United States Patent

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[54] **APPARATUS FOR ASSEMBLING ANODES FOR ELECTROLYTIC CELLS**
9 Claims, 6 Drawing Figs.

[52] **U.S. Cl.** ..... **29/203 R**
[51] **Int. Cl.** **H01r 33/00**
[50] **Field of Search** ..... 29/203 R, 204

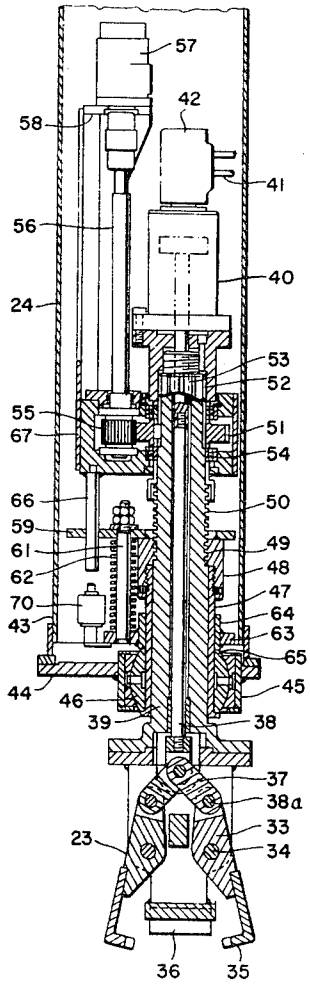
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ABSTRACT: Relates to an apparatus for securing threaded anode sections to a threaded anode in an electrolytic cell in which the anode clamping assembly is floatably mounted relatively to a supporting structure so that contact pressure between the anode section and an anode in the electrolytic cell will not exceed an amount sufficient to fracture the anodes.



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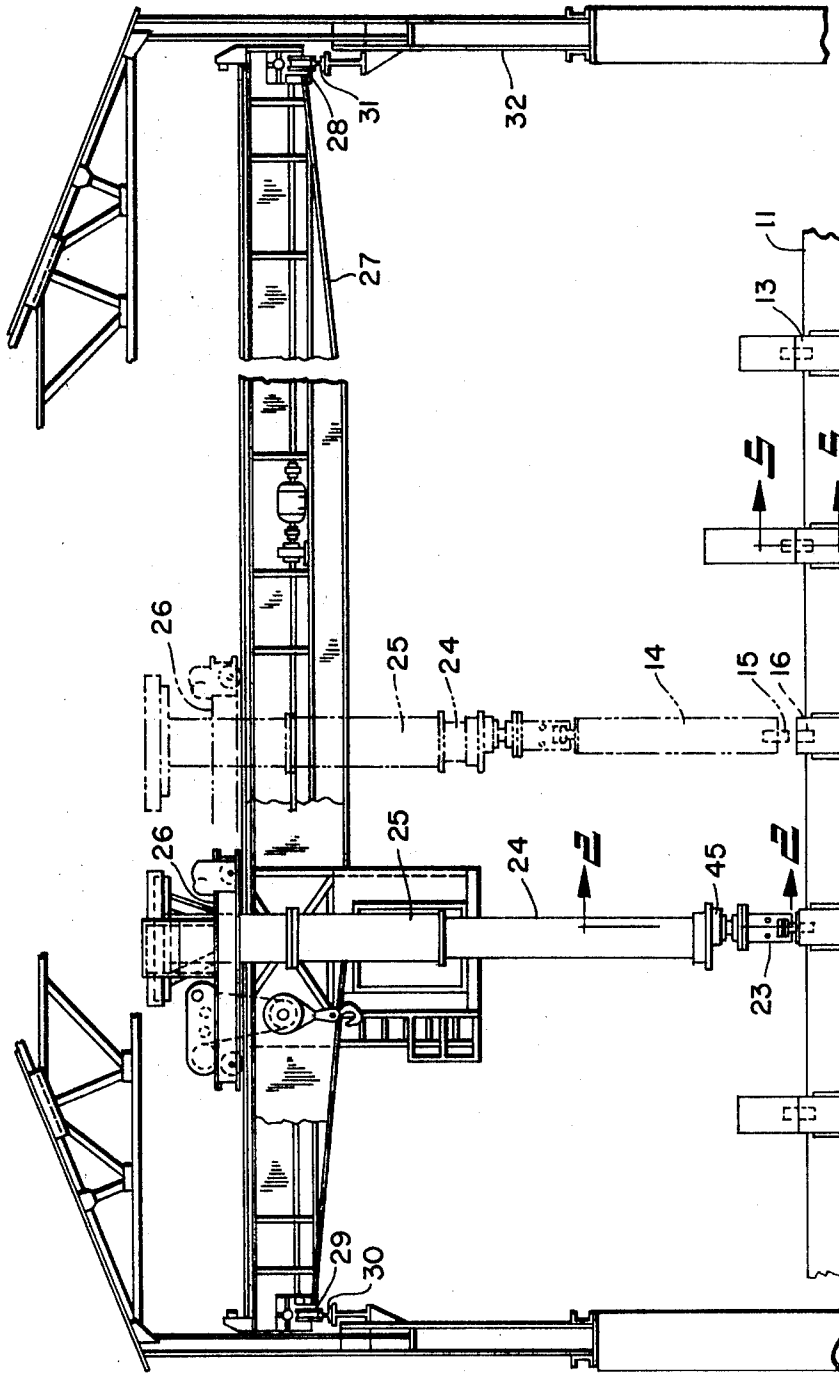


