

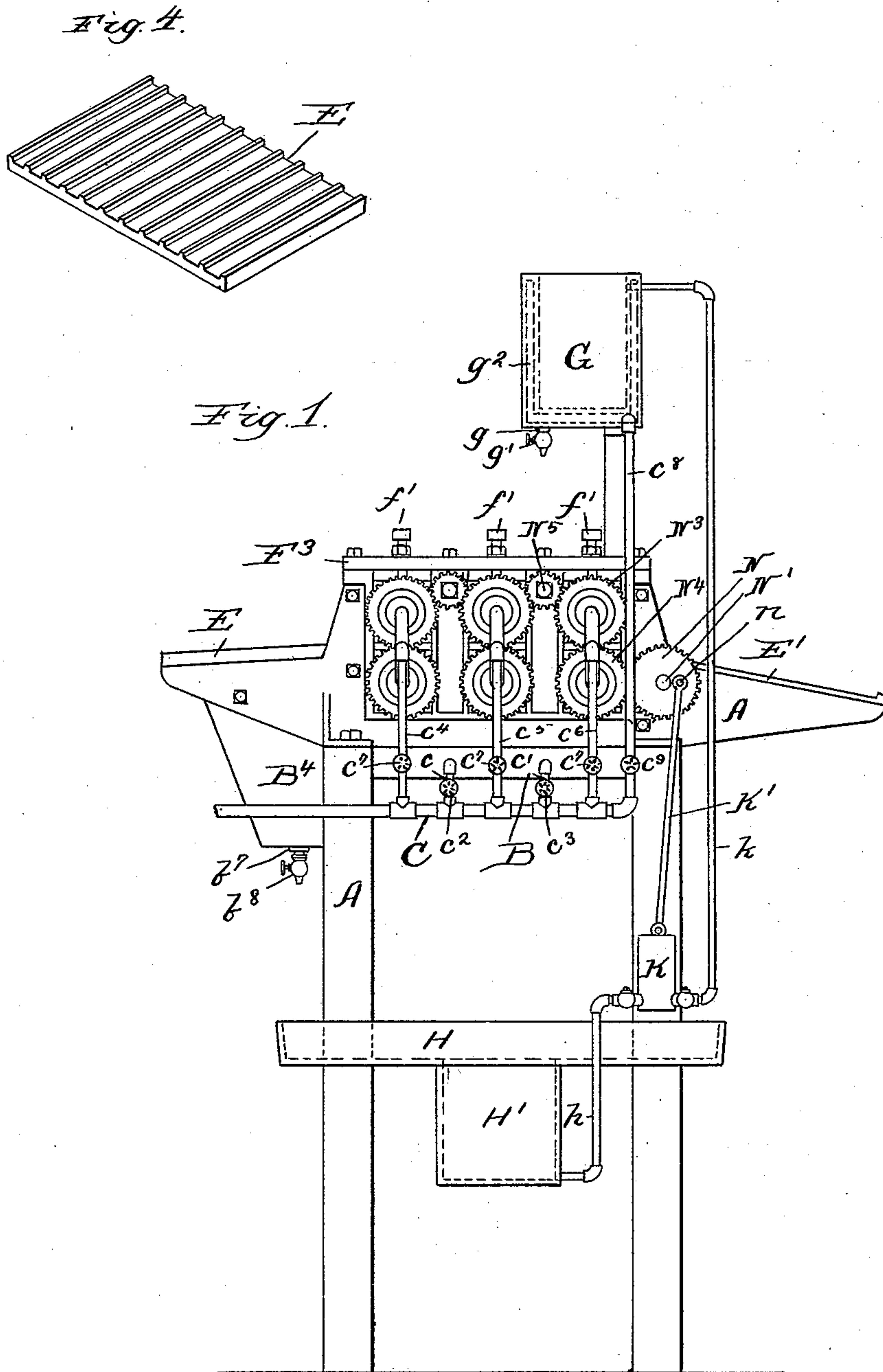
(No Model.)

2 Sheets—Sheet 1.

E. NORTON & J. G. HODGSON.
MACHINE FOR DRYING AND FLUXING METAL SHEETS.

No. 488,025.

Patented Dec. 13, 1892.



Witnesses:

Lew. C. Curtis
H. W. Munday,

Inventors:

Edwin Norton
John G. Hodgson
By Munday, Curtis & Adeock,
their Attorneys.

