United States Patent

Neuman et al.

[15] **3,685,116**

[45] **Aug. 22, 1972**

[54] **METHOD AND APPARATUS OF MOUNTING AND SECURING A RECTILINEAR ELEMENT ON A SUPPORT MEMBER OF A MACHINE**

[72] Inventors: **Marcel L. Neuman,** 19 rue Chabannes, Collonges-Au-Mont D'OR; **Louis F. Colomb,** 22 rue Edouard Idoux, Givors, both of France

[22] Filed: **Nov. 13, 1970**

[21] Appl. No.: **89,187**

Related U.S. Application Data

[62] Division of Ser. No. 715,841, March 25, 1968, abandoned.

[30] **Foreign Application Priority Data**

March 30, 1967 France.....67100801
June 27, 1967 France.....67112020
Jan. 28, 1968 France.....68137577

[52] **U.S. Cl.** .....**29/200 B**
[51] **Int. Cl.** **B23p 19/00**
[58] **Field of Search**.....29/200 B, 200 R, 509, 521, 29/160

[56] **References Cited**

UNITED STATES PATENTS

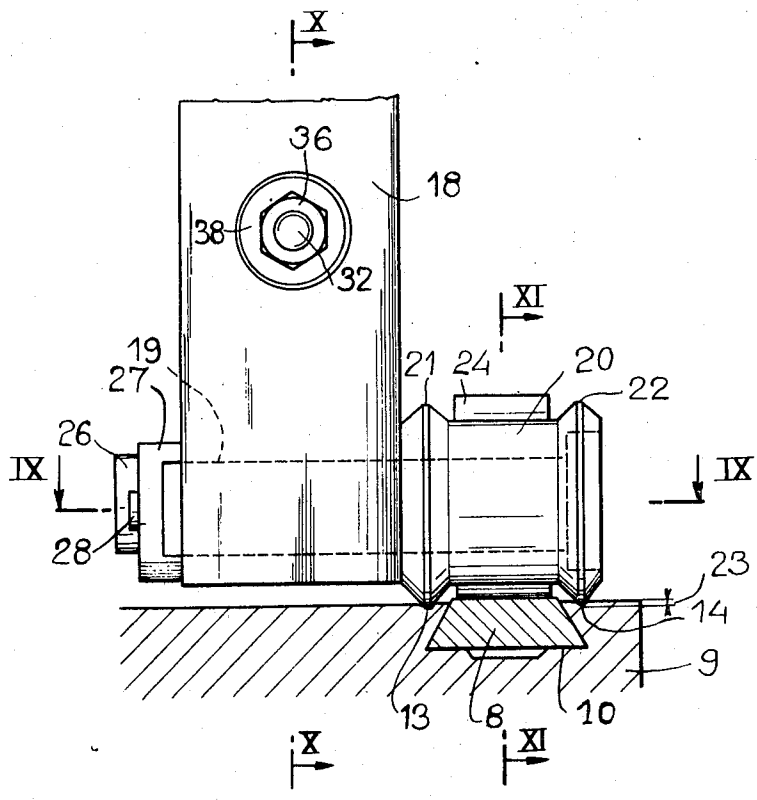
2,135,766	11/1938	Pierce	29/160
2,190,611	2/1940	Sembdner	29/521
2,343,043	2/1944	Brugmann	29/200 B
2,450,987	10/1948	Potter	29/509 X

Primary Examiner—Thomas H. Eager
Attorney—Delio & Montgomery

[57] **ABSTRACT**

An apparatus for securely mounting a rectilinear element on a support member comprising a support member having a trapezoidal section grooved therein and a rectilinear element having a complementary trapezoidal shaped portion received in the groove, the two trapezoidal shapes being such that when the rectilinear element is inserted in the groove a slight play will exist between the complementary inclined sides of the grooved element and a high pressure is exerted on the inclined edges of the groove to bed the rectilinear element in the groove.

