

Feb. 15, 1966

G. MANTOVANELLO ET AL
SUSPENSION OF ANODIC CASINGS IN CELLS FOR
THE ELECTROLYTIC PRODUCTION OF ALUMINUM

3,235,478

Filed Nov. 15, 1963

5 Sheets-Sheet 1

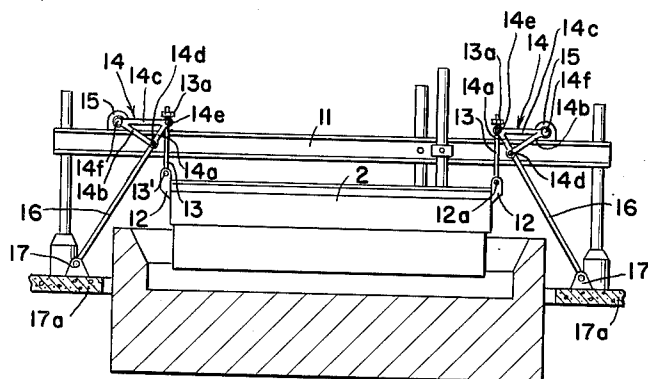


FIG. 1

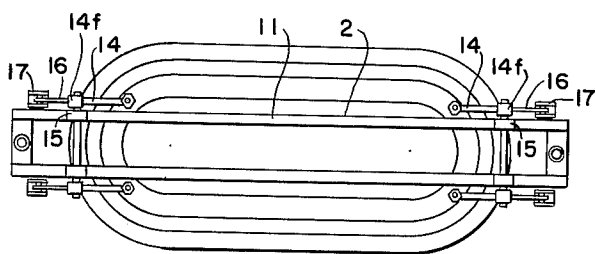


FIG. 2

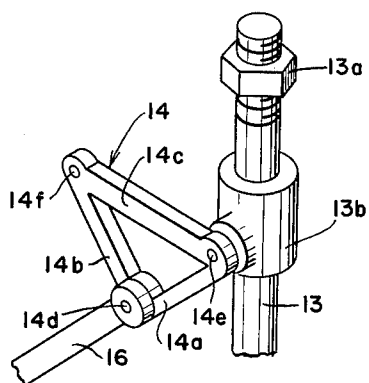


FIG. 3

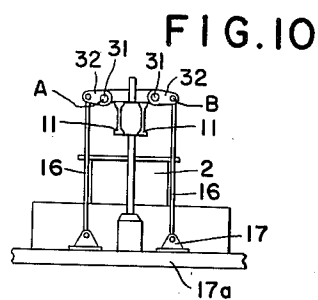


FIG. 10

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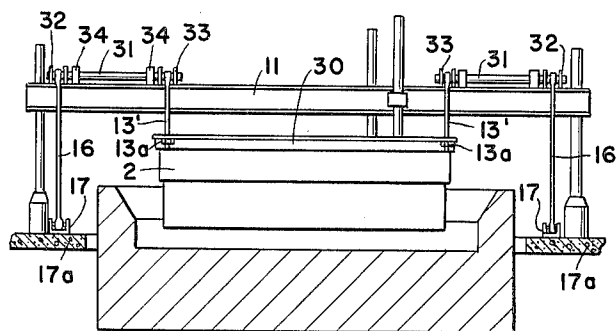