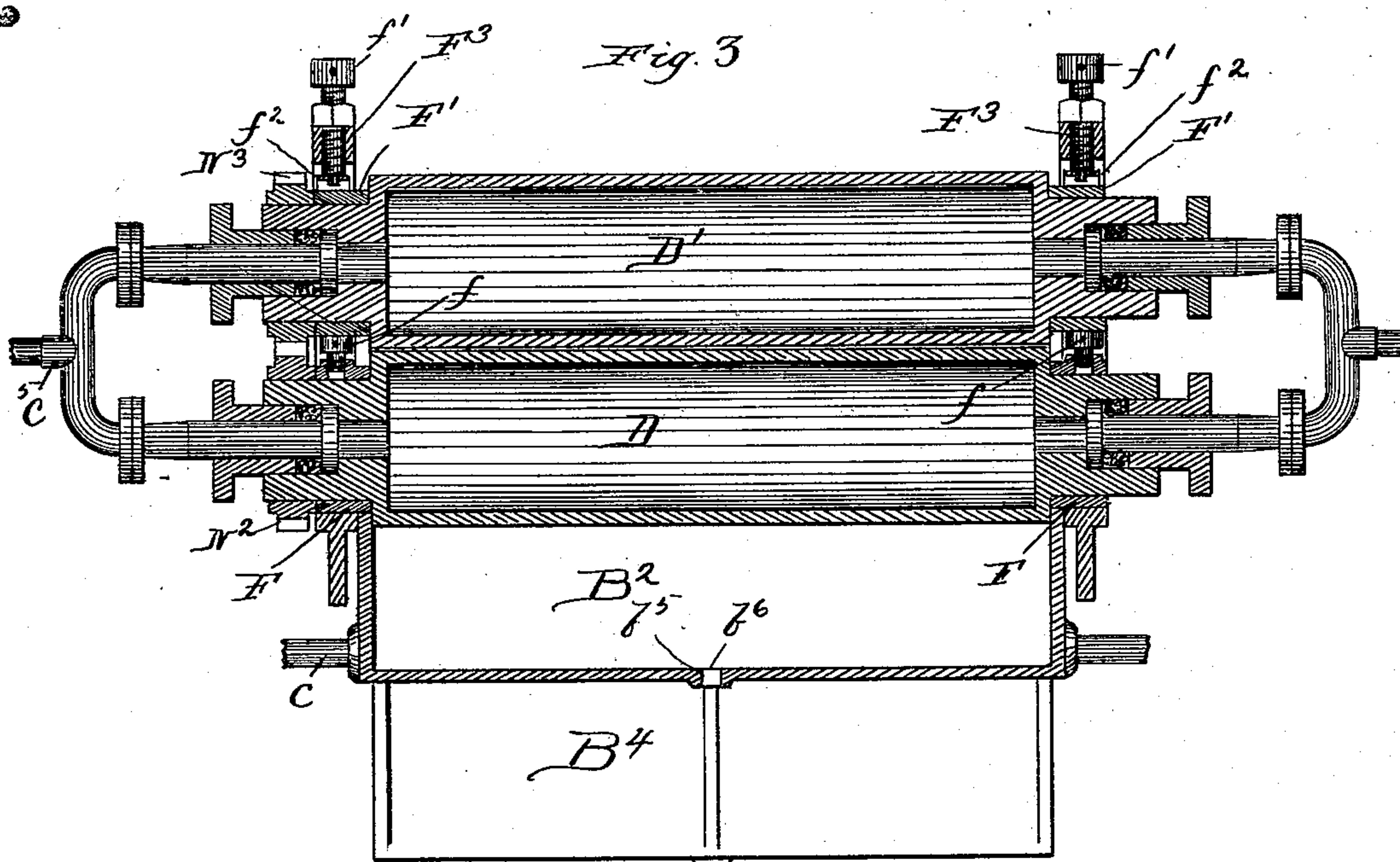
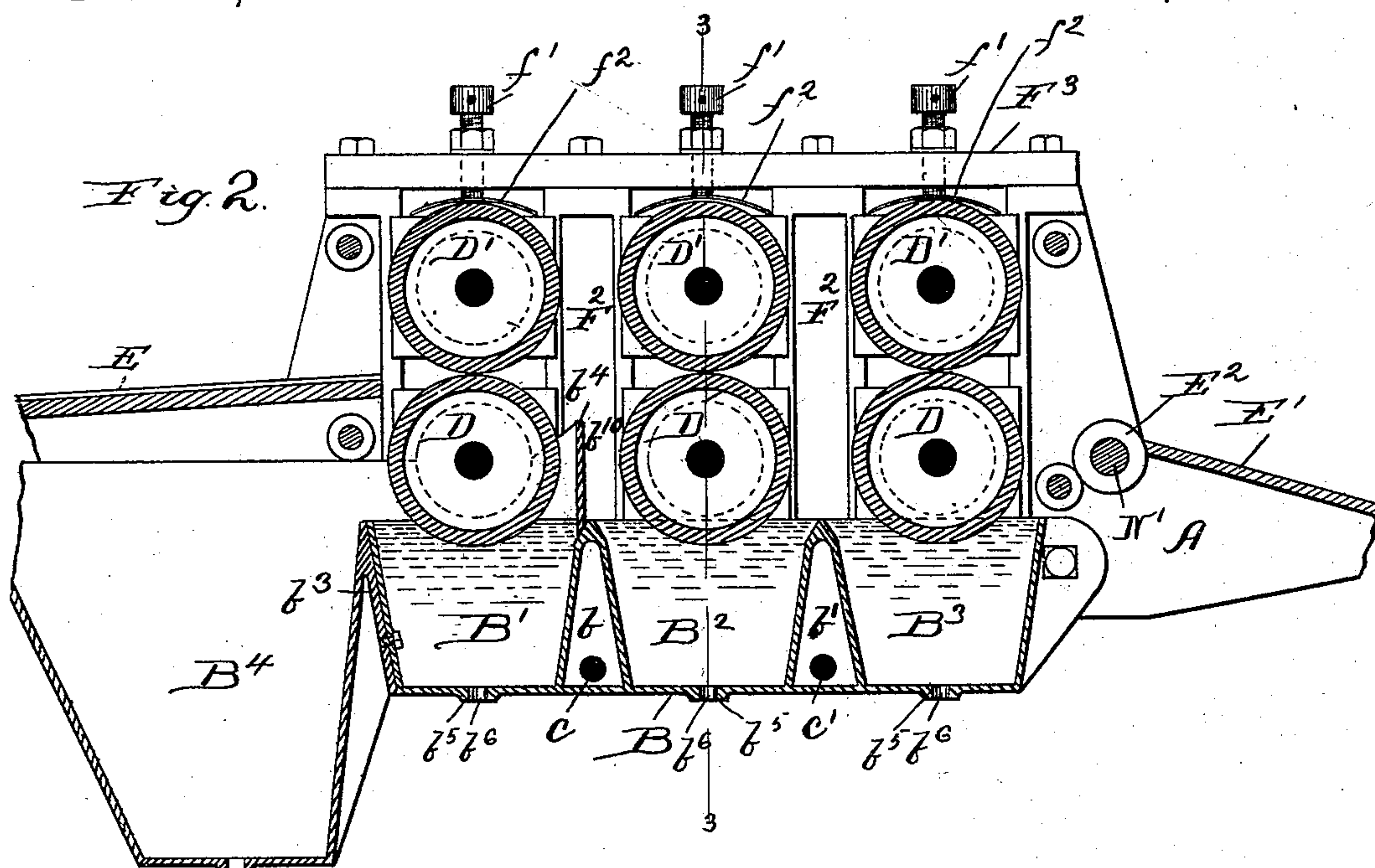
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UNITED STATES PATENT OFFICE.