7 Claims, 13 Drawing Figures



PATENTED AUG 22 1972 3,685,116

SHEET 1 OF 6

Fig. 1

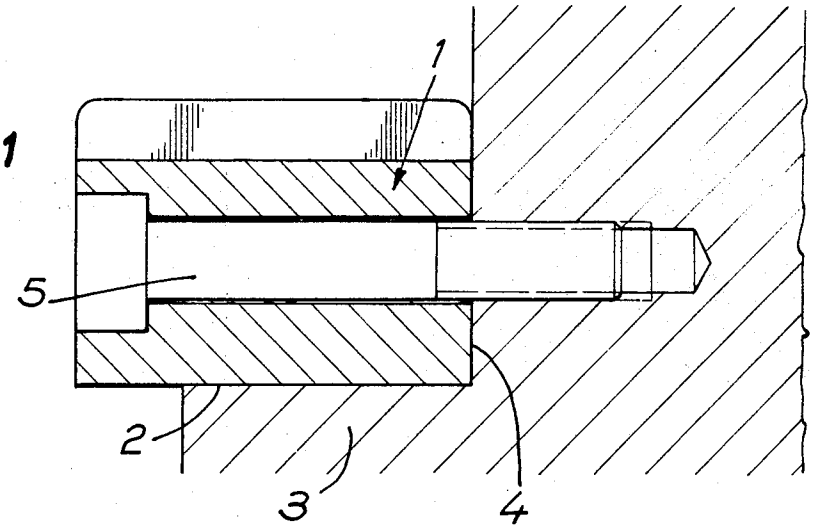


Fig. 2

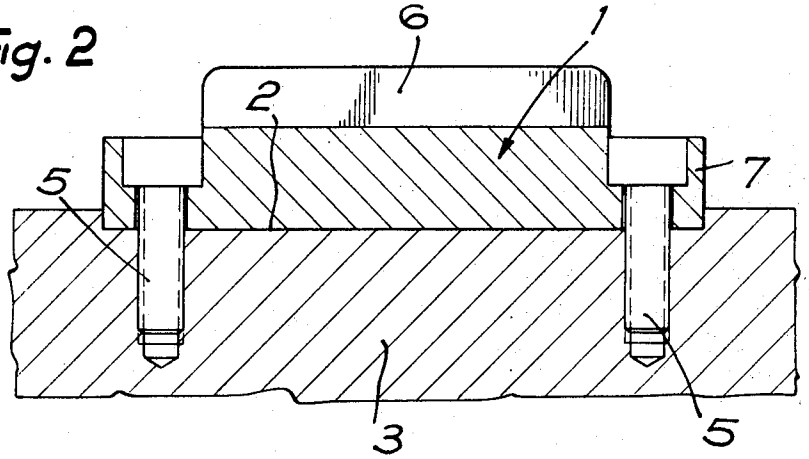
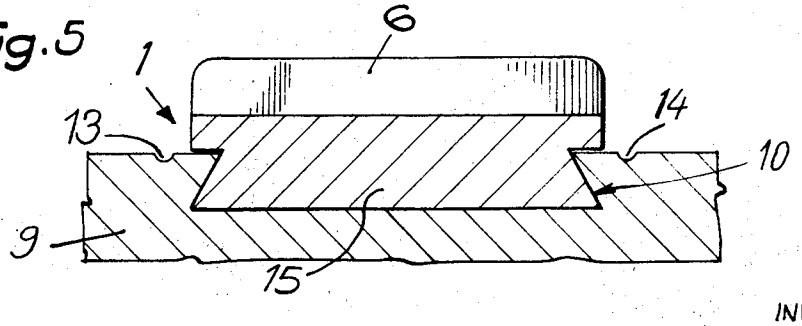