FIG. 8

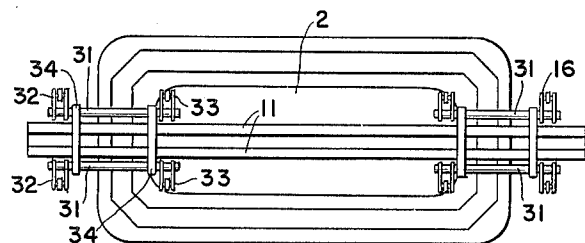


FIG. 9

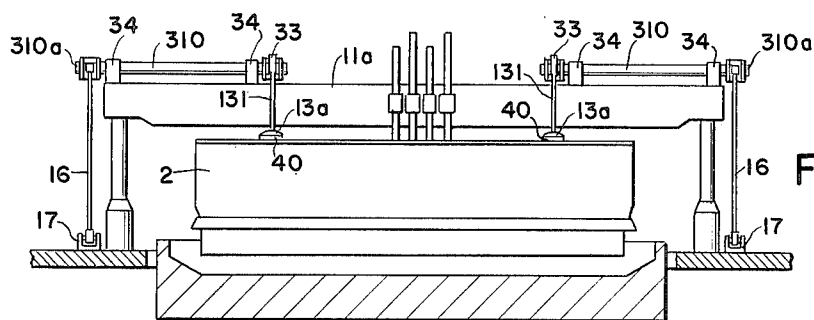


FIG. 13

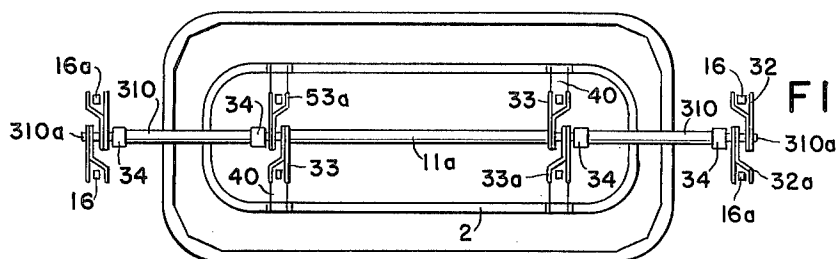


FIG. 14

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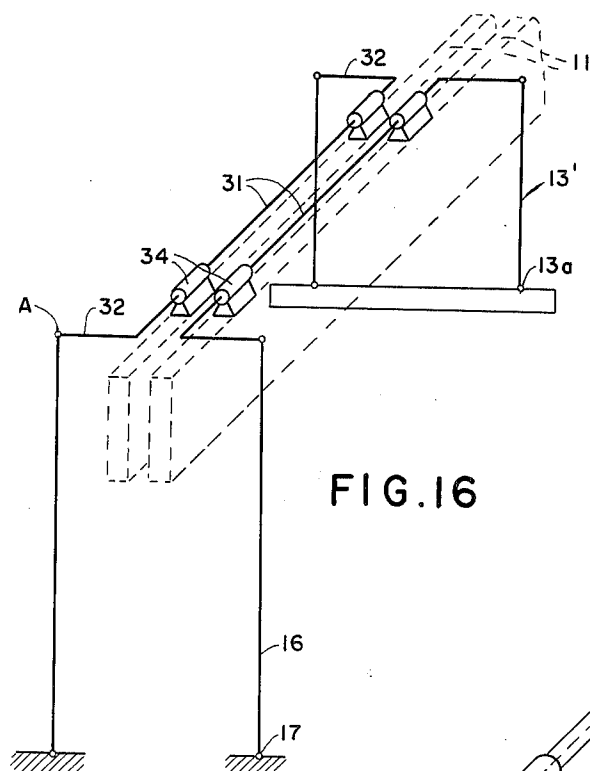