FIG. 1

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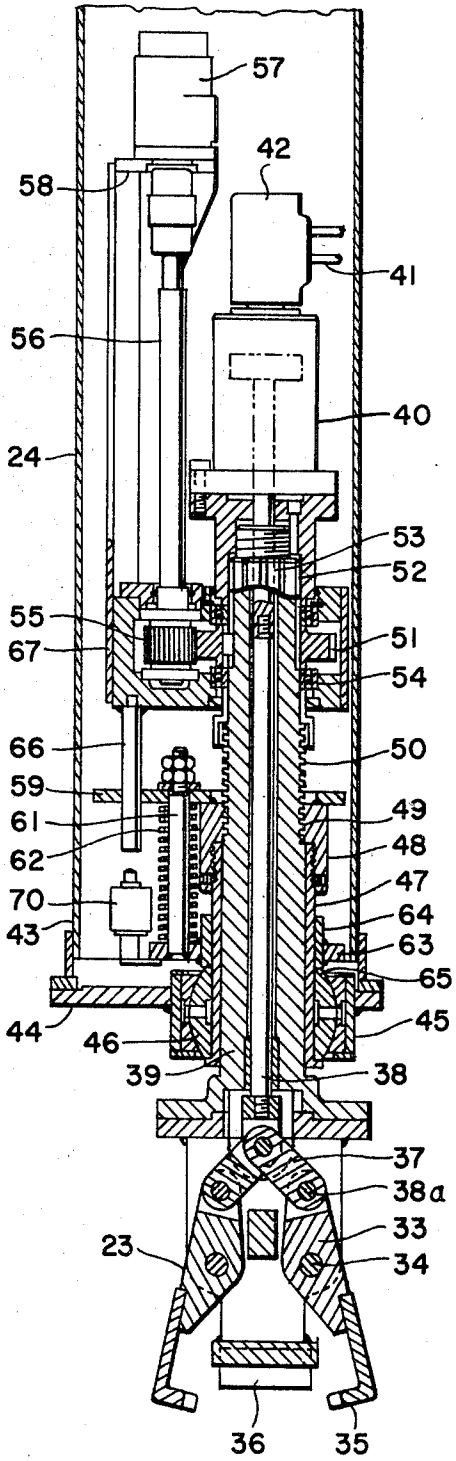


