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CLAMPING DEVICE FOR ELECTRIC CONNECTIONS

Filed June 22, 1960

2 Sheets-Sheet 1

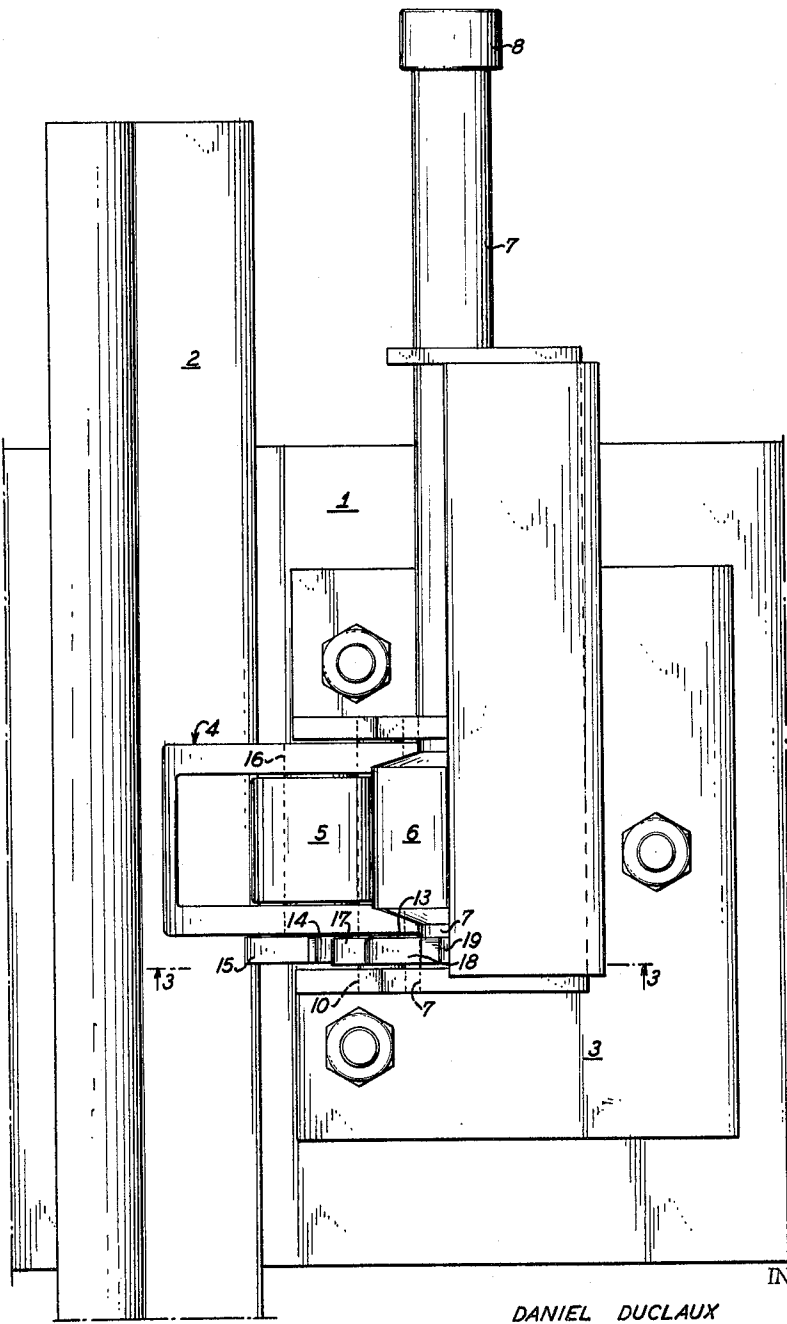


Fig. 1

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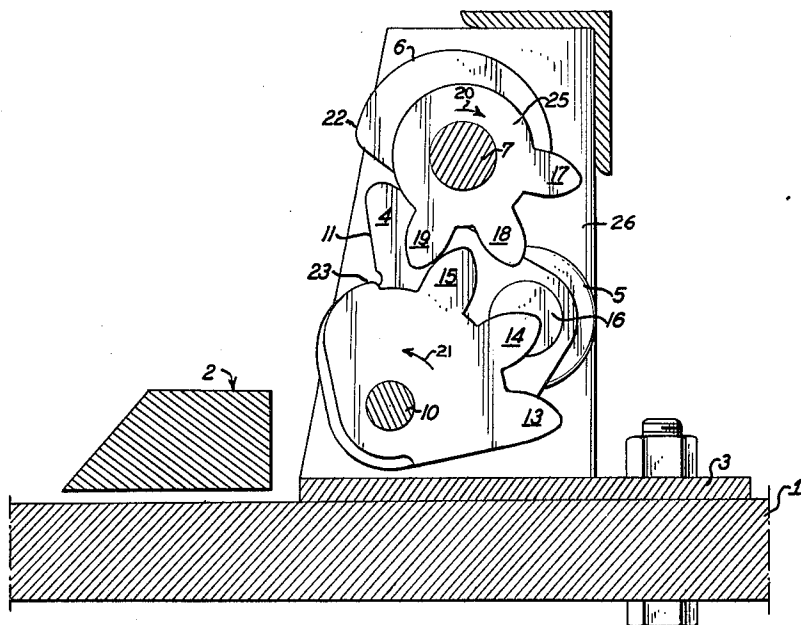


Fig. 2

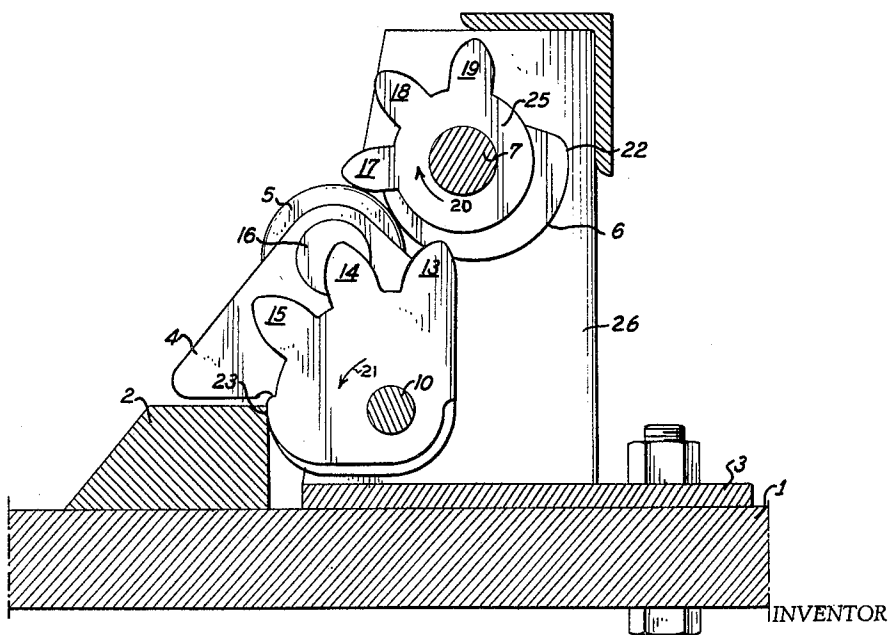


Fig. 3

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CLAMPING DEVICE FOR ELECTRIC CONNECTIONS

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5 Claims. (Cl. 269-221)

The present invention relates to a clamping device for electric connections and concerns, more particularly, a device intended for use in cells for the manufacture of aluminum for the junction of movable bars or rods with the bus bars feeding current to the anodes.

In some electrical installations, there is a need for connecting conducting bars while keeping the joint readily demountable in order to be able to change the position of the joint on the bars. When these bars operate with currents of several thousand amperes, it is necessary to ensure an excellent contact to prevent voltage drops at the junction point. Until now, it was only possible to obtain such connections with bar clamp systems comprising, for example, plates united together by means of numerous screws or bolts, or locked by wedges. The mounting and dismounting of these bar clamps were slow operations; for example, for mounting, it was indeed necessary to use two successive steps: bringing up the clamping part, then the locking proper; moreover, it was not easy to maintain uniform clamping conditions.

These drawbacks were especially noticeable in the case of cells used for the manufacture of aluminum in which the anodes—either of the Soderberg type with vertical studs, or prebakes—are supplied with current from a bar which has to be connected to a bus bar. While in such installations, the connection is always made at the same place on the bus bar, it is made at any point of the bar feeding current to the studs or anodes, so as to be able to connect the latter bar in various positions, according to the progress of the anode.