FIG. 16

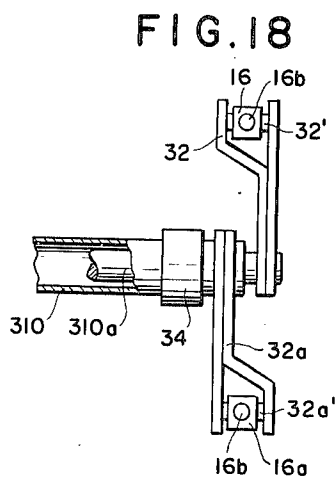


FIG. 18

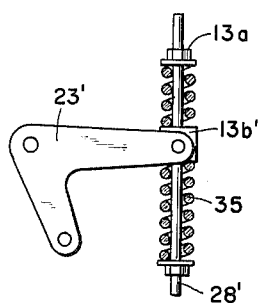


FIG. 11

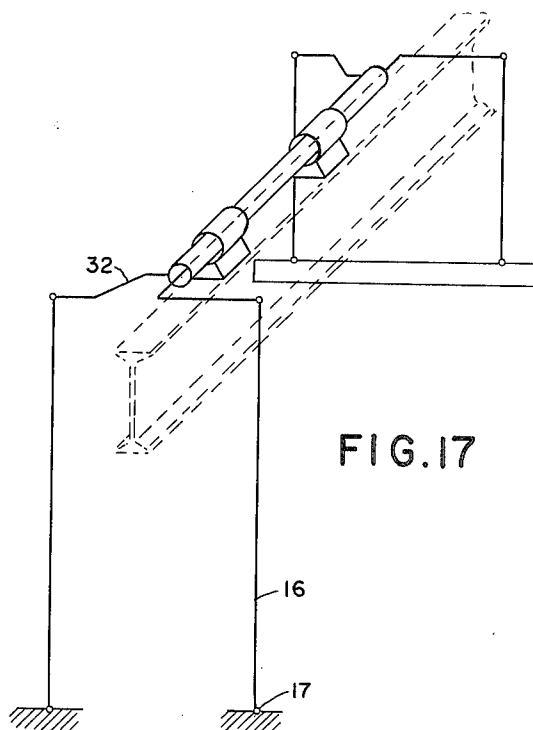


FIG. 17

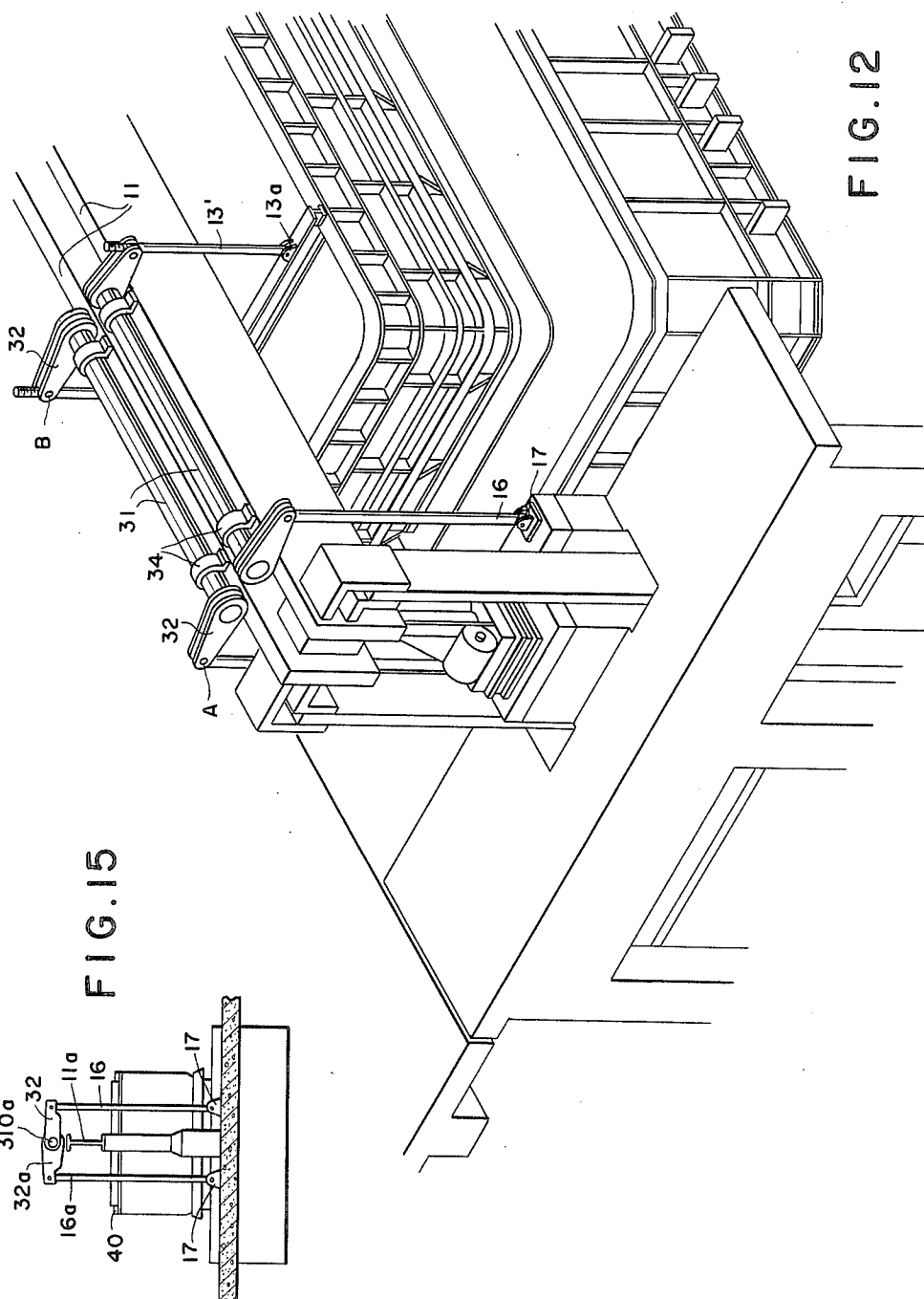
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**SUSPENSION OF ANODIC CASINGS IN CELLS
FOR THE ELECTROLYTIC PRODUCTION OF
ALUMINUM**

Giovanni Mantovanello and Silverio Bruni, Milan, Italy

Filed Nov. 15, 1963, Ser. No. 323,927

Claims priority, application Italy, Mar. 25, 1958,

4,502/58

9 Claims. (Cl. 204-225)

This application is a continuation-in-part containing subject matter divided from our copending application Serial No. 801,266, filed March 23, 1959, now Patent No. 3,127,338.

The present invention relates to a new type of suspension of the anodic casing for self-baking electrodes in cells for the electrolytic production of aluminum.

In particular this is an improvement to the recent types of electrolytic cells for the production of aluminum which are fitted with self-baking electrodes, e.g. of the Soederberg-Montecatini type, provided with vertical iron contact rods for feeding the electric current to the anode, and includes the types described in copending applications Serial No. 480,509, filed January 7, 1955, now Patent No. 3,029,194; Serial No. 551,679, filed December 7, 1955, now Patent No. 2,938,843; and Serial No. 587,985, filed May 29, 1956, now Patent No. 2,952,592, all assigned to the assignee of the present application.

The suspension system claimed herein can be applied to anodes having a circular or rectangular cross section as well as to those having a rectangular cross section with rounded short sides. In such a suspension system, the contact rods are firmly anchored to the baked portion of the anode and, therefore, exert also the function of a suspension member. In the afore-mentioned types of cells the vertical iron contact rods are connected by suitable clamps with the anodic beam, the ends of which are supported by vertical screw jacks which render possible the vertical regulation of the anode.

The anodic beam of the electrolytic cell comprises one or more rigidly connected metallic beams. In the specific examples disclosed in the present specification reference is made to an anodic beam comprising two elements. Obviously the scope of the present invention includes also cells having one beam element or more than two beam elements. Hence the generic term "anodic beam" is used herein without being limited to any particular number of elements.

The anode of the cell is contained in a sheet-iron casing, suitably reinforced by means of iron sections and destined to contain the crude electroodic paste and to protect the half-baked and baked portions against atmospheric oxidation. The anodic casing in general is terminated by a small anodic gas collecting ring for collecting the liberated "anodic gas" and the products formed by distillation of the pitch used as a binder for the anodic paste.

During normal running of the electrolytic cell the anodic casing should cover the electrode to the greatest extent possible without coming too close to the molten electrolytic bath, in order to avoid any possibility that iron may pollute the bath and, therefore, pollute the aluminum produced.

To achieve these ends, the anodic casing must remain at a predetermined and constant distance from the bath while the anode must be lowered regularly as carbon is continuously burnt by the oxygen developed at the anode from the electrolysis of alumina in the bath.

The anode therefore slides within the casing which remains in a stationary position.

For this reason, in cells as made heretofore the casing as well as the contact rods in general have not been

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connected directly with the anodic beam. With the prior systems as used heretofore, the casing is usually connected with a special independent beam resting on supports connected with the ground. The casing is adjusted, by means of screw jacks or the like, at the desired distance from the bath, which distance remains constant in practice, and the electrode, pushed by the anodic beam through the contact rods, slides gradually down through the casing. In these prior devices the anodic beam is controlled by the vertical screw jacks as the electrolytic combustion of the baked anode paste proceeds.