FIG. 2

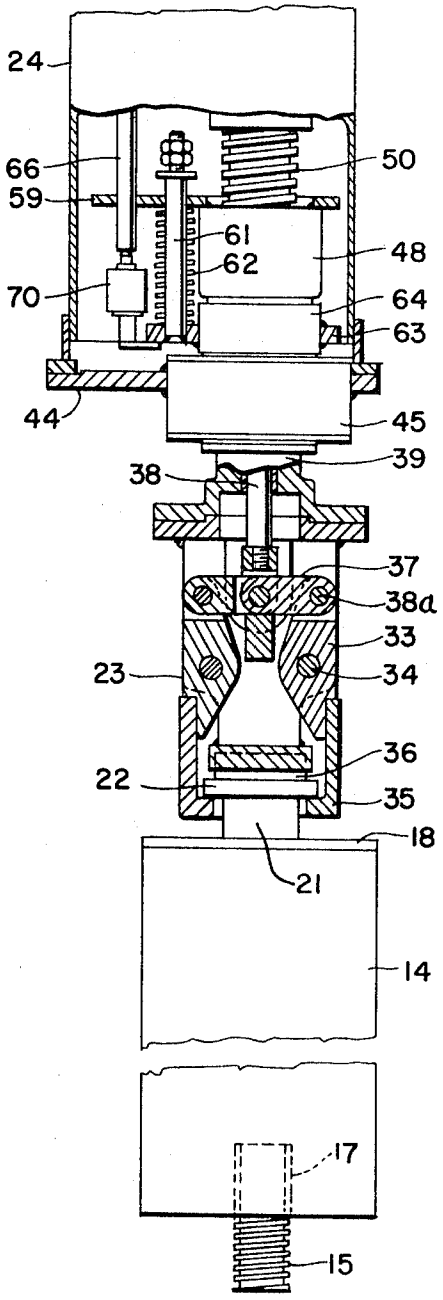


FIG. 3

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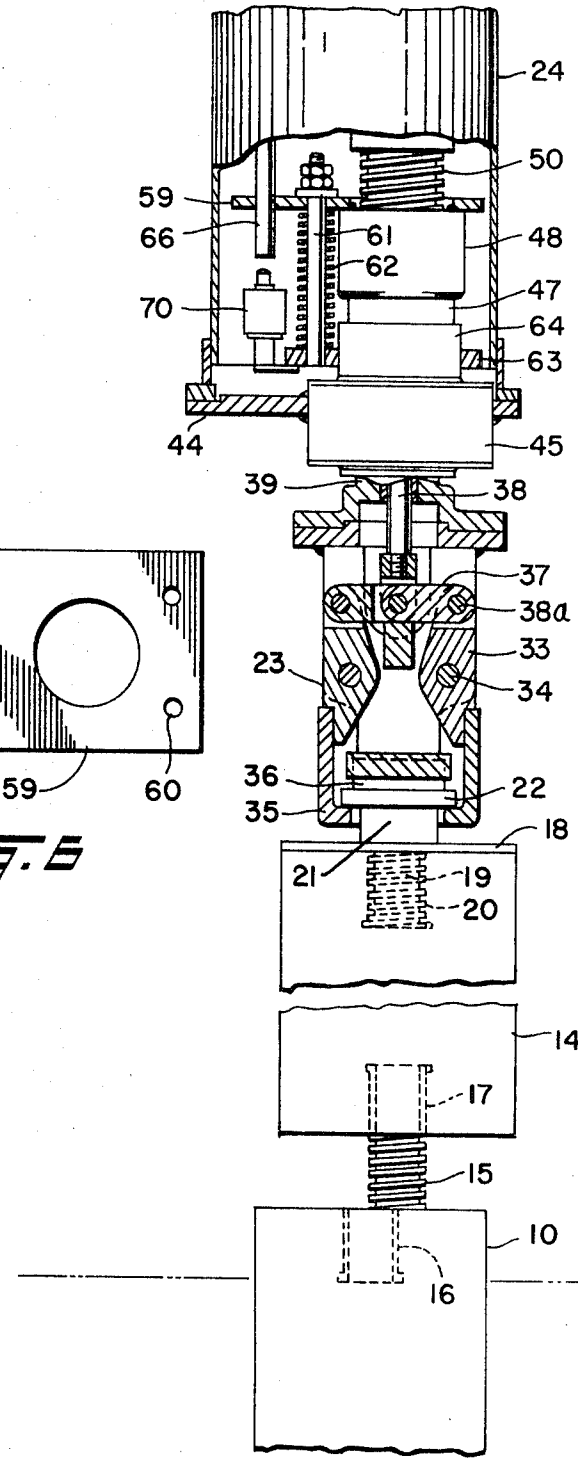


