

Oct. 27, 1959

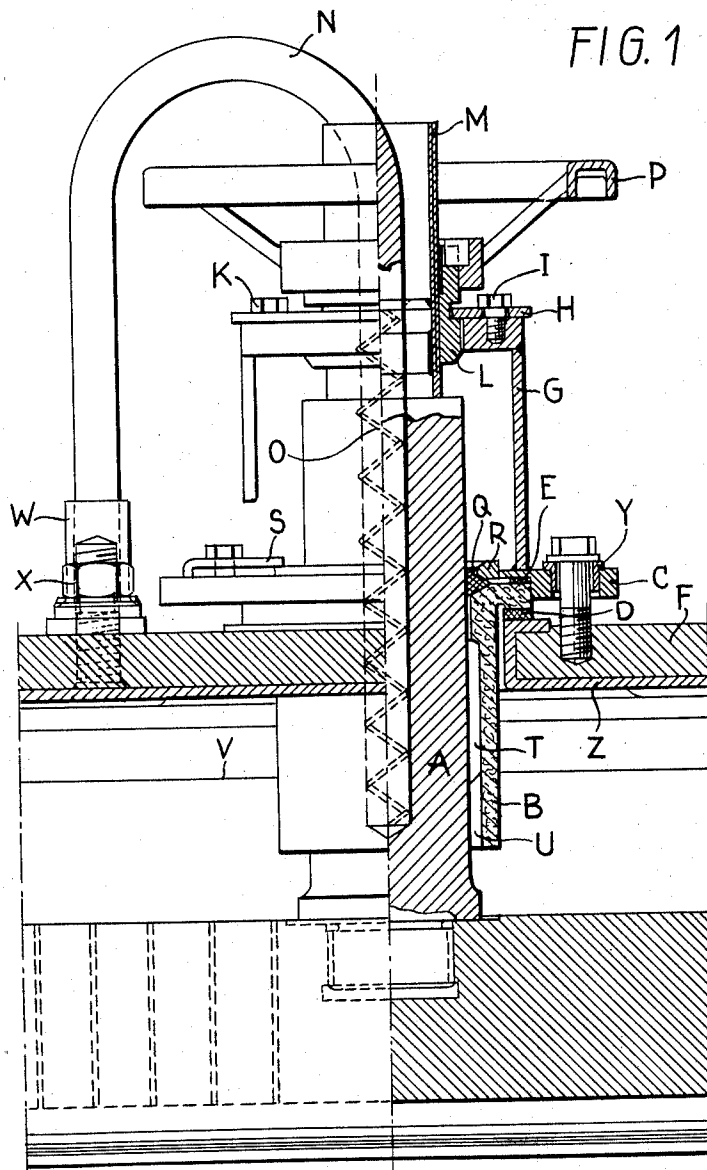
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2,910,423

DEVICE FOR ADJUSTING ANODES IN ELECTROLYTIC CELLS

Filed March 4, 1957

2 Sheets-Sheet 1



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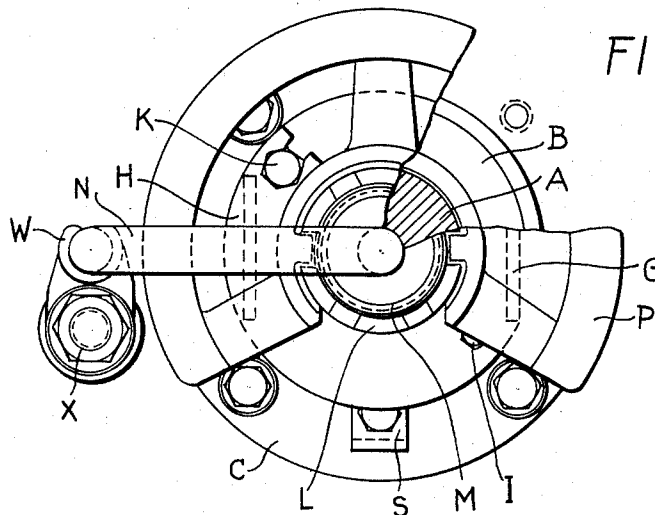


