Nov. 20, 1951 W. B. COOPER ET AL 2,575,409

CURRENT COLLECTOR FOR ELECTROPLATING APPARATUS

Filed June 30, 1948 2 SHEETS—SHEET 1

Fig. 1

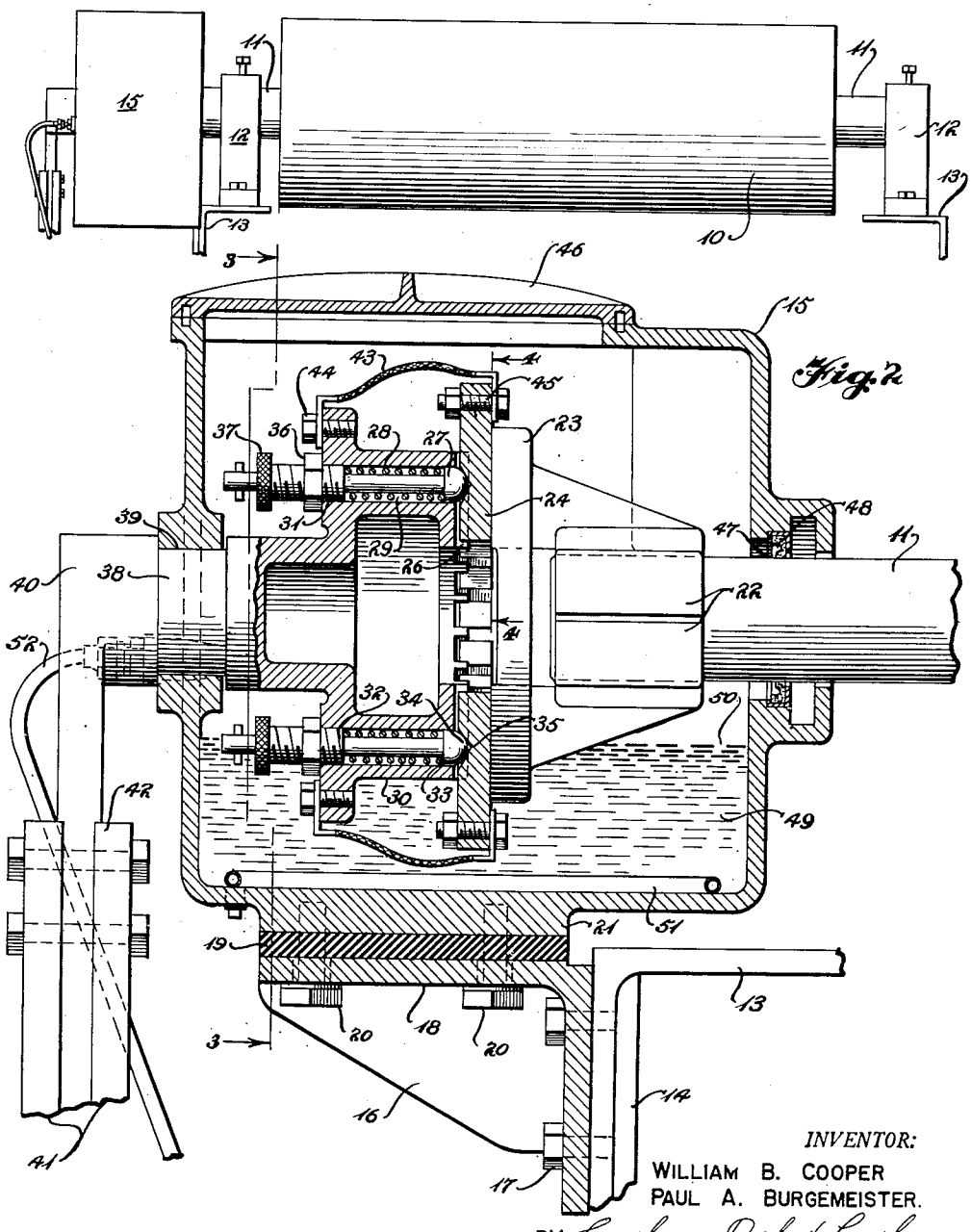


Fig. 2

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Fig. 3

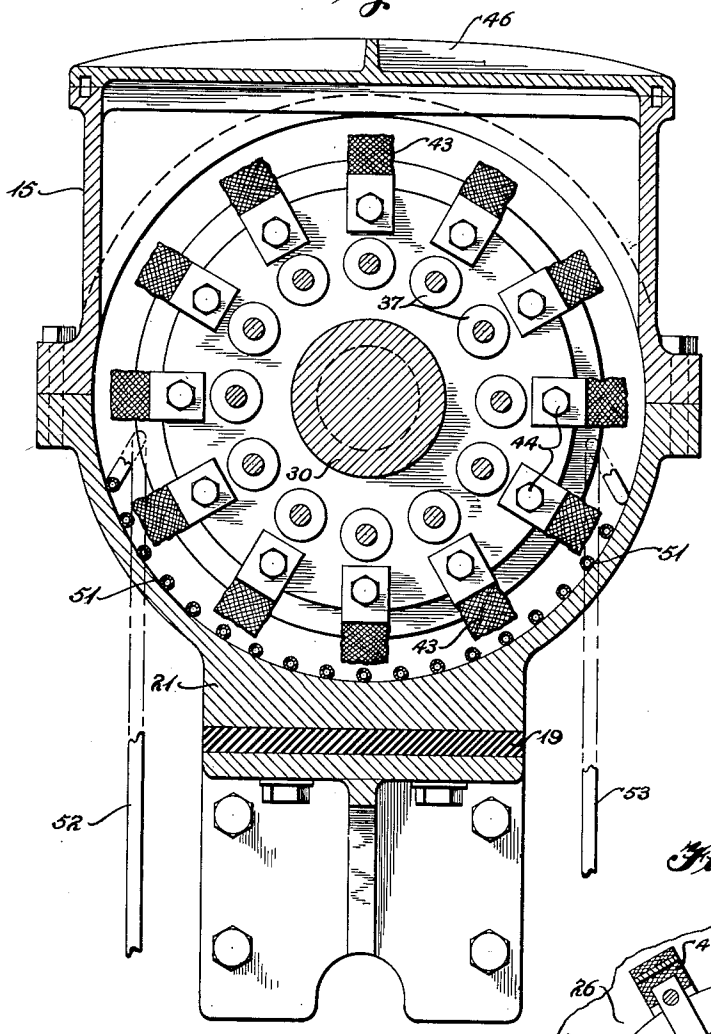



Fig. 4

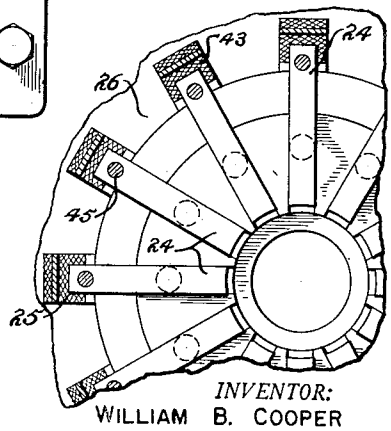
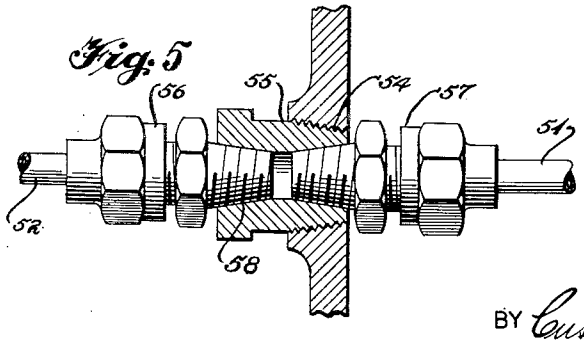



Fig. 5

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Patented Nov. 20, 1951

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# UNITED STATES PATENT OFFICE

2,575,409

## CURRENT COLLECTOR FOR ELECTRO-PLATING APPARATUS

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Application June 30, 1948, Serial No. 36,106

6 Claims. (Cl. 173—324)

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The present invention relates to electric current carrying collectors for use particularly in the coating of metal, such as steel, with tin by electro-deposition.

The primary object of the invention is to provide a collector which will enable the carrying of greater quantities of current without over-heating of the contact surfaces. In prior constructions, unless they are made quite large, over-heating has been encountered when the current reaches about 2500 amperes. Aside from being objectionable because of excessive bulk and weight, such collectors have the disadvantage that they require an enormous area of contact between the fixed and movable contact surfaces. This creates substantial friction and the freely rotatable current carrying rolls, over which the metal strip travels during plating, are thereby retarded in their rotation. As a result, the travelling strip skids over the rolls rather than travels with them and the plated coating is not uniform and is frequently so defective as to require that the strip either be run through again or rejected.