Fig. 5



INVENTORS
Marcel L. Neuman
Louis F Colomb

BY
Dorlo and Montgomery
ATTORNEYS

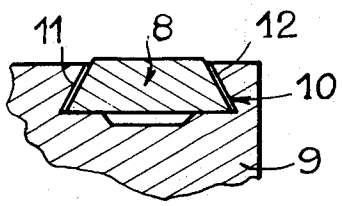


Fig 3

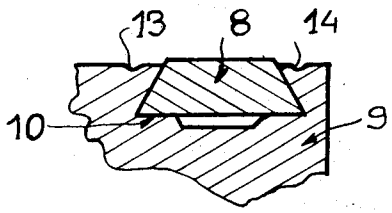
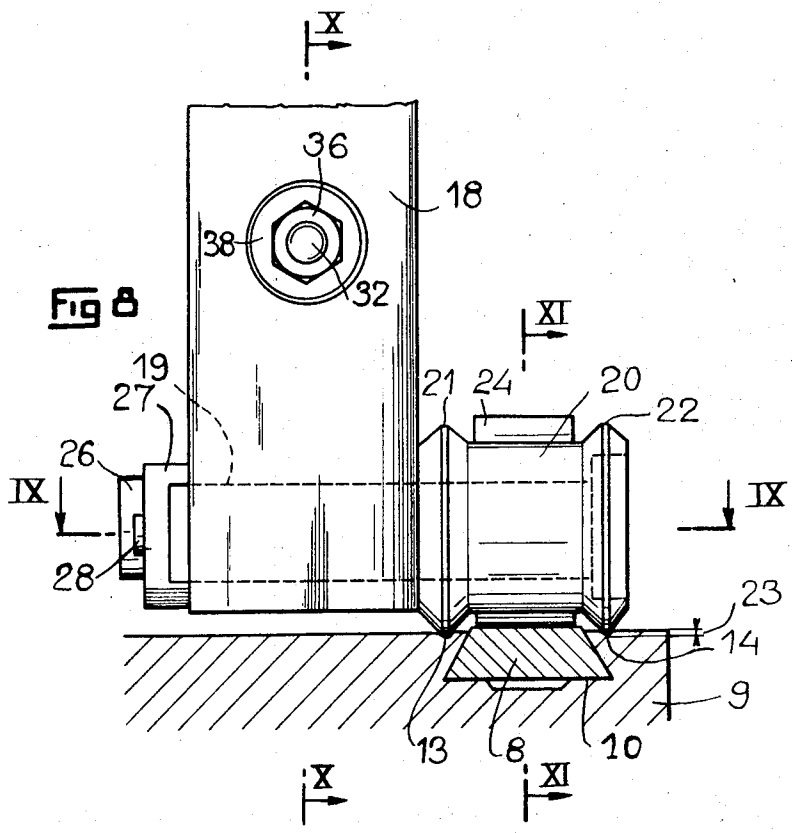