The suspension of the anodic casing on an independent supporting beam involves structural complications which all lead to the need for increased horizontal and vertical space requirements for the anode, thus rendering more difficult the accommodations of devices for mechanizing the various operations for conducting the cell, such as, e.g. mechanized charging of the anode paste and of the alumina, tapping of the aluminum produced, mechanized breaking of the crust. The necessity of mechanizing those operations is particularly felt in high amperage cells, e.g. of 100 ka. and more.

It is therefore an object of the present invention to provide an improved type of suspension for the anodic casing of an aluminum electrolytic cell so as to maintain the anodic casing at a constant distance from the electrolytic bath, while permitting the anode to be regularly lowered as necessary.

It is a further object of the invention to provide an improved type of suspension for the anodic casing of an aluminum electrolytic cell, which suspension is structurally simple in construction and which requires a minimum of space, thus rendering possible the automatic and mechanized charging of anode paste into the cell.

Still another object of the invention is to provide a type of suspension for the anodic casing of an aluminum electrolytic cell which blocks only downward movement of the casing, but which results in upward movement of the casing when the anode is lifted from a predetermined level.

According to the present invention these and other objects are achieved by connecting the casing to the anodic beam, to which the contact rods are also secured, by means of a mechanical system having a variance of one degree of freedom and which keeps the casing in a predetermined position while the beam is lowered in order to make up for anode consumption.

In this way the former types of supporting beams expressly destined for and attached to the casing can be dispensed with.

Of course, in both the known means of suspension and in that claimed herein, when the anode is lifted for working needs, such as variation of interpolar distance, the casing, owing to its considerable upward taper, is dragged upwards by the electrode. The guide stays of the casing slide within their guide holes to permit such upward movement, and blockage of casing movement occurs only for descent.

If, to make up for electrolytic combustion the anode in an apparatus according to the invention, is lowered by the amount by which it was previously raised, the casing returns to its predetermined position.

This connection or suspension according to the invention preferably comprises a mechanical system of which several modifications are described herein; namely a rigid-lever system of several types which operate on the same general principle though differing in construction.

The novel features which are considered as characteristic of the invention are set forth in particular in the appended claims. The invention itself, however, both as to its construction and its method of operation, together

with additional objects and advantages thereof, will be best understood from the following description of specific embodiments and modifications when read in connection with the accompanying drawings in which the same numerals designate the same or corresponding parts throughout the several figures, and in which:

FIG. 1 represents diagrammatically in elevation view one embodiment of the suspension system according to the invention, using a rigid lever system;

FIG. 2 represents the embodiment of FIG. 1 in plan view;

FIG. 3 is an enlarged detail of the suspension system of FIGS. 1 and 2;

FIG. 4 represents diagrammatically in elevation view another embodiment of a suspension system using rigid levers;

FIG. 5 is a plan view of the system according to FIG. 4;

FIG. 6 represents diagrammatically in elevation view another modification of a suspension system using rigid levers;

FIG. 7 is a plan view of the system according to FIG. 6;

FIG. 8 is an elevation view of still another embodiment of the suspension system using a rigid lever system;

FIG. 9 is a plan view of the system according to FIG. 8;

FIG. 10 is an end view of the system according to FIG. 8;

FIG. 11 represents diagrammatically a detail of a modification of the embodiment of FIG. 4 in larger scale;

FIG. 12 is a perspective view of the system according to FIGS. 8-10;

FIG. 13 is an elevation view, partly in section, of another modification of the suspension system, in which concentric hinges are used;

FIG. 14 is a plan view of the embodiment of FIG. 13;

FIG. 15 is an end view of the embodiment of FIG. 14;

FIG. 16 is a diagrammatic representation of the embodiment of FIGS. 10-11-12 having parallel hinges;

FIG. 17 is a diagrammatic representation of the embodiment of the device of FIGS. 13-15 having concentric hinges; and

FIG. 18 is an enlarged view, in a partially cut-away section, of a detail of FIG. 15.

Although the drawings illustrate a type of anode having an elongated rectangular section with rounded shorter sides, it is obvious and should be understood that the present description also is intended to include rectangular or circular anodes.

Rigid lever systems according to several embodiments of the invention are illustrated in FIGS. 1 to 18 and these comprise systems of linked rigid members, which connect the anode casing 2 with the anodic beam 11 and operate to produce a result similar to the embodiment previously described in patent application, S. N. 801,266, so that the casing remains stationary when the beam 11 is lowered.

Several structural modifications of such system of rigid linked members are described as preferred embodiments of the present invention as follows:

FIGS. 1-3 illustrate diagrammatically, by way of example, one embodiment of the principle of a system for connecting the casing 2 to the beam by means of simple rigid levers, stay rods and struts.

As best illustrated in FIG. 1, four eye brackets 12 are secured to the four corners of the upper edge of the casing 2. Four stay rods are pivotally attached at 12a to the eye brackets 12. A nut 13a at the opposite and upper extremity of stay rods 13 permits adjustment of the length of stay rods 13. A bushing 13b is slidably mounted on rod 13 and is provided with a projecting boss. Four triangular levers 14, having respective legs 14a, 14b and 14c, are pivotally mounted at 14f for rotating on respective ones of four horizontal journalling pivots 15

which are welded or otherwise secured to the anodic beam 11. The three legs 14a, 14b and 14c of each triangular lever 14 are fixed with respect to each other and at their vertices 14d, 14e and 14f form pivoting means for struts 16, bushings 13b on stay rods 13 and journals 15, respectively.