EDWIN NORTON AND JOHN G. HODGSON, OF MAYWOOD, ASSIGNORS TO SAID
NORTON, AND OLIVER W. NORTON, OF CHICAGO, ILLINOIS.

MACHINE FOR DRYING AND FLUXING METAL SHEETS.

SPECIFICATION forming part of Letters Patent No. 488,025, dated December 13, 1892.

Application filed April 6, 1892. Serial No. 427,983. (No model.)

To all whom it may concern:

Be it known, that we, EDWIN NORTON and JOHN G. HODGSON, citizens of the United States, residing at Maywood, in the county of Cook and State of Illinois, have invented a new and useful Improvement in Machines for Drying and Fluxing Sheets of Steel or Iron Preparatory to Tinning the Same, of which the following is a specification.

Our invention relates to an improved machine for simultaneously drying and fluxing pickled sheets of iron or steel preparatory to coating the same with tin or other metal.

Heretofore in the process of manufacturing tin plates by what is commonly known as the "palm-oil" process after the iron or steel sheets have been pickled in a bath of dilute sulphuric acid to remove the scale or oxidation therefrom the sheets are immersed in a bath of clean water to protect them from oxidation. From this water bath the sheets are taken one by one and while still wet immersed immediately in a bath of hot palm-oil, by which the moisture is evaporated from the wet sheet and the sheet fluxed or coated with oil. The temperature of the oil in this oil-pot is necessarily kept comparatively low to prevent the steam generated from the wet sheets causing the oil to boil violently over, and even at such low temperature great difficulty and waste are experienced in practical operation from the oil boiling over and taking fire.

The object of our invention is to provide a machine by which the wet sheets as they come from the water bath may be quickly dried, coated with flux, and heated to the proper temperature to produce the best results, when they are placed in the molten metal or the pot containing the molten tin covered with oil.

To this end a machine embodying our invention comprises, preferably, three pair of revolving hollow metal rolls heated by steam admitted to their interior, a steam-jacketed oil-pot divided into three partitions or troughs, two or more of which are filled with hot palm-oil, and in which the lower rollers of two or more of said pairs revolve, so that the same are continually coated with oil, a feed-table from which the sheets are fed between the first pair of rollers and by the heat of which the moisture is chiefly evaporated from the

sheet before passing to the succeeding rolls, which are supplied with oil, and by which the sheet is further heated and simultaneously fluxed or coated with oil and every trace of the moisture driven off, so that when the sheets thus dried, fluxed, and heated are delivered from the machine and placed into the bath of molten tin covered with palm-oil they will cause no agitation or boiling over of the oil in the tin pot.