FIG. 2

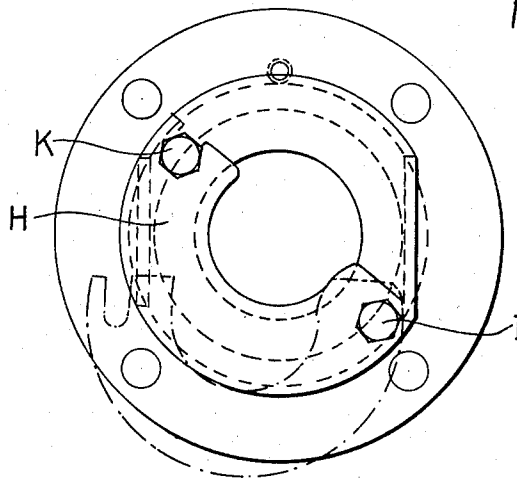


FIG. 3

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DEVICE FOR ADJUSTING ANODES IN
ELECTROLYTIC CELLS

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Application March 4, 1957, Serial No. 643,719

Claims priority, application Germany March 3, 1956

4 Claims. (Cl. 204—225)

The present invention relates to a device for lifting and lowering the graphite anodes in alkali chloride-electrolytic cells.

The graphite anodes in alkali chloride-electrolytic cells of known style in which the electrodes are arranged horizontally are used up by corrosion and erosion mainly on the side facing the cathode. Thus, the distance between the electrodes is enlarged bringing about an increase of the internal resistance of the cell and thus a raise in the cell voltage as well as an increase of the evolution of heat per unit of time at constant current intensity. Attempts have often been made to avoid the undesired elevated consumption of electric energy by continuously adjusting the anodes to a small distance between the electrodes with the application of operating mechanisms. There are known numerous operating mechanisms of this kind, but all are very defective so that their application in practice is doubtful and the desired economy of energy is not obtained to a satisfactory degree. The special characteristics of the largest part of adjusting devices for anodes consist in single characteristics known in themselves and in their use in the alkali metal chloride electrolysis.

A special inconvenience of the known adjusting devices for anodes which are operated by a screwing device consists in the very troublesome, time-consuming and difficult mounting of the anode in the cell cover and in the adjusting device as well as the equally unfavorable demounting.

A further disadvantage with the known adjusting devices is the problem of the sealing of the anode shaft against the cell cover at the passage which has not yet been solved with satisfaction. This problem is connected with the problem of the favorable mounting of the anode in the cell cover since the sealing of the anode shaft against the cell cover is especially difficult when mounting. A further advantage occurs when using known adjusting devices in that a good seal with an easily adjustable anode has a short lifetime. In view of the corrosion with chlorine, renewed sealing is repeatedly required during the running time of the anode which can be carried out only with great difficulties in mounting.

Disadvantages are also found with known adjusting devices in which the current supply to the anode takes place via the adjusting members which are not firmly connected with the anode shaft. In the case of mechanical adjusting devices, the anode shaft glides when adjusted in comparison with the structural elements guiding it and eventually in comparison with the elements moving the shaft. An unobjectionable electric contact between the current supply and the anode is only guaranteed when the part supplying the current is firmly connected with the anode shaft. When the electric current is carried by way of corresponding structural elements of the adjusting device and not directly to the anode shaft, the danger exists that the contact resistances of the parts sliding against

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each other and thus also the corresponding tensions created attain great values during operation. This fact causes an undesired consumption of energy and considerable damage of the adjusting device may take place.

5 Parts firmly connected with the anode shaft which project therefrom can cause difficulty in the fitting especially in the case when, with the possibility of easy mounting and demounting, an easy adjustment of the anode during the operation is desired.

10 Now we have found that an exactly defined combination of different single characteristics results in an adjusting device for anodes which avoids the indicated disadvantages of the known devices.