Struts 16 are hingedly attached at their lower extremity 17 to a fixed base 17a while at the other end they are pivotally attached to the lower vertex 14d of triangular levers 14. The length of the stay rods 13 as adjustable by threaded nut 13a so that the vertical position of the anodic casing 2 with respect to beam 11 can be changed as desired.

Rod 13 slides together with nut 13a freely in bushing 13b to which member 14 is articulated at 14e.

Thus, nut 13a limits the stroke of rod 13 and consequently of casing 2, only downwardly not upwardly. Therefore, once the position of nut 13a is adjusted, if the anodic beam 11 is lowered, the position of the casing 2 remains substantially unvaried, while a cooperating rotation of the stays 13, struts 16 and triangular levers 14 takes place around their respective pivot joints. If the anodic beam 11 is lowered, bushing 13b abuts against the nut 13a, limiting the further lowering of casing 2, and the rods 16 act as struts between triangle 14 and pivot joint 17.

In raising the beam 11 from a lowered position, rod 16 rotates counterclockwise while arm 14a of triangular lever 14 rotates clockwise. Casing 2 is lifted only when the anode is lifted, and then stay rod 13 with nut 13a attached thereto slides upward through bushing 13b. The nut 13a limits only the downward stroke, but not the upward stroke of stay rod 13.

To lift the beam 11, while leaving the anode at standstill, the current carrying studs are utilized. For this purpose, the current carrying studs should be clamped to the casing and unclamped from the beam 11. If on the contrary the anode is to be lifted, the studs remain clamped to the beam 11 and in that case they are not clamped to the casing.

For vertical movements of the anodic beam, the sum of the projections of rods 13 and 16 on a vertical axis remains practically constant. Consequently, for a vertical translation of the anodic beam, the casing is displaced vertically an amount not exceeding 1 mm., which is quite negligible and of no influence in the operation of the furnace.

Example 1

By way of a numerical non-limiting example of actual dimensions, with a lowering of the beam 11 by 400 mm., the anodic casing 2 remains fixed in practice by using a lever system corresponding to that described above in connection with FIGS. 1 and 2, and having the following dimensions.

Triangular lever 14:

Length of arm 14c	-----mm--	600
Length of arm 14b	-----mm--	535
Length of arm 14a	-----mm--	271.6
Angle between the sides 14a and 14b (i.e. between the sides 535/271.6 mm.)	-----degrees--	90
Length of strut 16	-----mm--	1330
Length of stay 13	-----mm--	500

Obviously, the anodic casing 2 can also be kept fixed in practice by adopting other actual dimensions of the struts 16, stays 13 and triangular levers 14. For strokes or movements of the anodic beam 11 greater than 400 mm., the entire system can be re-dimensioned conveniently to suit the particular requirements.

FIGS. 4 and 5 illustrate a modification of the embodiment of the suspension system in which the connection from the casing to the anodic beam is by means of double rigid levers, rather than single triangular levers as in the embodiment of FIGS. 1-3.

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The system of FIGS. 4 and 5 is somewhat similar to the preceding one illustrated in FIGS. 1-3, except that in lieu of the single triangular levers 14, there is provided an assembly of two bell crank levers 18 and 19, connected to each other by a linking lever 20. The bell crank levers 18 and 19 are pivotally attached at 21 and 22 to the anodic beam 1-3, the connection to the casing 2 is completed by stay rods 13 and a bushing (not illustrated) corresponding to bushing 13b. The connection to the fixed base 17a is completed by struts 16 pivoted at 17. The length of the stay rods 13 is adjustable by means of a nut 13a so that once adjusted the anodic casing 2 remains in the desired position as the beam 11 is lowered. As the anodic beam 11 is lowered, the casing 2 remains at a standstill because of the fact that the individual components of the lever system cooperate with each other so as to displace the stays 13, slidable in bushing 13b, in a direction opposite to the lowering direction movement of the anodic beam.

The operation of the system according to FIGS. 4 and 5 is such that one can imagine the arms of levers 19 and 18 as the fixed radii of two imaginary pulleys, the centers of which are respectively 22 and 21. The connection between the linking point on the casing and the supporting point 17 is assured by angle rods 18 and 19, by the connecting rod 19 linking the angle rods and by struts 16.

When the anodic beam is moved, even considerably, e.g. about 18-20 cm., the corresponding displacement of the anodic casing is only about 1 mm., i.e. negligible and of no influence on the operation of the furnace. The reason for this is that for the vertical movement of the anodic beam, the sum of the vertical projections of rods 13 and 16 on a vertical axis remains practically constant. For a substantial displacement of the anodic beam, the vertical displacement of the casing is therefore only 1 mm., i.e. quite negligible.

Example 2

By way of a numerical non-limiting example of actual dimensions, with a system according to FIGS. 4 and 5, and for strokes of the anodic beam 11 in the range of, for example, 400 mm., the casing 2 remains fixed in practice with a system of levers having the following dimensions.

Length of struts 16	mm	1061
Length of links 20	mm	385
Length of stay 13	mm	500
Bell crank lever 19—345 x 250 mm.	angle	80°40'
Bell crank lever 18—250 x 355 mm.	angle	90°

It should be obvious that other dimensions of the elements of this system can also be used to keep the casing 2 at a standstill in practice. Also, with greater strokes of the anodic beam 11, the system can be re-dimensioned accordingly to suit the conditions.