Our invention further consists in the novel devices and novel combinations of parts and devices herein shown and described, and more particularly pointed out in the claims.

In the accompanying drawings, which form a part of this specification, and in which similar letters of reference indicate like parts, Figure 1 is a side elevation of a machine embodying our invention. Fig. 2 is a central vertical longitudinal section, and Fig. 3 is a section on line 3 3 of Fig. 2. Fig. 4 is a perspective view of the feed-table.

In said drawings, A represents the frame, which may be of any suitable construction.

B is the steam-heated oil pot or vessel divided by hollow partitions b b' into three compartments or parallel troughs B' B^2 B^3 . The three parallel troughs B' B^2 B^3 are heated by steam admitted into the hollow partitions b and b' from the steam-pipe C through the separate branches c c' , each of which is provided with a separate valve c^2 c^3 to regulate the temperature of the oil or flux in the several troughs or compartments of the vessel B. The oil or flux vessel is likewise furnished with a discharge trough or compartment B^4 , separated from the first trough B' by a partition b^3 . The partition b' between the first trough B' and the next trough or compartment B^2 is furnished with an upright extension b^4 considerably higher than the tops of the troughs and preferably extending up to about the level of the center of the lower rolls D. The purpose of this extension is to prevent the foaming and boiling oil in the first trough B' from rising and foaming over into the next trough B^2 . The water dripping from the wet plates and the steam generated by the first pair of rolls and carried down by the rolls into the hot oil will cause the oil in the first trough to foam and boil, and this exten-

sion serves to prevent boiling over into the trough B². The oil in the last trough B³ will remain entirely placid, as all moisture is freed from the sheet before it reaches the last pair of rolls, so that no moisture or steam can be communicated to the oil in the last trough B³. The oil in this last trough can therefore be and is heated to the requisite high temperature to produce the most complete and perfect fluxing of the sheet, and also to raise the temperature of the sheet itself to the required point to produce the best results when it is subsequently immersed in the tin pot. The last pair of rolls and the last oil-trough B³ may thus be and in practice are heated to a much higher temperature than the first pair of rolls and the first trough B¹, the middle pair of rolls and trough being heated to an intermediate degree. Each of the compartments B¹ B² B³ is furnished with an outlet b⁵, closed by a plug b⁶, so that the oil may be drawn out when desired.

D D' D D' D D' are three pairs of hollow steam-heated smooth metallic rolls journaled in suitable bearings F F', which are mounted on the frame of the machine in suitable vertical guides F², so that the upper bearing F' of each pair of rolls may be free to move up and down in said guides.

The three pairs of rolls D D' D D' D D' are mounted directly over the three oil troughs or compartments B¹ B² B³, and the lower roll D is immersed for a fraction of its circumference, preferably about one-fourth thereof, in the oil or flux in said troughs. The bearing or journal F' of the upper roll of each pair is separated from the lower journal F, upon which it rests, by an adjusting-screw f, so that the rolls may be set parallel to each other and the space between them adjusted so as to admit of the passage of the sheet between the rolls and at the same time permit the rolls to come close enough together after the sheet has passed to practically transfer the flux or oil from the lower roll to the upper one, and thus supply the oil to both sides of the sheet and thoroughly coat both sides thereof therewith. To permit of this slight up-and-down movement of the upper roll of each pair and at the same time keep the requisite pressure between the rolls, we provide the cap-plate F³ of the journal-guide with adjusting-screws f', which act against a spring f², that bears upon the journal-box F'. By this means the rolls may be allowed to come together or nearly together when there is no sheet passing between them, and thus cause the lower roll to transfer the oil to the upper one and then yield sufficiently to allow the sheet to pass between them.

The rolls D D' are all hollow and heated by steam admitted to each pair from the steam-pipe C through separate branch pipes c⁴ c⁵ c⁶, each furnished with separate regulating-valves c⁷, so that the temperature of each pair of rolls may be governed as required.

E is the feed-table, about on a level with

the meeting surfaces of the rolls D D', from which the sheets are fed into the first pair of rolls.

E' is the discharge-table, preferably arranged at an incline and furnished with a sheet-delivery roll E² at its inner edge.

G is the oil feed or supply tank from which, through a feed pipe or nozzle g, furnished with a regulating-valve g', the oil is fed or supplied to the troughs B² B³ in a regular manner, so as to keep the same full and the rollers D D' immersed therein to a regular and uniform depth. This oil-feed tank has a steam-jacket g² for heating the same by steam admitted through the branch pipe c⁸, the same being furnished with a valve c⁹ to regulate the temperature.

H is the drip pan or tank supported on the frame A below the oil-pot B, the same being large or wide enough to catch drippings from every part of the machine. It is furnished with a well H', from which leads a pipe h to a pump K, which forces the oil up into the supply-tank G through the connecting-pipe k. The pump K is operated by pitman-rod K', connected to a crank-pin n on the gear N on the driving-shaft N'.