Fig. 4

Fig. 6

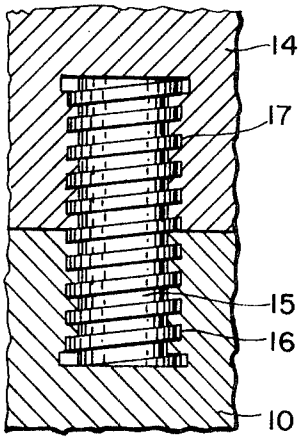


Fig. 5

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APPARATUS FOR ASSEMBLING ANODES FOR ELECTROLYTIC CELLS

This invention relates to apparatus for assembling graphite or carbon anode sections to similar anodes in electrolytic cells for the production of light metals.

In the operation of such cells, the lower ends of the carbon or graphite anodes are consumed and provision is made for lowering the anode through a suitable clamping mechanism in the cell cover as necessary. Periodically, a new anode section must be secured to the anode in the cell and this may be accomplished by providing the lower end of the new anode section with a coarse thread which is threaded into a coarse threaded counterbore in the upper end of the anode already positioned in the cell. The graphite or carbon from which the anodes are made are quite brittle and subject to being fractured rather easily. Thus, extreme care must be taken in threading a new anode section to the anodes in the cell.

Accordingly, it is an object of this invention to provide an apparatus for handling new anode sections, axially aligning the sections with anodes in an electrolytic cell and threadedly securing the section to such anode without fracturing the anodes.

A further object of this invention is to provide an apparatus for assembling a threaded anode section to a threaded anode in an electrolytic cell having means for floatably supporting the anode section as well as the means for clamping and rotating the anode section so that the contact pressure between the two anodes is insufficient to fracture either anode.

The invention, as well as additional objects and advantages thereof will be understood more fully when the following detailed description is read in connection with the accompanying drawings, in which:

FIG. 1 is a fragmentary transverse vertical sectional view illustrating the apparatus of this invention installed in an electrolytic cell facility.

FIG. 2 is a partial vertical sectional view taken along the lines 2–2 of FIG. 1, but with the anode clamps in retracted position.

FIG. 3 is a view similar to FIG. 2, but with the anode clamps in closed position.

FIG. 4 is a view similar to FIG. 3, but with the anode section misaligned with an anode in an electrolytic cell.

FIG. 5 is a partial cross-sectional view taken along the lines 5–5 of FIG. 1.

FIG. 6 is a plan view of the movable supporting plate.

As previously indicated, electrolytic cells for the manufacture of light metals are provided with a plurality of anodes **10** which are fixed to the electrolytic cell cover **11** by means of conventional adjustable clamp means **12** so that, as the lower end of the anodes **10** are consumed, the clamp **12** may be periodically loosened and the anode **10** lowered further into the electrolytic cell.

When the upper end **13** of the anodes approaches the upper end of the clamp means **12**, new anode section **14** is moved into vertical axial alignment with an anode **10**. The anode section **14** has a threaded stud **15** threadedly secured to a threaded counterbore **16**. FIG. **5** is a partial sectional view of the threaded stud **15** which is shown threadedly secured to the threads **16** in the upper end of an anode **10** and threadedly secured to similar threads **17** in the lower end of the anode section **14**. The upper end of the anode sections **14** have a metal connector plate **18** which is provided with a threaded stud **19** and threadedly secured to threads **20** at the upper end of the anode section **14**. The connector plate **18** is provided with an axially projecting contacting member **21** having a radially extending flange **22** which is engaged by a tong mechanism **23**.

The tong mechanism is supported by a hoist device **24** which may comprise a telescoping tubular hydraulically operated mast **25** attached to the trolley **26** which is movable longitudinally of the traveling crane **27**. The crane **27** is supported on wheeled trucks **28** and **29** at each end which travel along longitudinally extending rails **30** and **31** so that the hoist and tongs may be moved longitudinally of the electrolytic cell facility **32**. Since the trolley **26** may move longitudinally of the bridge crane **27**, the hoist mechanism **24** may be positioned over any one anode in any electrolytic cell in the facility **32**. A plurality of anode sections **14** are stored in a suitable container on the crane **27** or at some other location below the traveling crane **27** from which they are withdrawn and attached to an anode **10** as required.