The clamping device which is the object of the present invention overcomes these drawbacks while enabling a very rapid connection of the two bars. A single operation, which can even be carried out from a distance, accomplishes both operative steps which had to be successively made with the clamping apparatus used heretofore; moreover, the mechanical and electrical connection between both bars is much more effective and uniform than it was in the past.

The device which is the object of the present invention mainly consists of a clamping member, the rotating motions of which are linked (related) with those of an actuating member by two distinct motion-transmitting means, which means exert their action separately and successively during the displacement of the actuating member.

According to a special feature of the invention, the first of these motion-transmitting means is so selected, that the displacement of the clamping member is rapid, while the second means is so selected that its displacement is slow and irreversible.

According to a preferred embodiment of the invention, the actuating member is given a rotational motion about an axis parallel to the axis of rotation of the clamping member, the shafts of both members being journaled in a housing or frame which is firmly attached by any convenient means—as bolts—to one of the bars, preferably, the distributing bar to the anodes.

As regards the separate and successive motion-transmitting means between the actuating member and the clamping member: use can be made, first, of a toothed sector drive for rapid displacement of the clamping member and, second, of a cam and roller drive for the slow

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and irreversible displacement of the clamping member.

In one embodiment of the present invention, the actuating member comprises a toothed sector as well as a portion of a cam, both mounted on the axis of rotation of said member, while the clamping member is provided with a corresponding toothed sector, as well as with a roller, the axis of which is situated at a certain distance from the axis of rotation of the clamping member.

According to the invention, the cam and roller are adapted to make contact only from the moment when the teeth of the toothed sectors of the driving and clamping members are no longer in a meshing position.

In a clamping device made as outlined above, the cam contour and the distance between the roller axis and the axis of rotation of the clamping member are so selected, that this member exerts a very large and irreversible clamping (tightening) force on the movable bar, which bar is supported on the fixed distributing bar, or any other element integral therewith.

If the actuating member be rotated with a uniform angular speed, the clamping part will carry out, while the toothed gears are meshed, a high speed approach, then the motion will become slow and irreversible and will secure close contact between both bars when the cam on the actuating member contacts with the roller on the clamping member.

The clamping device of the present invention gives excellent results in connecting electric current conducting bars and, in particular, has great importance for the branch jointing of anode rods in cells used for the manufacture of aluminum. However, it is obvious that the device can also be applied in all cases where it is desired to have a quick approach with strong mechanical clamping between two parts, namely in the case where frequent clamping and unclamping of the same part are involved, or in the case where a large number of identical parts have to be put into place and removed, in turn. The device can be utilized, for example, as a quick-clamping vise on machine tools operating on a series of identical parts, for brake equipment, locking systems, etc.

In order to illustrate the invention, there is described below a preferred embodiment, given only as a non-limiting example.

In the drawings:

FIGURE 1 is a top plan view of a clamping device according to the invention, mounted on a distributing bar of an aluminum cell, and is used for joining the bar with a current input bar to an anode.

FIGURES 2 and 3 are sectional views of the same device along line 3—3 of FIGURE 1, illustrating the various steps of a clamping operation.

Referring to the drawings:

In FIGURE 1, there is shown the bus bar 1, to which is to be clamped the bar or rod 2 supplying current to an anode (not shown), and the frame 3 of the device fixed on the bus bar 1.

The clamping member 4 is represented on FIGURES 1 and 3 in the position in which it clamps bar 2 against bar 1. This member 4 comprises a roller 5 on which presses cam 6 carried by the actuating member 25, the rotating shaft 7 of which ends in a polygonal head 8 (FIGURE 1) adapted to be engaged by a tightening wrench.

FIGURE 3 shows a section of the device on line 3—3 of FIGURE 1, when the device has not yet clamped bar 2 against bus bar 1, but is about to clamp them together.

As will be observed, the clamping member 4, pivoting about shaft 10, comprises a clamping face 11, a toothed section 13, 14, 15 and, also, the roller 5 which can turn freely about a shaft 16 situated at a certain distance from shaft 10.

The actuating member 25 of the device, which turns on

a shaft 7, comprises a toothed sector 17, 18, 19 capable of meshing with the toothed sector of the clamping part, and a cam 6.