The rolls D D' are driven from the driving-shaft through a set of connecting-gearing N² N³ N⁴, the gears N² being on the lower rolls, the gears N³ on the upper rolls, and the gears N⁴ on intermediate shafts N⁵.

The discharge-compartment B⁴ of the oil-pot B is furnished with an outlet b⁷, provided with a valve or nozzle b⁸, through which the oil may flow into the drip-pan below.

The feed-tank G is from time to time supplied with oil to replace that adhering to the sheets passing through the machine, or, if preferred, the fresh oil may be put in the drip-pan H. By means of this tank and its feed-valve we automatically keep the troughs B¹ B² B³ supplied with oil.

In operation the wet sheets as they come from the water bath are fed between the several pairs of rollers D D', whereby the same are simultaneously dried, heated, and fluxed, the sheets passing out onto the delivery-table E' with every particle of moisture driven therefrom, heated and fluxed and ready to be placed in the tinning or metal coating bath. By means of the steam-regulating valves and the separate branch pipes leading to the several pairs of rollers the first pair of rolls and the oil in the first trough B may be kept at a comparatively-low temperature, so that the moisture and steam produced from the wet sheets will not cause too violent foaming and boiling of the oil. The next succeeding pair of rolls and the oil-trough B² are heated to a higher degree, and the final pair of rollers and trough are heated to a still higher temperature, so that the fluxed sheet will be delivered from the machine in proper condition to enter the tinning-bath. The rolls revolve continuously, and at the intervals when no sheet is between the rolls the flux or oil will be

transferred to the lower roll of each pair to the upper one, so that the oil or flux will be properly supplied to both sides of the sheet. During this operation the overhead feed-tank continuously supplies or feeds the oil to the oil-troughs, thus maintaining the oil at a proper level, and at the same time the pump redelivers the oil collected in the well of the drip-pan into the feed-tank.

By means of this machine the wet pickled sheets may be very quickly dried, heated, and fluxed without giving any opportunity for the same to become oxidized or tarnished on either side and without waste of the oil or flux and without danger of the same getting on fire, the work being also done automatically and without the necessity of hand labor.

The number of pairs of rolls which we preferably employ is three, as shown in the drawings; but the number of pairs of rolls may be increased or diminished, if desired.

As the oil in the first trough will be in a boiling, foaming, or frothing condition, owing to the steam and moisture from the wet sheets, it will foam up and come in contact with the first roll D, even though this trough be not full of oil.

As shown in the drawings, the oil-supply tank G delivers the fresh oil only to the last two troughs B² B³, the single nozzle employed delivering the oil midway between them on the partition b'. It generally is not necessary to deliver the oil from the supply-tank directly into the first trough B', as some foaming up of the oil in the second trough B² will take place from time to time in the space b¹⁰ between the second roll D and the extension b² of the partition b, and boil or foam over said extension into the trough B', and thus supply said trough with oil. The oil does not foam up over the partition b, as the moisture and steam are mostly driven off from the sheets by the first pair of rolls and practically all driven off as the sheet passes the second and still-hotter pair of rolls, so that the steam and moisture are practically confined to the space between the first two pairs of rolls and the space on the front side of said first pair of rolls.

By employing a series of pairs of graduated heating-rolls—that is to say, rolls each successive pair of which are heated to a higher temperature than the preceding pair—as the means or instrumentality for drying, heating, and fluxing the wet pickled sheets said operations are performed simultaneously or practically simultaneously, so that the sheets have not time or opportunity to become tarnished or oxidized, their surfaces being protected or coated at all times either by the water or by the oil as they pass through the machine, and we thereby secure at the same time the important result of at once preventing undue foaming, boiling, and waste of the oil and the proper heating and thorough fluxing of the sheet, as the wet sheet is first operated upon and its water chiefly driven off by the first pair of rolls at a temperature so

low as not to produce violent or undue foaming and boiling of the oil and as the sheet, after being further dried and heated by the next pair of rolls and their hot oil, is then finally heated to the proper degree and thoroughly fluxed by the last pair of rolls, the temperature of which may be raised to any desired degree without causing any agitation of the oil in their oil-trough, and the work is also done automatically. As the lower heated rolls of each pair revolve directly in the several oil troughs or compartments, the rolls themselves serve as a means for heating the oil in the oil-troughs and of keeping the oil in the different troughs at the graduated or different temperatures of the rolls themselves, as desired.

The feed-table E should be slightly inclined to permit the water to continually drain from the wet sheet as it is fed to the first pair and enters between them, and it should also be made of slats or provided with corrugations in or openings through it to prevent the water from adhering to its surface unnecessarily. The object of employing an open or corrugated feed-table and the object of inclining the same are to prevent the sheet from carrying an unnecessary amount of water or moisture to the first pair of rolls.