The tong mechanism **23** comprises a pair of pivotable tong links **33** pivoted around pins **34** and having an L-shaped tong **35** at one end thereof. When the links **33** are retracted, the tongs **35** will engage the underside of the flange **22** of the connector **21**. The tong mechanism further includes a base member **36** for engaging the contact piece **21** of the connector **18**. A link **37** is pivotably connected at **38***a* to the upper end of the tong link **33** and the upper end of each of the links **37** are connected to an actuating rod **38**. The rod **38** is mounted for sliding reciprocal movement within the tong actuating shaft **39** and the upper end of the rod **38** is actuated by the rotatable piston of ram **40**. The ram **40** is secured to the shaft **39** and suitably supplied with hydraulic fluid through hoses **41** via a nonrotating valve **42**. With the tongs in the position shown in FIG. **2** and the base **36** bearing against the member **21**, the ram **40** is actuated to move the rod **38** in a downward direction into the position shown in FIG. **3** whereby the rod **38** causes the links **37** and tong links **33** to pivot into closed position as shown in FIG. **3** thereby moving the tongs **35** beneath the flange **22**.

The base **43** of hoist **24** is provided with a supporting plate **44** having a cylindrical collar **45** for supporting a spherical bearing **46**. The bearing **46** has an internal sleeve **47** in which the drive shaft **39** rotates. The upper end of the sleeve **47** is provided with a threaded control member **48** which is suitably fixed to the sleeve **47** and provided with internal threads **49** meshing with external threads **50** on the shaft **39**. The pitch of the threads **49** and **50** is identical to the pitch of the threads **17** and **20** so that as the shaft **39** is rotated the shaft **39** together with the tong mechanism **23** are advanced axially by a distance per revolution which is equal to the pitch of the threads on the anodes.

The shaft **39** is secured to a pinion gear **51** which slides on spline **52** at the upper end **53** of the shaft **39** supported on bearings **54**. Thus, the shaft **39** may slide relative to the gear **51** as it is being rotated by the gear **51**.

The gear **51** is driven by a pinion gear **55** connected to the lower end of shaft **56** driven by a suitable motor **57** supported on a mounting bracket **58** which is axially aligned but radially offset to the shaft **39**. It is thus seen that as the shaft **56** is rotated by motor **57**, the shaft **39** is rotated via the gears **55** and **51** and the tongs are moved axially at a rate controlled by the control member **48**.

A plate **59** which is shown in plan view in FIG. **6** is provided with a plurality of holes **60** through which studs **61** extend. The plate **59**, of course, is welded or otherwise secured to the control member **48** and the entire weight of the tongs, sleeve **47**, control member **48**, shaft **39**, the drive means for the shaft **39**, the rod **38**, and the ram **40** and valve **42** are supported by the plate **59**. In turn, the plate **59** is supported on a plurality of springs **62**, each of which surrounds one of a plurality the studs **61** extending through holes **60** of plate **59** shown in FIG. **6**. The lower end of each of the studs **61** is fixed to a collar **63** which is secured to a member **64** bearing against the upper end **65** of the spherical bearing **46**. It is thus apparent that the plate **59** which supports the entire weight of the tong mechanism and its drive is floatably mounted relative to the base **46**.

A pin **66** depends from the housing **67** and extends through a hole **69** in the plate **59**. Any reaction torque effected by the operation of the motor **57** is transmitted through the plate **59** via the pin **66**. Moreover, the pin **66** may move relatively to the plate **59** to sense relative movement between the supporting structure and the clamping or tong assembly **23**.

Whenever an anode is connected to the clamping assembly or tong mechanism **23**, the weight of the anode will compress the springs **62** into the position shown in FIG. **3** of the drawings thereby decreasing the distance between the support **44** and the plate **59**. Likewise, the pin **66** will move downwardly and engage and close a limit switch **70**. The circuit to the motor **57** may then be energized to rotate the shaft **39**. With the apparatus in this condition should the anode section **14** be misaligned with an anode **10** in the cell so that the threaded stud **15** engages the top of the anode as the tong rotating mechanism is actuated, the tong assembly as well as pin **66** will move upwardly and the limit switch **70** will be opened to deenergize the motor **57** and stop rotation of the shaft **39** and the anode section **14**. It is noted that, since the entire weight of the tong mechanism **23** and its operating mechanisms, as well as the cathode, are floatably mounted on the support **44**, very little contact pressure is required between a misaligned stud **14** and a cathode **10** to cause the pin **66** to move a sufficient distance to open the limit switch **70**. This limited contact pressure is so low as to be insufficient to cause fracture of the frangible carbon or graphite material from which the studs are made.