In the position represented on FIGURE 2, the clamping member 4 is completely inside the housing 26, and the bar 2 can be freely shifted before being disposed in a suitable position in relation to bus bar 1.

When the actuating member 25 is turned in the direction of arrow 20, the clamping member turns in the direction of arrow 21 at approximately the same angular speed, both toothed sectors being in mesh. There is obtained thereby a quick approach of the clamping member to the bar 2 by a rotating motion of about one third of the actuating member.

As the rotating motion of the actuating member proceeds, the last tooth 17 of the toothed sector escapes from the toothed sector 13, 14, 15 of the clamping member, as represented on FIGURE 3, where it will be seen that bar 2 is brought nearer to the distributing bar 1, but is not yet pressed against it. At this instant, cam 6 comes into contact with roller 5 and the rotating motion of the actuating member produces a very high pressure on the clamping member and a slow displacement of the latter.

It will be seen that when the end 22 of cam 6 arrives in contact with roller 5, maximum clamping is attained without the application of a large force to the actuating member.

In practice, it is advantageous to operate the actuating member with a dynamometric key in order to always obtain uniform clamping pressures. In the case where very frequent clamping and unclamping operations are to take place, the actuating member can be actuated by a motor.

According to an embodiment which gives good results, the clamping member 4 is provided with a spur 23 (FIGURE 3) enabling the bar 2 to be positioned automatically; the bar 2 is preferably placed at the beginning of the clamping operation against the housing and at its precise position in which it is at the end of the approach motion.

In the same way that the quick approach and clamping are accomplished with a single motion of the actuating member, the reverse operation first induces slow unlocking of the clamping member—as long as the cam contacts the roller—then comes rapid withdrawal of the clamping member, as soon as the toothed sectors again enter into mesh.

As will be seen from the foregoing description of the clamping device and its operation, the cooperation of the toothed sectors moves the clamping member at an angular velocity of the same order as that of the actuating member. In contrast thereto, the engagement of the cam and the roller produces a movement of the clamping member at an angular velocity which is relatively smaller than that of the actuating member.

Further, it will be apparent that the toothed sectors are in engagement during at least a part of the angular displacement of the actuating and clamping members, also, that the cam and roller are in engagement during at least a part of the angular displacement of the actuating and clamping members.

I claim:

1. A device for clamping a fixed bar to a movable one

so that in the unclamped position the space situated before the fixed bar is free for the approach of the movable bar from above, comprising, in combination: a housing attached to the fixed bar; a movable clamping member comprising a clamping face, an actuating member adjacent said clamping member, both said clamping member and said actuating member being mounted in the housing for rotation upon parallel shafts; first cooperating means on said members comprising toothed sectors which are in engagement during a part of the angular displacement of the actuating and clamping members and which are adapted to move said clamping face out of said housing in a rotary path at an angular velocity of the same order as that of the actuating member to approach said movable bar to said fixed bar, and separate cooperating means mounted respectively on said clamping and actuating members for moving said clamping member, after the approach motion, at an angular velocity relatively smaller than that of said actuating member, for applying pressure to the clamping face, to thereby clamp the bars together.

2. Device according to claim 1, wherein said separate cooperating means comprise a cam and a roller which are in engagement during the part of the angular displacement of said actuating and clamping members when said toothed sectors are not engaged.

3. Device according to claim 2, wherein the motion produced by said separate cooperating means is irreversible.

4. Device according to claim 2, wherein the said cam is attached to said actuating member and said roller is mounted on said clamping member.

5. A device for clamping two bars together under substantial pressure comprising a supporting housing attached to one bar, two parallel shafts supported within said housing, an actuating member carried on one shaft and a clamping member carried on the other, said actuating member comprising an actuating toothed sector and a cam section axially displaced from said actuating toothed sector, said clamping member comprising a clamping toothed sector in meshing relationship with said actuating toothed sector and a support member axially displaced from said clamping toothed sector and carrying a clamping face and a third shaft, said third shaft supporting a roller which engages said cam member, said actuating toothed sector effecting rotation of said clamping member through said clamping toothed sector to move said support member out of said housing in a rotary path about said clamping member shaft and into clamping position and said cam section thereafter effecting clamping of the bars through said roller.

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