It has been found that the present invention can safely carry 5000 amperes or more without the foregoing objections and without evidence of over-heating. Moreover, the collector structure is small and light enough to be carried on the electro-plating tank.

An additional object of the invention is to provide a collector which will require relatively little copper and still allow a greater current load to be handled.

A further object of the invention is to provide a construction wherein the frictional load is reduced to a minimum by continuously lubricating the contacts.

Another object of the invention is to provide a construction wherein the collector is enclosed, so that the current carrying device is maintained clean and free of foreign particles which might produce a short circuit or accumulate in a manner to increase the friction.

Also, a feature of the invention resides in keeping the wearing parts constantly lubricated to thereby increase the life of the collector structure.

Another feature of the collector construction is its relatively low cost to build and to operate as compared with previous devices.

A further feature of the invention comprises a collector structure in which the contacts are submerged in oil thereby reducing the possibility of sparking due to faulty contact, i. e., the oil will serve to quench customary arcing.

An equally important feature of the invention consists in cooling the oil bath in which the fixed

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and moving contacts are disposed, whereby cooled oil coming in contact with the current carrying parts constantly absorbs the heat. Preferably, the oil is cooled by inserting a cooling coil in the oil bath and circulating a cooling medium such as cold water through the coil. On the other hand, the heated oil may be removed from the bath, circulated through suitable heat exchanging means to cool it, and then the cooled oil returned to the bath.

Referring to the drawings:

Figure 1 is a diagrammatic view of one of the current carrying rolls having the current carrying collector structure connected at one end, the continuous strip to be plated travelling over this roll which is rotated by the passage of the strip.

Figure 2 is a sectional view of the improved collector structure.

Figure 3 is a section on the line 3—3 of Figure 2.

Figure 4 is a detail view showing the mounting of the fixed contacts, and

Figure 5 is a detail view of a wall connection for the pipes used in circulating a cooling medium or the oil for constantly cooling the oil bath.

In Figure 1 there is shown at 10 one of the current carrying rolls of an electroplating bath. A suitable number of such rolls, arranged in spaced relation, are supported for free rotation above the liquid level of the bath. The rolls are carried by their shafts 11 of conductive material which are mounted for rotation on bearings 12 supported by the brackets 13 connected to the upper edges 14 of opposite side walls of the tank containing the bath.

A continuous strip of metal, for example, a steel band, is drawn over the rolls and over cooperating rolls submerged in the bath, whereby the strip is moved vertically as well as longitudinally of the bath for carrying out the plating operation. The rolls 10 and their shafts 11 are rotated by the movement of the strip thereover and impart a charge to the travelling strip.

One end of each shaft 11 of the rolls 10 is extended outwardly beyond the wall 14 of the tank, as shown in Figure 1, and into a closed housing 15 suitably supported on an insulating bracket 16 mounted on one of the tank walls 14, as shown in Figure 2. The bracket 16 is suitably bolted to the tank wall as shown at 17 and its shelf portion 18 carries an insulating layer 19. The studs 20 connecting the base 21 of the housing and the intermediate insulating layer 19 to the shelf 18 are of non-conducting material, in case the housing is made of conductive material. In this housing 15 are positioned the fixed and moving contacts, as well

as an oil bath, and preferably means for cooling the bath, as will now be described. The housing has the upper rectangular portion and a curved bottom portion, each provided with flanges for connecting the portions together as by bolts, as shown in Figure 3.

Referring to Figure 2, rotating shaft 11 carries a two-part conductor sleeve 22 at its end within the housing. This sleeve is clamped to the conductor shaft in any suitable manner so as to rotate with the shaft and conduct current thereto and to the roll 10 as the latter is rotated by the traveling strip. The sleeve 22 carries a circular conductor ring 23 which, in its rotary movement, engages the fixed, radially disposed contacts 24 arranged in radial grooves 25 of the face 26 which is an integral part of the conductor block 30, as shown in Figure 4. The ring 23 and contacts 24 are of copper.

