position, fixed bearings below the chain carrier within the reach of the hooks thereof, and a support for the article to be zinked provided with journals fitting into said hook-bearings, substantially as and for the purpose specified.

5. In a machine of the class described, the combination, with the pan for containing the molten zinc and the traveling carrier for the article to be zinked, of brush-shafts arranged on opposite sides of the carrier, mechanism for revolving the brushes in a direction at right angles to and toward said carrier, and motion-translating mechanism for translating the rotary motion of the brush-shafts into reciprocating motion connected with and oper-

ated directly from the brush-shafts, substantially as and for the purposes specified.

6. In a machine of the class described, the combination, with the pan for containing the molten zinc and a traveling carrier for the article to be zinked, of brush-shafts arranged on opposite sides of the carrier, mechanism for moving the same toward and from said carrier, a belt-pulley for and connected with each shaft by a spline or feather, and motion-translating mechanism for translating the rotary motion of the brush-shafts into reciprocating motion connected with and operated directly from the brush-shafts, substantially as and for the purposes specified.

7. In a machine of the class described, the mechanism for imparting lateral motion in opposite direction to the brush-shafts, which consists in the combination, with sliding bearings for said shafts and superposed rack-bars secured thereto, of an intermediate pinion for each pair of rack-bars, said pinions being mounted on the same cross-shaft, substantially as described.

8. In a machine of the class described, the combination, with the brush-shaft and a worm or endless screw connected therewith by a feather or spline, of a crank-shaft, intermediate gearing operated by the endless screw to rotate said crank-shaft, an actuating-arm connected with the brush-shaft, mechanism for imparting a reciprocating motion to the arm, abutments to hold said arm against independent reciprocation on the shaft, and a connecting-rod connecting said arm with the crank-shaft, substantially as and for the purposes specified.

9. In a machine of the class described, the combination, with the brush-shaft, a worm or endless screw connected therewith by a spline or feather, and sliding bearings for said shaft, of a connecting-bar rigidly secured to said bearings, an arm connected with the shaft and reciprocating on the connecting-bar, abutments to hold said arm against independent reciprocation on the brush-shaft, a crank-shaft, intermediate gearing operated by the endless screw to rotate the crank-shaft, and a connecting-rod connecting the crank-shaft with the reciprocating arm, substantially as and for the purposes specified.

10. In a machine of the class described, the combination, with the brush-shaft *c*, of a worm or endless screw connected therewith by a spline or feather, sliding bearings for said shaft, and a rack-bar and pinion for moving said bearings on their support, of a connecting-bar rigidly secured to the brush-shaft bearings, an arm connected with the shaft and reciprocating on the connecting-bar, abutments to hold said arm against independent reciprocation on the brush-shaft, a crank-shaft, intermediate gearing operated by the endless screw to rotate the crank-shaft, a connecting-rod connecting the crank-shaft with the reciprocating arm and bearings for said crank-shaft, and intermediate gearing rigidly secured to and moving with the brush-shaft bearings, substantially as and for the purposes specified.

11. In a machine of the class described, the combination, with the endless carrier, of a support for the article to be zinked, comprising a supporting-bar and holding-tongues, in combination with mechanism for closing the tongues, consisting of a cam operating on the arms of the tongue-jaws to move said arms in opposite directions and close the jaws, substantially as described.

12. In a machine of the class described, the combination, with the endless carrier, of a support for the article to be zinked, comprising a supporting-bar and a plurality of tongues suspended therefrom, in combination with a cam-shaft *i* and cams *i'* thereon lying between the arms of the tongue-jaws and operating to simultaneously move the arms of all the tongue-jaws in opposite directions to close the jaws when a partial rotation is imparted to the cam-shaft, substantially as described.

13. In a machine of the class described, the combination, with the pan for containing the zinc, and the endless carrier h^2 h^2, provided with hook-bearings at suitable distances apart, whose position is alternately reversed, and the curvilinear bearers i^3, provided with the projection or stop i^7, of the support for the articles to be zinked, provided with journals i^2, fitting into the hook-bearings of the carriers, substantially as and for the purposes specified.

In testimony whereof I affix my signature in presence of two witnesses.

FRIEDRICH WELHELM KOFFLER.

Witnesses:
EDMUND JUSSEN,
OTTO SCHIFFER.