The embodiment according to FIGS. 6 and 7 is particularly suitable for anodes of great length, and comprises two pairs of stays 28, 29 connected to the beam 11 by means of a bell crank lever 23 and a linking lever 26.

The assembly of this embodiment comprises a strut 16, one end of which is hingedly pivoted on a fixed base 17a at 17, and the other end is pivotally connected with an angular or bell crank lever 23 which can rotate on a pivot 24 fixedly attached to anodic beam 11. The other end of lever 23 is slidably connected by means of a bushing (similar to 13b) to the stay rod 28. Stay rod 28 is pivotally hinged to casing 2 at 28a, and another pair of stay rods 29 are similarly hinged at 29a to the anodic casing. A horizontal stay rod 25 joints the respective bushings 13b (not shown in FIG. 6) located on each respective pair of stay rods 28, 29 and a lever arm 26 joins the slidable bushing on rod 29 to a pivot journal 27 which is fixedly attached to beam 11.

The four pairs of stays 28, 29 complete the connection

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between levers 23, 26 and the casing 2. In this embodiment the casing is supported at eight points, four points being distributed on each side (28a, 29a, 29a, 28a), and the distance between these connecting points are approximately the same on each of the two opposite longitudinal sides along the upper edge 30 of casing 2.

The suspension system illustrated in FIGS. 8-10 and 12 supports the casing from the anodic beam 11 by means of a system of rigid levers and stiff transmission members which are somewhat analogous in principle to the preceding embodiments, but operates in planes which are perpendicular to the two anodic beams instead of in planes parallel thereto, as in the preceding embodiments.

In this embodiment the assembly comprises four struts 16, each having one end hinged to a fixed base 17a at 17, and the other end of each lever 16 is pivotally attached to levers 32 (FIGS. 9, 10). Each of the levers 32 is fixedly secured, such as by a key, to the outwardly extending terminal portion of a respective bar 31. Bars 31 are pivotally journaled in supports 34 which are fixedly attached to the anodic beam 11. The inwardly extending end portion of each bar 31 is fixedly secured, such as by a key, to respective levers 33. Stay rods 13' having nuts 13a threaded on their lower extremities, are slidably connected through holes in the upper angles 30 of casing 2. The upper ends of rods 13' are pivotally suspended from the inner extending end portions of bars 31.

The operation of the embodiment of FIGS. 8-10 and 12 is analogous to that of the previous embodiments, in that if the beam 11 is lowered, the suspension system coacts in such a manner as to leave the casing 2 fixed in a predetermined position.

The system of FIGS. 8-10 and 12, which is a preferred embodiment, still further simplifies the application of levers and rods to the present invention. The anodic beam 11 is rigidly connected with the current carrying points supporting the electrode. Consequently, when the anodic beam is lifted or lowered, the carbon anode is correspondingly lifted or lowered.

The anode itself moves inside the anode casing, which must remain in its position fixed in advance. Anodic beam 11 is provided with two supports 34 which carry rod 31 rotatable in bushings located at the ends of the support 34. The rod 31 and arms 32 are mutually rigidly connected by welding or bolting. The arms 32 are connected to the ground at 17 by means of strut 16 which is hinged at both ends. The anode casing 2 is connected at point 13a with hinge 31-32-34 by means of the stay rod 13'.

Operation of the device according to FIGS. 8, 9 and 10 is as follows.

The anodic beam 11 is generally moved down in the amount of about 2 centimeters per day to follow the consumption of the carbon electrode. When this anodic beam 11 is thus moved vertically to fix the desired position of the anode, the casing should not follow the displacement of the anode, the latter itself being displaceable inside of the casing. The device according to the invention substantially prevents any such movement of the anodic casing. In fact, where the anodic beam 11 moves vertically (the only possible movement), rod 31 is displaced accordingly. The arms 32, rigidly connected with the rod 31, rotate about the axis of rod 31, translating the same along a circumferential arc, whose center is point 17 and whose radius is rod 16. The two arms 32 are of the same length, and the linkage point between the respective arms 32 and the rod 16 performs a translation similar to that of the axis of rod 31. The result thereof is that the linking point 13a at which rod 13' is joined to the casing does not itself move vertically.

Any of the types of connection illustrated in FIGS. 1-18 can be applied for suspension of any type of anode, such as rectangular, rectangular with rounded short sides, circular, etc. Depending upon the length of the anode and the distance between the anode and the outer side

wall of the electrolytic cell, one or the other of the illustrated suspension systems may be preferable.

The suspension system according to FIGS. 1 and 2 is particularly suitable for rather short anodes which are disposed not too far away from the cell wall. The suspension system illustrated in FIGS. 4 and 5, and 6 and 7, are best suited for long anodes, which are relatively distant from the side wall of the cell, while the suspension system of FIGS. 1 and 2 is best suited for short anodes close to the cell wall. The suspension system of FIGS. 8-10 and 12 is well suited for anodes of any type.

By adjusting the nut 13a, the stays 13 or 13' which connect the anodic casing 2 with the respective levers of any of the suspension systems illustrated can be adjusted to any suitable length, corresponding to the desired position or elevation of the casing 2 or, better to say, by means of the nut 13a, it is possible to vary the maximum distance 14e-13', that is, the maximum distance between the beam 11 and the casing. Stay rods 28, 29, and 13 and 13' are all similar in this respect. Thus, the position of the casing 2 is maintained in position by means of the threadedly adjustable stays 13, 13', 28 and 29.