The contacts 24 are pressed toward the ring 23 so as to assure a constant current conducting engagement of the contacts 24 with the ring 23. This is achieved by means of the slidable pins 27 which are urged toward the contacts 24 due to engagement by the springs 28, as will now be set forth. The pins 27 and springs 28 are disposed in suitable circularly arranged spaced openings 29 in a conductor block 30. The spring pressure may be adjusted by any suitable means such as a threaded sleeve 31 engaging one end of the spring 28 and also forming a stop, as shown at 32 in Figure 2. The inner surface 33 of the rounded head 34 of each pin forms a stop for the spring 28 at its other end, whereby the rounded heads of the pins are constantly seated in the spaced circularly arranged recesses 35 in the contacts 24 which register with the openings 29 in the block 30. The sleeves 31 are threaded and are adjustably mounted in the threaded projections 36 carried by the block 30, whereby turning of the knurled rings 37 fixed to the sleeves will move the sleeves with respect to the openings 29 to thereby vary the distance between the stops 32 and 33 and control the pressure of the pins upon the ring 26.

The block 30 is rigidly supported within the casing at one side thereof as shown in Figure 1, by means of the conductive projection 38 which tightly fits within and closes an opening 39 in the wall of the closed housing 15. The projection 38 has electrical contact with a conducting bar 40 which, in turn, is connected to a pair of current carrying bars 41 leading from the generator, as shown at 42. The bar 40 and projection 38 may be integral or connected in any suitable manner as by welding or by bolting the parts together.

In this manner, current is carried by the bars 41 through the bar 40 to the conductive projection 38 and block 30. The current is distributed from this block to the respective fixed contacts 24 by means of the circularly spaced flexible conductors 43, one for each of the fixed contacts as shown in Figure 3. The flexible conductors are connected to the block 30 and to the contacts 24 by bolts 44 and 45, respectively.

The casing is provided with a removable cover 46 and at the wall of the housing 15 through which the shaft 11 is introduced, the opening 47 is sealed by a suitable gasket 48, as shown in Figure 2.

Oil or other suitable lubricant 49 is carried in the housing 15 to a level substantially as indicated at 50. It will be observed that the conductor ring 23 constantly rotates through



this bath so as to lubricate the electrically engaging surfaces of the fixed contacts 24 and the ring 23.

Referring to Figures 2 and 3, the oil is maintained constantly cooled by circulating a suitable cooling medium such as water by means of the coil 51 which is immersed in the oil bath 49 as shown. The cooling medium is constantly removed through the line 52 to any suitable type of heat exchanger (not shown) where it is cooled and returned to the housing through the line 53. It will be noted that the coil 51, as shown in Figure 3, comprehends substantially the entire depth of the oil level so as to effect a continuous and uniform cooling and conforms to the curved inner surface of the bottom of the housing 15 so as to be located out of the path of movement of the ring 23.

The pipes 52 and 53 are connected into the walls of the housing 15 in a manner to make a sealed connection 54 as shown in Figure 5, there being a separate connection for each of the said pipes to the coil to form the closed circulating system. This connection comprises a plug member 55 sealed into the wall of the housing into which pipe couplings 56 and 57 for the outside and inside of the housing are threadedly received as at 58. As shown in Figure 5, an end of the cooling coil 51 is engaged in an inner coupling 57 at each end of the coil, and the pipes 52 and 53 are connected to the respective outer couplings 56.

The construction above described is effective for carrying a current of 5000 amperes or more without overheating, and is of such light weight that it can be carried on the wall of the tank 14 as shown in Figures 1 and 2.

All of the moving parts are kept constantly lubricated to reduce wear and increase the life of the structure. Moreover, the continuous conductive engagement between the fixed contacts 24 and the ring 23 is assured.

It will be noted that the contacts 24 are held against rotation with respect to the rotating conductor member 23 by the pins 27 engaging in the recesses 35 but are otherwise unsupported, being connected to the block 30 only by the relatively loose flexible electrical conductors 43.

Instead of continuously circulating a coolant liquid such as water through the circulating system provided by the coil 51, pipes 52—53 and heat exchanger, the oil or lubricant can itself be constantly circulated through the system.

It is, of course, understood that a collector structure, as described above, is associated with each of the rolls 10 where, as is usually the case, there are employed a plurality of such rolls.

We claim:

1. A collector device for electrodeposition apparatus, comprising a housing, a collector roll shaft extending into said housing and mounted for rotation, a conductor member having a ring contact carried by said shaft within the housing, a ring member fixed against rotation and carrying radial contacts adapted to be engaged by said conductor member in its rotation on said shaft, a conductor block supported in said housing and carrying said fixed member, means constantly urging said radial contacts toward said conductor member to thereby assure continuous engagement between the fixed contacts and the rotating conductor member, said means being carried by said block and including spring-pressed pins having heads which are normally urged into engagement with said radial con-

tacts, said block having a conductor projection extending through a wall of said housing, and an electrical connection to said projection, whereby current is passed through said shaft to its roll for imparting a charge to a strip passing over the roll during electroplating.