By combining with the oil-troughs with drying, heating, and fluxing rolls which are hollow and heated by steam admitted to their interior we are enabled not only to heat the rolls to different degrees of temperature, as desired, but also to prevent the oil from catching fire and the waste and danger incident thereto.

We prefer to locate the oil-feed nozzle g between the pairs of rolls and not to deliver the oil directly upon the rolls from this feed-nozzle, as the oil will be more evenly distributed over the surface of the upper rolls by transferring it from the lower ones; but this arrangement may of course be varied, if desired. The oil-troughs, however, are the means which we prefer to employ for supplying or coating the surface of the rolls with the oil.

We claim—

1. The machine for drying, heating, and fluxing pickled sheets of iron or steel preparatory to tinning or coating the same with metal, consisting in a series of pairs of hollow heated rolls D D', means for heating the rolls to different degrees of temperature, the last pair to a higher degree than the first pair, and means for supplying oil flux to the surface of said rolls, said pairs of rolls and the means for supplying oil flux thereto being so combined and arranged in respect to each other, substantially as shown and described, that the wet pickled sheets may pass between the rolls without being immersed in or carried through the hot oil flux, substantially as specified.

2. In a machine for drying, heating, and fluxing wet pickled sheets of iron or steel preparatory to tinning or coating the same with metal, in combination with a series of pairs

of heated rolls D D', means for heating said rolls, the succeeding pair to a higher degree than the preceding pair, and oil troughs or compartments, one for each pair of said rolls, said pairs of rolls and oil-troughs being so arranged and combined that the lower roll only of each pair shall come in contact with the oil in the trough, so that the sheets to be dried, heated, and fluxed may pass between the rolls without being immersed in the oil, substantially as specified.

3. In a machine for drying, heating, and fluxing wet pickled sheets of iron or steel preparatory to tinning or coating the same with metal, the combination, with a series of pairs of heated rolls D D', the first pair being at a lower temperature than the last pair, of oil troughs or compartments for each pair of said rolls and means for heating said troughs and compartments and regulating the temperature thereof, substantially as specified.

4. In a machine for drying, heating, and fluxing wet pickled sheets of iron or steel preparatory to tinning or coating the same with metal, the combination, with a series of pairs of heated rolls D D', the first pair being at a lower temperature than the last pair, of oil troughs or compartments for each pair of said rolls and means for heating said troughs and compartments and regulating the temperature thereof, the upper one of each pair of said rolls being movable as to its axis or shaft to admit of the passage of the sheets between the rolls and the surface of the rolls to approach each other when the sheets are not passing between them, so that the oil will be transferred to the upper rolls from the lower rolls, substantially as specified.

5. In a machine for drying, heating, and fluxing wet pickled sheets of iron or steel preparatory to tinning or coating the same with metal, the combination, with a series of pairs of heated rolls D D', the first pair being at a lower temperature than the last pair, of oil troughs or compartments for each pair of said rolls and means for heating said troughs and compartments and regulating the temperature thereof, the upper one of each pair of said rolls being movable as to its axis or shaft to admit of the passage of the sheets between the rolls and the surface of the rolls to approach each other when the sheets are not passing between them, so that the oil will be transferred to the upper rolls from the lower rolls, and springs and adjusting-screws to regulate the pressure between the rolls of each pair, substantially as specified.

6. In a machine for drying, heating, and fluxing wet pickled sheets of iron or steel preparatory to tinning or coating the same with metal, the combination, with a series of pairs of heated rolls D D', the first pair being at a lower temperature than the last pair, and means for heating said rolls and regulating the temperature thereof, of oil troughs or compartments for each of said pairs of rolls and a feed-table E, substantially as specified.

7. In a machine for drying, heating, and fluxing wet pickled sheets of iron or steel preparatory to tinning or coating the same with metal, the combination, with a series of pairs of heated rolls D D', the first pair being at a lower temperature than the last pair, of oil troughs or compartments for each pair of said rolls, and a discharge-table E', and means for heating said rolls and troughs and regulating the temperature thereof, substantially as specified.

8. In a sheet drying, heating, and fluxing machine, the combination, with a series of hollow steam-heated rolls D D', the first pair of said rolls being at a lower temperature than said last pair, of a steam-heated oil-vessel B, having separate troughs or compartments divided by hollow partitions, into which steam is admitted for heating said troughs or compartments, and means for regulating the temperature of the sets of rolls, and means for supplying steam to said hollow rolls and hollow partitions for heating the same, substantially as specified.

9. The combination, with hollow steam-heated rolls D D' D D', of an oil-vessel having separate troughs or compartments, one for each pair of said rolls, separated by a hollow steam-heated partition, and means for supplying steam to said hollow rolls and hollow partitions for heating the same, substantially as specified.

10. In a machine for drying, heating, and fluxing wet pickled sheets of iron or steel preparatory to tinning or coating the same with metal, the combination, with two or more pairs of rolls D D', of an oil-vessel B, having two or more troughs or compartments separated by a hollow steam-heated partition, and means for supplying steam to said hollow partitions, substantially as specified.