We propose a device for lifting and lowering anodes in 15 alkali chloride electrolytic cells having a horizontal arrangement of the electrodes with the use of a screwing device which is operated in a manner that the anode shaft moves relatively to the upper cover plate of the cell. According to the invention, the device is characterized in 20 that the anode shaft, including the parts of the moving device firmly connected with it or including the parts firmly connected with it and at least one part movably connected with it, is formed in a manner that the anode shaft can be moved in and out of the free assembly opening 25 in the cell cover as in the case of the mounted state. The anode shaft is guided through a guide bush with as little friction as possible and it is simultaneously sealed with as little friction as possible against the guide bush as well as against the gasket ring pressed against the anode 30 shaft and acting like a stuffing bush. The part serving for the current supply is connected firmly and electrically well conductive with the anode shaft. The mechanical connection of corresponding parts of the moving device and of the part serving for the current supply with the 35 anode shaft can be directly or indirectly provided.

In the case of the adjusting device according to the invention the current supply to the anode is not conducted by way of the members of the adjusting device which glide 40 when operating the device in contact with the anode shaft.

The gasket ring already mentioned which acts like a stuffing bush can be provided continuously or in a slit 45 manner with an oblique cut or section. When using gasket rings of the slit form, an advantage is achieved with respect to the mounting in that the gasket ring can 50 be readily exchanged without difficulty and without interrupting the anode operation. Further elements of the device proposed according to the invention consist in the guide bush in the opening of the cell cover which guides 55 the anode shaft or that the guide bush has the form of an immersion bush, in which case it is advantageous that the guide bush simultaneously guides the anode shaft below the cell cover.

It proved to be advantageous to install in axial direction 60 the adjusting nut by means of a swingable strap. In this case, the adjusting nut simultaneously takes charge of the upper radial guide of the anode shaft.

Furthermore, it is useful to form the contact device of the part of the current supply which is firmly connected 65 with the anode shaft in a manner that it can be moved in and out through the opening of the part of the moving device limiting the radial mobility of the adjusting nut and possibly also through the opening of the adjusting nut.

Furthermore, it proved to be advantageous according to 70 the invention to form the device in a manner that all moving and fixing members which are not connected with the anode shaft are connected with a flange and that the guide members are oriented to the flange by fitting to the flange or that they are connected with the flange or that they are partially oriented to the flange through fitting and partial connection with the flange. It is expedient to dimension the flange in a manner that—in mounted

state—its plan is completely within the external boundary line of the plan of the anode belonging to it.

In the case of the device according to the invention, it proved to be advantageous electrically to isolate against the cell cover the parts of the device which are not firmly connected with the anode shaft by suitable intermediate layers and/or by the use of electrically isolating materials for these parts.

The advantages especially connected with the combination of characteristics according to the invention are:

(1) For each single anode of a cell, a complete adjusting device is present.

(2) All parts of the device mounted with the cell cover can remain on the cell cover even while the anode is exchanged.

(3) The anode shaft and the parts of the device connected with it, that is the parts firmly connected as well as the parts which may be movably connected with it, are dimensioned in a manner that upon mounting and demounting the anode they can be moved in and out through the opening in the cell cover which remains according to point 2 (free assembly opening).

(4) The fixation of height of the anode is possible by one single manipulation.

(5) The friction between the anode shaft and its guide as well as between the anode shaft and the elements of its sealing against the cover of the cell is so small that it is possible to carry out by hand the mounting and demounting of the anode without additional expenditure of energy.

(6) The sealing between the anode shaft and the cell cover can be exchanged without interrupting the operation of the cell, without reducing the normal pressure of chlorine in the cell and without the escape of greater amounts of chlorine from the cell.

(7) It is not necessary to remove the fixing screws of the device from their counterthreads when the anode is exchanged and also the fixing nuts remain on their counterthreads when the anode is exchanged.

(8) The number of parts of the device which are not connected with the anode shaft and which can be removed from the device when the anode is changed without violating point 7 is small.

(9) The part serving for the current supply which is connected firmly and in an electrically well conductive manner with the anode shaft does not affect the favorable mounting and demounting conditions mentioned.

(10) During the operation of the cell, it is possible to readily adjust the anode and when the anode shaft is satisfactorily sealed against the cell cover it is well guided.