2. A collector device for electrodeposition apparatus, comprising a housing, a collector roll shaft extending into said housing and mounted for rotation, a conductor member having a ring contact carried by said shaft, a ring member fixed against rotation and carrying radial contacts adapted to be engaged by said conductor member in its rotation on said shaft, a conductor block supported in said housing and carrying said fixed member, means constantly urging said radial contacts toward said conductor member to thereby assure continuous engagement between the fixed contacts and the rotating conductor member, said means being carried by said block and including spring-pressed pins having heads which are normally urged into engagement with said radial contacts, said contacts having recesses in which the heads of said pins engage to hold the contacts against rotation, said block having a conductor projection extending through a wall of said housing, and an electrical connection to said projection, whereby current is passed through said shaft to its roll for imparting a charge to a strip passing over the roll during electroplating.

3. A collector device for electrodeposition apparatus, comprising a housing, a collector roll shaft extending into said housing and mounted for rotation, a conductor member having a ring contact carried by said shaft within the casing, a ring member fixed against rotation and carrying radial contacts adapted to be engaged by said conductor member in its rotation on said shaft, a conductor block supported in said housing and carrying said fixed member, said block having a conductor projection extending through a wall of said housing, a bath of cooling lubricant retained in the bottom portion of said housing, said conductor member continuously moving through said bath during its rotation whereby the surface thereof and the surfaces of said contacts are continuously lubricated and cooled, and an electrical connection to said projection, whereby current is passed through said shaft to its roll for imparting a charge to a strip passing over the roll during electroplating.

4. A collector device for electrodeposition apparatus, comprising a housing, a collector roll shaft extending into said housing and mounted for rotation, a conductor member having a ring contact carried by said shaft within the housing, a ring member fixed against rotation and carrying radial contacts adapted to be engaged by said conductor member in its rotation on said shaft, a conductor block supported in said housing and carrying said fixed member, said block having a conductor projection extending through a wall of said housing, a bath of cooling lubricant retained in the bottom portion of said housing, said conductor member continuously moving through said bath during its rotation, whereby the surface thereof and the surfaces of said contacts are continuously lubricated and cooled, means connected to the housing for maintaining the lubricant relatively cool, and an electrical connection to said projection, whereby current is passed through said shaft to its roll for imparting a charge to a strip passing over the roll during electroplating.



5. A collector device for electrodeposition apparatus, comprising a housing, a collector roll shaft extending into said housing and mounted for rotation, a conductor member having a ring contact carried by said shaft in the housing, a ring member fixed against rotation and carrying radial contacts adapted to be engaged by said conductor member in its rotation on said shaft, a conductor block supported in said housing and carrying said fixed member, said block having a conductor projection extending through a wall of said housing, a bath of cooling lubricant retained in the bottom portion of said housing, said conductor member continuously moving through said bath during its rotation, whereby the surface thereof and the surfaces of said contacts are continuously lubricated and cooled, means connected to the housing for maintaining the lubricant relatively cool, said means including a coolant circulating system comprising a coil disposed in the bath for constantly circulating a cooling medium therethrough, and an electrical connection to said projection, whereby current is passed through said shaft to its roll for imparting a charge to a strip passing over the roll during electroplating.

6. A collector device for electrodeposition apparatus comprising a housing, a collector roll shaft extending into said housing and mounted for rotation, a conductor member having a ring contact carried by said shaft within the housing, a ring member fixed against rotation and carrying radial contacts adapted to be engaged by said conductor member in its rotation on said shaft, a conductor block supported in said housing and carrying said fixed member, said block having a conductor projection extending through a wall of said housing, a bath of cooling lubricant retained in the bottom portion of said housing, said conductor member continuously moving through said bath during its rotation, whereby the surface thereof and the surfaces of said contacts are continuously lubricated and cooled, means connected to the housing for maintaining the lubricant relatively cool, said means comprising a circulating system for withdrawing the lubricant from the bath, cooling it, and returning the cooled lubricant to the bath, and an electrical connection to said projection, whereby current is passed through said shaft to its roll for imparting a charge to a strip passing over the roll during electroplating.

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