FIG. 11 illustrates a modification of the suspension system of FIGS. 6 and 7, but is also applicable to any of the suspension systems of FIGS. 1-10. The end of the lever 23' is pivotally attached to a bushing 13b' slidable on rod 28'. A pair of sturdy helical springs 35 on each end of the bushing 13b' between the upper and lower nuts 13a. Consequently, if the anodic beam 11 is lowered to follow the anode consumption, when the casing 2 is dragged downward, the springs 35 become tensioned or compressed thereby so as to bring the casing 2 slowly again back into the desired position.

The device of FIG. 11 provides an elastic means to provide the delay necessary for the casing 2 to be restored to its initial position. As above explained, the carbon anode must itself move inside of the casing 2. The conventional Soederberg anode is composed of a lower cokified portion and of a pasty upper portion (crude paste). It sometimes happens that the cokified or partially cokified portion will strongly adhere to the casing. In such case, when the anodic beam 11 is moved vertically, the casing inevitably will also be dragged in the same direction and consequently rod 31 will be submitted to a torsional stress. The rotation of point B, the hinge point between rod 16 and arm 32, is proportional to the stress applied, to the length of the rods 31 and to the modulus of elasticity of the material composing the rod 31. Once the vertical translation of the anodic beam 11 is completed, the torsion-annulling momentum, being equal but opposed to the above torsional stress, tends to detach the anode from the casing gradually and slowly. The casing 2 will then automatically be restored to its initial position.

FIGS. 13, 14, 15 and 18 illustrate another modification of the suspension system in which concentric hinges are used. Torsion rods or shafts 310 and 310a are mounted concentrically, one within the other, and parallel to the beam 11a. As best shown in FIG. 18, hollow shaft 310 is journaled in support 34, which is mounted on beam 11a (FIG. 13.) One arm 32 is fixed to the end of inner shaft 310a, and another arm 32a is fixed to the end of the outer shaft 310. The struts or push rods 16, 16a pass through the eyelets in blocks 16b of the respective hinge pins 32' and 32a' and are blocked at each end of the pins by nuts. The blocks 16b are integral or rigidly fixed to the respective pins 32' and 32a'. Thus, the units composed of struts 16 and 16a are freely pivotable in the spaces of the yoke-shaped arms 32 and 32a and are swingable in a direction perpendicular to the plane of the beam 11a.

The term "polygonal linkage means" as used herein defines articulated polygons composed of coplanar or spatial links and struts converging to form hinges or pivot points. In each case, one pivot is fixed on the ground, one on the

anodic beam and one on the casing. The analytical solution of the problem of providing such an articulated polygon where the hinge on the casing remains fixed when the pivot on the anodic beam is displaced, leads to the conclusion that movement of the casing is very small for a considerable movement of the anodic beam.

It will be obvious to those skilled in the art, upon studying this disclosure, that devices according to our invention can be modified in various respects and hence may be embodied in devices other than as particularly illustrated and described herein, without departing from the essential features of our invention and within the scope of the claims annexed hereto.

We claim:

1. In an apparatus for recovering metal by electrolysis in a fused bath, including a pot structure constituting a cathode, an anode of the continuous type, a casing for said anode mounted independently of said pot structure for vertical movement relative thereto, a vertically movable suspension beam above said casing, and contact rod suspending said anode from said beam; a suspension system for supporting said casing from said beam and capable of maintaining said casing approximately at a desired constant position of elevation relative to said pot structure during vertical displacements of said anode and of said suspension beam, said system comprising polygonal linkage means having a plurality of coplanar linking members converging to form a plurality of pivoted joints, one of said pivoted joints being attached to a fixed support apart from said beam, a second of said pivot joints being connected to said anodic beam, and a third of said pivot joints being connected to said casing, and means arranging said linking members of said linkage means for translating vertical motion into motion components acting at least partially in a non-vertical direction so that vertical movement of said casing will be substantially negligible for a considerable vertical movement of said anodic beam.

2. In an apparatus for recovering metal by electrolysis in a fused bath, including a pot structure constituting a cathode, an anode of the continuous type, a casing for said anode mounted independently of said pot structure for vertical movement relative thereto, a vertically movable suspension beam above said casing, and contact rods suspending said anode from said beam; a suspension system for supporting said casing from said beam and capable of maintaining said casing approximately at a desired constant position of elevation relative to said pot structure during vertical displacements of said anode and of said suspension beam, said system comprising polygonal linkage means including at least one pair of levers each defining a plurality of pivot points, means hingedly connecting respective first ones of said pivot points to said beam, rod means having one end pivotally connected at respective second of said pivot points of said levers and having another end hingedly attached to a fixed base apart from said beam, stay rod means pivotally connected at one end thereof to said casing, bushing means slidable on said stay rod means, and means pivotally attaching said levers at respective third of said pivot points to said bushing, said levers being interposed between said rod means and said stay rod means.

3. In an apparatus for recovering metal by electrolysis in a fused bath, including a pot structure constituting a cathode, an anode of the continuous type, a casing for said anode mounted independently of said pot structure for vertical movement relative thereto, a vertically movable suspension beam above said casing, and contact rods suspending said anode from said beam, a suspension system for supporting said casing from said beam and capable of maintaining said casing approximately at a desired constant position of elevation relative to said pot structure during vertical displacements of said anode and of said suspension beam, said system comprising linkage means for translating vertical motion of said beam into motion components acting at least partially in a non-

vertical direction, means defining a fixed pivot connection apart from said beam and casing, said linkage means being attached at one connecting location thereof to said casing for suspending the latter and linked at another connecting location of said linkage means to said fixed pivot connection, said linkage means comprising strut means hingedly attached at one end of the latter to said fixed pivot connection, and including stay rod means pivotally connected to said casing to form said one connecting location of said linkage means, bell crank means pivotally connected between said anodic beam and the other end of said strut means, guide means slidable on said stay rod means, one end of said bell crank means being pivotally connected to said guide means.