When the lower end of one of the anodes **10** in the cell cover **11** is consumed to the extent that a new anode section **14** must be added, the crane operator positions the tongs **23** over the connector **21** of a new anode which is stored in a suitable container on the crane **27** as previously explained. Assuming the tongs are in the position shown in FIG. **2** the operator lowers the hoist **24** until the base member **36** contacts the flange **22** of the connector. The operator then actuates valve **42** causing the piston of the ram **40** to move downwardly to actuate the rod **38** in a downward direction into the position shown in FIG. **3** causing the links **37** to pivot thereby moving the tongs **35** beneath the flange **22**. The hoist is then actuated to raise the tongs and the attached new anode **14** and the crane is moved to convey the new anode into a position above an anode **10** in the cell as shown in FIG. **1**. The motor **57** is then energized which rotates the sleeve **39** as well as the tong mechanism and the attached anode. Such rotation also causes the sleeve **39** and the attached anode to move downwardly by the control member **48** and threads the threaded stud **15** at the lower end of the anode section **14** into the thread counterbore **16** at the upper end of the anode **10**.

Since the tong mechanism and the new anode are floatably mounted, and in the event that the stud **15** is not properly aligned with the threaded counterbore **16** as shown in FIG. **4**, the tong assembly as well as pin **66** will move upwardly a slight distance and the limit switch **70** will be open to deenergize the motor **57** and stop rotation of the shaft **39** and the anode section **14**. The operator then reverses the motor **57** to cause the sleeve **47** to be retracted on the control member **48** and the crane is moved to respot the new anode **14** above the threaded counterbore **16**.

I now claim:

1. An apparatus for securing a threaded anode section to a threaded anode in an electrolytic cell comprising in combination;

a supporting structure,

overhead means for horizontally moving said supporting structure relative to an electrolytic cell so that an anode section may be moved into vertical alignment with an anode in said electrolytic cell,

means secured to said overhead means for raising and lowering said supporting structure relative to said overhead means to position the threaded base of the anode section adjacent the upper end of said anode in said cell,

a clamping assembly including clamping means for engaging the upper end of an anode section, said assembly including power means for actuating said clamping means, means for rotating said clamping means, threaded means for controlling axial movement of said clamping means while said clamping means are rotated so as to axially move said clamping means at a rate equal to the pitch of the threads on said anodes, and

means for floatably mounting said clamping assembly on said supporting structure whereby contact pressure between an anode section in said clamping assembly and an anode in the electrolytic cell will be reduced to an amount insufficient to fracture the anodes.

2. An apparatus as claimed in claim **1** in which said means for floatably mounting said clamping assembly comprises spring means between said clamping assembly and said supporting structure which are compressed when an anode is supported by said assembly.

3. An apparatus as claimed in claim **2** in which said spring means includes a plurality of axially aligned springs.

4. An apparatus as claimed in claim **1** in which said threaded means for axially moving said clamping means comprises a nonrotatable threaded control member, a threaded shaft for rotating said clamping means in threaded relationship with said control member, the threads on said shaft and control member being of the same pitch as the threads on the anode and anode section.

5. An apparatus as claimed in claim **4** in which said shaft is driven through a gear which is slidably mounted on said shaft.

6. An apparatus as claimed in claim **5** in which said gear is driven by power means supported on said shaft.

7. An apparatus as claimed in claim **4** in which said shaft is provided with a longitudinal bore, an actuating rod extending through said bore and connected to said clamping means and a ram for actuating said rod.

8. An apparatus as claimed in claim **1** having means for sensing relative movement between the supporting structure and said clamping assembly due to contact of an anode section in said assembly with an anode in said cell.

9. An apparatus as claimed in claim **8** having means initiated by said sensing means to stop rotation of said clamping means whenever said relative movement exceeds a predetermined amount.