(11) By adjusting all anodes in one cell at short intervals the medium tension of the cell can be reduced in a manner that, at a current density of 3500 amperes/m.², it is only 6.8% above the sum of decomposition voltage and over-voltage. In comparison with an electrolyzing unit equipped, for example, with the known adjusting devices according to German Patents Nos. 931,350, 934,044 and 934,045—with the same current density—the attainable gain of voltage with the use of an electrolyzing unit provided with the adjusting device described amounts to about 17%.

(12) By the most exactly adjusted distance between the electrodes in the electrolytic cells with a given current density, a relatively very low internal temperature of the cell results so that the corrosion of the internal walls of the cell depending on the temperature is considerably reduced. If it is not intended to reduce corrosion, it is possible, in comparison with electrolyzing units which are not provided with the adjusting device described, to considerably increase the loading of the unit. As compared with an electrolyzing unit in which the single anodes are adjusted to a small distance between the electrodes about every 70 days only by stopping and demounting the cell, it is possible to increase the current density at the same corrosion strain by 47%.

The drawings diagrammatically represent an embodi-

ment for the adjusting device according to the invention. Figure 1 is side view partially in section of the adjusting device. Figures 2 and 3 are top views of the apparatus of Fig. 1.

The moving device in this embodiment is divided from the other parts of the cell by the cell cover. In the case of other embodiments, the division can also take place, for example, by a separate current conductor bar and by the cell cover.

Anode shaft A is guided by a guide bush B made of a material which is corrosionproof against chlorine, for example porcelain. Guide bush B is pressed by flange C with intercalation of gasket D and an elastic shim plate E against cell cover F. A stirrup G (Fig. 1) firmly connected with flange C carries strap H (Fig. 3) which is swingable round screw I simultaneously serving as support for strap H. When operating, strap H is secured by a second screw K. When the strap H is swung out, it is only necessary to loosen screw K from stirrup G which carries its counterthread as shown in Fig. 3.

The adjustment of the height of the anode is carried out by an adjusting screw L. When operating, strap H grips in a notch of adjusting nut L thus axially fixing it. Adjusting nut L threaded into the corresponding counterthread of a thread jacket M which is firmly connected with anode shaft A. By turning adjusting nut L anode shaft A is axially moved. The use of the thread jacket M is advantageous since the thread of a jacket made, for example, of bronze or special steel, is much more insensitive against mechanical damages at the same strain than a thread cut on the graphitized carbon of the anode shaft. Further advantages consist in the fact that the length of the corresponding part of the current supply can be reduced to a minimum in the case thread jacket M is used and a seizing of adjusting nut L on its counterthread—caused by graphite dust—is avoided.

Cable N for the current supply is flexible and in order to attain a good electric contact it is cast with liquid tin into a boring of anode shaft A. The fixing of thread jacket M on anode shaft A takes place in an analogous manner and in the same operation. By the specially worked upper part of anode shaft A represented in Fig. 1, after the solidification of the tin poured in, jacket M is secured against forces which might cause a twisting of jacket M towards anode shaft A as well as a removal from anode shaft A. In a corresponding manner the hold of current supply cable N in anode shaft A is improved by using a spiral groove O (Fig. 1) in the boring of anode shaft A.

Adjusting nut L may be moved by a key or, as represented in Figs. 1 and 2, by a removable handwheel P. The key or the removable handwheel are not considered to be elements belonging to the adjusting device.

In the case where no special sealing is used chlorine can escape through the slit between the guide bush B and anode shaft A. Anode shaft A is, therefore, sealed by gasket ring Q which is pressed between conic planes through a contact ring R by means of a pressure lever S to act simultaneously against anode shaft A and guide bush B. According to the kind of impregnation of anode shaft A, it is possible to use gasket rings Q, for example, of profiled rubber, asbestos cloth, soaked with a partially chlorinated liquid, such as, for example, chloroparaffin or asbestos cloths which are impregnated, for example, with polytetrafluoroethylene. In the case where a partially chlorinated liquid is used as sealing agent, the friction created by the adjusting is simultaneously reduced to a minimum by lubrication. Lubrication and to a small extent even sealing may be attained by liquids which are not partially chlorinated, such as, for example, water.