4. In an apparatus for recovering metal by electrolysis in a fused bath, including a pot structure constituting a cathode, an anode of the continuous type, a casing for said anode mounted independently of said pot structure for vertical movement relative thereto, a vertically movable suspension beam above said casing, and contact rods suspending said anode from said beam, a suspension system for supporting said casing from said beam and capable of maintaining said casing approximately at a desired constant position of elevation relative to said pot structure during vertical displacements of said anode and of said suspension beam, said system comprising linkage means for translating vertical motion of said beam into motion components acting at least partially in a non-vertical direction, means defining a fixed pivot connection apart from said beam and casing, said linkage means being attached at one connecting location thereof to said casing for suspending the latter and linked at another connecting location of said linkage means to said fixed pivot connection, said linkage means comprising strut means hingedly attached to one end of the latter to said fixed pivot connection, and including stay rod means pivotally connected to said casing to form said one connecting location of said linkage means, said linkage means further including two pairs of bell crank levers, one bell crank of each pair being hingedly attached to another end of said strut means, means pivotally attaching each of said bell crank levers to said beam, two linking levers respectively joining the bell crank levers of a respective pair to each other, bushing means slidable on said stay rod means, and means pivotally connecting said bushing means to another one of said bell crank levers of each pair.

5. In an apparatus for recovering metal by electrolysis in a fused bath, including a pot structure constituting a cathode, an anode of the continuous type, a casing for said anode mounted independently of said pot structure for vertical movement relative thereto, a vertically movable suspension beam above said casing, and contact rods suspending said anode from said beam, a suspension system for supporting said casing from said beam and capable of maintaining said casing approximately at a desired constant position of elevation relative to said pot structure during vertical displacements of said anode and of said suspension beam, said system comprising linkage means for translating vertical motion of said beam into motion components acting at least partially in a non-vertical direction, means defining a fixed pivot connection apart from said beam and casing, said linkage means being attached at one connecting location thereof to said casing for suspending the latter and linked at another connecting location of said linkage means to said fixed pivot connection, said linkage means comprising strut means hingedly attached at one end of the latter to said fixed pivot connection and swingable in a plane perpendicular to that of said anodic beam, stay rod means engageable with said casing for supporting the latter, pivoted means mounted on said beam and connected to the other end of said strut means, rod means disposed parallel to said beam and fixedly attached to said pivoted means for rotation therewith, and lever means pivotally connecting said rod means with said stay rod means.

6. In an apparatus for recovering metal by electrolysis in a fused bath, including a pot structure constituting a cathode, an anode of the continuous type, a casing for said anode mounted independently of said pot structure for vertical movement relative thereto, a vertically movable suspension beam above said casing, and contact rods suspending said anode from said beam, a suspension system for supporting said casing from said beam and capable of maintaining said casing approximately at a desired constant position of elevation relative to said pot structure during vertical displacements of said anode and of said suspension beam, said system comprising linkage means for translating vertical motion of said beam into motion components acting at least partially in a non-vertical direction, means defining a fixed pivot connection apart from said beam and casing, said linkage means being attached at one connecting location thereof to said casing for suspending the latter and linked at another connecting location of said linkage means to said fixed pivot connection, said linkage means comprising strut means hingedly attached at one end of the latter to said fixed pivot connection to define said other connecting location, and including lever means pivotally attached to the other end of said strut means, stay rod means pivotally linked to said casing for supporting the latter and defining said one connecting location, bushing means slidable on said stay rod means, journal means fixedly attached to said anodic beam and forming a pivot connection thereon for said lever means, and spring means disposed on said stay rod means and in operable connection with said bushing means for upwardly urging said stay rod means and said casing.

7. In an apparatus for recovering metal by electrolysis in a fused bath, including a pot structure constituting a cathode, an anode of the continuous type, a casing for said anode mounted independently of said pot structure for vertical movement relative thereto, a vertically movable suspension beam above said casing, said contact rods suspending said anode from said beam, a suspension system for supporting said casing from said beam and capable of maintaining said casing approximately at a desired constant position of elevation relative to said pot structure during vertical displacements of said anode and of said suspension beam, said system comprising linkage means for translating vertical motion of said beam into motion components acting at least partially in a non-vertical direction, means defining a fixed pivot connection apart from said beam and casing, said linkage means being attached at one connecting location thereof to said casing for suspending the latter and linked at another connecting location of said linkage means to said fixed pivot connection, said linkage means comprising strut means hingedly attached at one end of the latter to said fixed pivot connection and swingable in a plane perpendicular to that of said anodic beam, stay rod means engageable with said casing for supporting the latter, journal means mounted on said beam, a pair of shafts rotatably journaled in said journal means and disposed parallel to said beam, first lever means fixed to one end of each of said shafts and pivotally linked to the other end of said strut means, and second lever means pivotally connecting each of said shafts with said stay rod means.

8. A suspension system according to claim 7, said shafts being arranged parallel to each other on said beam.

9. A suspension system according to claim 7, one of said shafts being hollow and the other of said shafts being arranged concentrically within said one shaft.

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