11. The fluxing-vessel B, divided into separate troughs or compartments B' B² B³ by hollow partitions *b b'* and furnished with a steam-pipe C, having separate branch pipes *c c'*, leading to said hollow partitions, substantially as specified.

12. The fluxing-vessel B, divided into separate troughs or compartments B' B² B³ by hollow partitions *b b'* and furnished with a steam-pipe C, having separate branch pipes *c c'*, leading to said hollow partitions, said branch pipes being provided with valves for regulating the heat, substantially as specified.

13. The combination of oil or fluxing troughs with two or more pairs of hollow steam-heated rolls D D', revolving therein, the upper roll of each pair being movable as to its axis or shaft to permit the sheets to pass between and the rolls to approach each other when the sheets are not so passing, and thus transfer the oil from the lower roll to the upper one, said upper rolls of each pair having movable boxes F', supported on adjusting-screws, and means for supplying steam to said roll, substantially as specified.

14. The combination of oil or fluxing troughs

with two or more pairs of hollow steam-heated rolls D D', revolving therein, the upper roll of each pair being movable as to its axis or shaft to permit the sheets to pass between and the rolls to approach each other when the sheets are not so passing, and thus transfer the oil from the lower roll to the upper one, said upper rolls of each pair having movable boxes F', supported on adjusting-screws and provided with springs f² and adjusting-screws f, and means for supplying steam to said rolls, substantially as specified.

15. In a machine for drying, heating, and fluxing wet sheets of iron or steel preparatory to coating the same with metal, the combination, with a series of pairs of steam-heated rolls, the first pair being at a lower temperature than the last pair, of steam-heated oil troughs or compartments for each pair of said rolls and means for heating said rolls and oil troughs or compartments and regulating the temperature thereof, substantially as specified.

16. In a machine for drying, heating, and fluxing wet sheets of iron or steel preparatory to coating the same with metal, the combination, with a series of pairs of steam-heated rolls, the first pair being at a lower temperature than the last pair, of steam-heated oil troughs or compartments for each pair of said rolls, and an inclined feed-table for delivering the sheets to the first pair of said rolls, and means for heating said rolls and oil troughs or compartments and regulating the temperature thereof, substantially as set forth.

17. In a machine for drying, heating, and fluxing wet sheets of iron or steel preparatory to coating the same with metal, the combination, with a series of pairs of steam-heated rolls, the first pair being at a lower temperature than the last pair, of steam-heated oil troughs or compartments for each pair of said rolls, and a corrugated or open feed-table for delivering the sheets to the first pair of said rolls, and means for heating said rolls and oil troughs or compartments and regulating the temperature thereof, substantially as specified.

18. In a machine for drying, heating, and fluxing wet sheets of iron or steel preparatory to coating the same with metal, the combination, with a series of pairs of steam-heated rolls, the first pair being at a lower temperature than the last pair, of steam-heated oil troughs or compartments for each pair of said rolls, and a corrugated or open inclined feed-table for delivering the sheets to the first pair of said rolls, and means for heating said rolls and oil troughs or compartments and regulating the temperature thereof, substantially as specified.

19. In a machine for drying, heating, and fluxing wet sheets of iron or steel preparatory to coating the same with metal, the combination, with a series of pairs of steam-heated rolls, the first pair being at a lower temperature than the last pair, of steam-heated oil

troughs or compartments for each pair of said rolls, and a discharge-table, and means for heating said rolls and oil troughs or compartments and regulating the temperature thereof, substantially as specified.

20. In a machine for drying, heating, and fluxing wet sheets of iron or steel preparatory to coating the same with metal, the combination, with a series of pairs of steam-heated rolls, the first pair being at a lower temperature than the last pair, of steam-heated oil troughs or compartments for each pair of said rolls, an inclined feed-table for delivering the sheets to the first pair of said rolls, and a discharge-table, and means for heating said rolls and oil troughs or compartments and regulating the temperature thereof, substantially as specified.

21. In a machine for drying, heating, and fluxing wet sheets of iron or steel preparatory to coating the same with metal, the combination, with a series of pairs of steam-heated rolls, the first pair being at a lower temperature than the last pair, of steam-heated oil troughs or compartments for each pair of said rolls, and a corrugated or open inclined feed-table for delivering the sheets to the first pair of said rolls, and a discharge-table, and means for heating said rolls and oil troughs or compartments and regulating the temperature thereof, substantially as specified.

22. In a machine for drying, heating, and fluxing wet sheets of iron or steel preparatory to coating the same with metal, the combination, with a series of pairs of steam-heated rolls, the first pair being at a lower temperature than the last pair, of steam-heated oil troughs or compartments for each pair of said rolls, and an oil-feed tank for delivering oil automatically to said oil-troughs and means for heating said rolls and oil troughs or compartments and regulating the temperature thereof, substantially as specified.