Bush B, which according to German Patent No. 944,942 is advantageously formed as immersion bush, guarantees a satisfactory guide of anode shaft A with low friction during the adjusting operation. Due to the

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protection of bush B surrounding anode shaft A and due to the chlorine cushion formed in the volume of siphon T, a good guide with low friction is maintained even after prolonged operation of the anode since crystallizations of alkali chloride in the brine is rendered impossible by the chlorine cushion. Only in the lower part of bush B in which the guide ribs U are to be found, there may occur inferior crystallizations caused by small fluctuations of the surface of brine V. The crystallization does not noticeably increase the friction between guide bush B and anode shaft A when moving in an axial direction, but the crystallization prevents rotatory motion of the anode round the axis of anode shaft A during the adjusting operation. For this reason, a torsional protection on anode shaft A above cell cover F is not necessary which fact proves to be favorable for the mounting. As soon as gasket ring Q is damaged or removed, bush B acts as immersion bush. Liquid penetrates into siphon volume T and displaces the chlorine cushion described above. By this phenomenon the direct escape of chlorine from the gas volume of the cell has become impossible. Only the chlorine which may penetrate into the volume of siphon T in the form of small and tiny bubbles can escape when gasket ring Q is removed.

Current supply cable N is soldered with a cable lug W which is in electric contact with current carrying cover F or with the current conductor bar by a screw connection X. Screw connection X does not belong to the moving device. In the case where no electric shunt from cell cover F by way of the adjusting device to the anode shall occur flange C is electrically isolated against cell cover F, for example as indicated in Fig. 1. Y represents an electrically isolating bush and Z an electrically isolating coating of the cell cover.

The adjusting device for anodes furthermore possesses the advantage that all moving and fixing members which are not connected with anode shaft A are connected with flange C and not directly with cell cover F and that guide bush B is oriented by fitting in flange C. It is, therefore, easy to exchange seal D and elastic shim plate E. It is thus also possible to carry out readily the mounting of the fittings consisting of parts B, C, G, H, I, K, and S on cell cover F as well as the corresponding demounting. When mounting, it is very easy to attain conformity of the axis of adjusting nut L, guide bush B and anode shaft A so that a binding of anode shaft A in guide bush B cannot occur, even in the case flange C is differently

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tightened against cell cover F. Therefore, it is possible to adjust the side of anode which faces the cathode—without any inconvenience—parallel to the bottom of the cell and thus parallel to the cathode.

The conditions of a simple and easy mounting of anodes in the cell covers and in the adjusting devices as well as a favorable demounting can also be transferred to adjusting devices bringing about the axial movement of the anode not by a nut on a thread connected with the anode shaft but by other moving mechanisms characterized, for example, by spiral slot, lever, eccentric, wedge or rack.

It is also possible to use the adjusting device described for anodes having several anode shafts.

We claim:

1. A device mounted on the sealing cover of an alkali chloride electrolytic anode-cathode cell for the vertical adjustment of an anode relatively to the cover of the cell and to the cathode which comprises an anode shaft, an adjusting member rigidly connected to the upper portion of the anode shaft said shaft being supported in an opening in said cover of the cell in a manner permitting mounting and dismantling, an electrically non-conductive guide bush arranged in said opening of the cover and through which the anode shaft is passed, said inner surface of the bush lying in spaced relationship with the shaft, an undetachable current supply lead connected with the anode shaft, and a gasket ring arranged above said guide bush in the opening of the cover, said gasket ring being pressed against the anode shaft and the guide bush.

2. A device according to claim 1 comprising a supporting structure for said device having a holding means for the screw nut which can act as a radial guide of the anode shaft arranged on top of the supporting structure and fixed in axial direction by a swingable strap.

3. A device according to claim 1 comprising a supporting structure for said device having a flange for adjustable mounting on the cover of the cell.

4. A device according to claim 1 comprising electrically insulating layers arranged between the supporting structure and the cover of the cell.

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