23. In a machine for drying, heating, and fluxing wet sheets of iron or steel preparatory to coating the same with metal, the combination, with a series of pairs of steam-heated rolls, the first pair being at a lower temperature than the last pair, of steam-heated oil troughs or compartments for each pair of said rolls, and a steam-heated oil-feed tank above said troughs and furnished with means for feeding the oil therefrom into said troughs, and means for heating said rolls and oil troughs or compartments and regulating the temperature thereof, substantially as specified.

24. In a machine for drying, heating, and fluxing wet sheets of iron or steel preparatory to coating the same with metal, the combination, with a series of pairs of steam-heated rolls, the first pair being at a lower temperature than the last pair, of steam-heated oil troughs or compartments for each pair of said rolls, and a drip-pan below said oil-troughs, and means for heating said rolls and oil troughs or compartments and regulating the

temperature thereof, substantially as specified.

25. In a machine for drying, heating, and fluxing wet sheets of iron or steel preparatory to coating the same with metal, the combination, with a series of pairs of steam-heated rolls, the first pair being at a lower temperature than the last pair, of steam-heated oil troughs or compartments for each pair of said rolls, a drip-pan below said oil-troughs, and an overhead oil-feed tank, and means for heating said rolls and oil troughs or compartments and regulating the temperature thereof, substantially as specified.

26. In a machine for drying, heating, and fluxing wet sheets of iron or steel preparatory to coating the same with metal, the combination, with a series of pairs of steam-heated rolls, the first pair being at a lower temperature than the last pair, of steam-heated oil troughs or compartments for each pair of said rolls, a drip-pan below said oil-troughs, an overhead oil-feed tank, and a pump and connecting-pipes for delivering the oil automatically from said drip-pan to said overhead feed-tank, and means for heating said rolls and oil troughs or compartments and regulating the temperature thereof, substantially as specified.

27. The combination of a pair of heated fluxing-rolls, an oil trough or vessel, an oil-supply tank G above said oil-trough furnished with a feed-nozzle *g*, and means for heating said rolls, substantially as specified.

28. The combination of a pair of heated fluxing-rolls, an oil trough or vessel, an oil-supply tank G above said oil-trough furnished with a feed-nozzle *g*, a drip-pan below said oil trough or vessel, and means for heating said rolls, substantially as specified.

29. The combination of a pair of heated fluxing-rolls, an oil trough or vessel, an oil-supply tank G above said oil-trough furnished with a feed-nozzle *g*, a drip-pan below said oil trough or vessel, a pump and connecting-pipes for delivering the oil from said drip-pan to said oil-feed tank, and means for heating said rolls, substantially as specified.

30. The combination of a pair of heated fluxing-rolls, an oil trough or vessel, an oil-supply tank G above said oil-trough furnished with a feed-vessel *g*, and a steam-pipe and connections for heating said rolls and said oil trough or vessel, substantially as specified.

31. The combination of a pair of heated fluxing-rolls, an oil trough or vessel, an oil-supply tank G above said oil-trough furnished with a feed-nozzle *g*, and a steam-pipe and connections for heating said rolls and said oil trough or vessel and said oil-feed tank, substantially as specified.

32. The combination, with steam-heated rolls D D' D D' D D', of an oil-containing vessel B, furnished with separate troughs or compartments B', B², B³, and B⁴, having hollow partitions *b b'* heated by steam, and a drip-pan H, having well H', oil-feed tank G above said oil-trough, having nozzle *g*, pump K, and connecting-pipes leading from said pump to said drip-pan and feed-tank, and steam-pipes and connections for supplying the steam to said rolls and hollow partitions, substantially as specified.

33. The combination of two or more pairs of heated rolls and oil-troughs in which they revolve, the partition between the first two oil-troughs being furnished with an extension *b⁴*, and means for heating said rolls, substantially as specified.

34. The combination, with rolls D D' D D' D D', of an oil vessel or pot divided into troughs or compartments B' B² B³ by hollow heated partitions *b b'*, said partition *b* between the first two pairs of rolls having an extension *b⁴*, and means for supplying steam to said hollow partitions *b b'* to heat the same, substantially as specified.

35. The combination, with the frame furnished with guides F², of rolls D D', having journal boxes or bearings F F', fitting in said guides F², and adjusting-screws *f* for supporting the boxes F of the upper roll, and a flux-trough in which the lower roll revolves, substantially as specified.

36. The combination, with the frame furnished with guides F², of rolls D D', having journal boxes or bearings F F', fitting in said guides F², and adjusting-screws *f* for supporting the boxes F of the upper roll, and a flux-trough in which the lower roll revolves, an adjusting-screw *f'*, and spring *f²*, said adjusting-screw *f* and spring *f²* being above the upper roll, substantially as specified.

EDWIN NORTON.
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Witnesses:

EDMUND ADCOCK,
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