Fig 4

Fig 8



INVENTORS
Marcel L. Neuman
Louis F. Colomb

BY
DeLio and Montgomery
ATTORNEYS

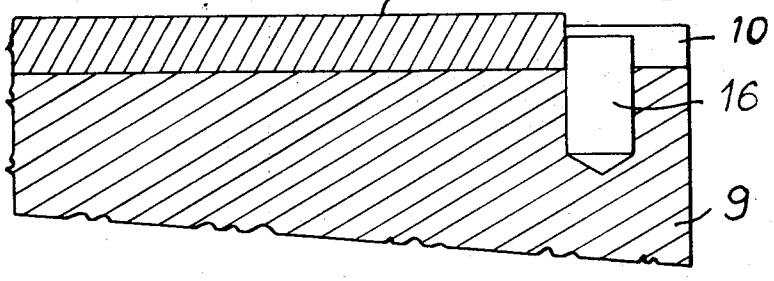


Fig. 6

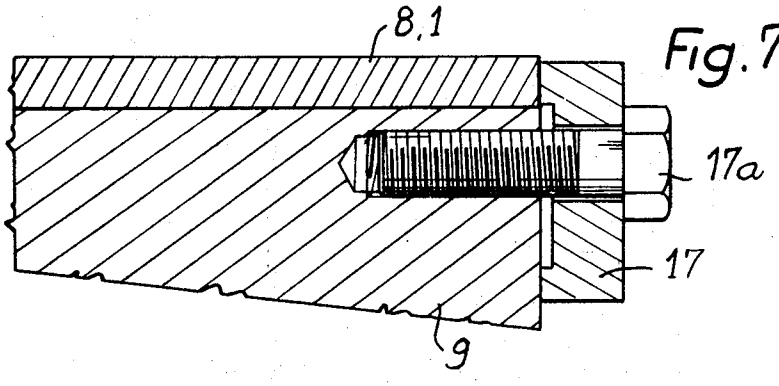


Fig. 7

INVENTORS

Marcel L. Neuman
Louis F. Colomb

BY

De Lio and Montgomery
ATTORNEYS

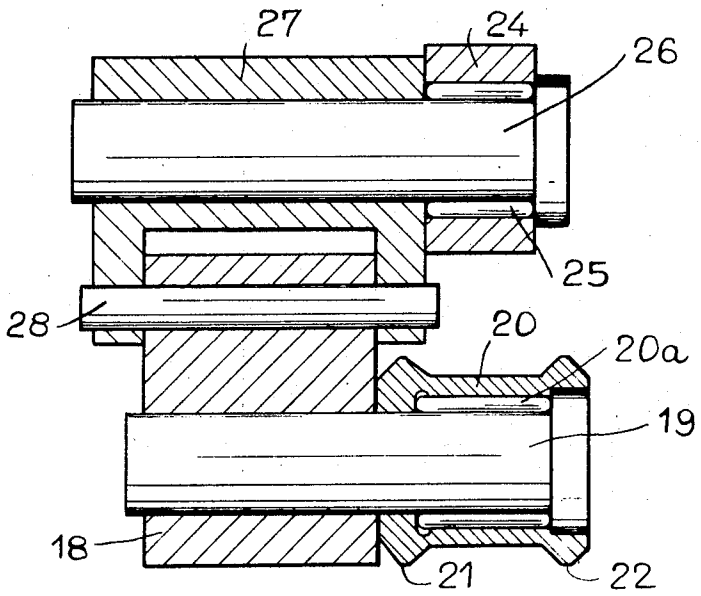
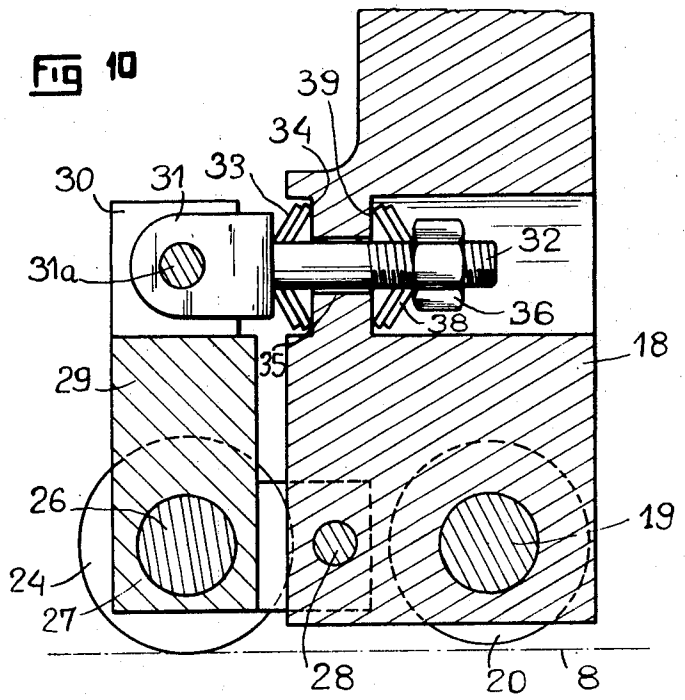


Fig 9

Fig 10



INVENTORS
Marcel L. Neuman
Louis F. Colomb

BY
DeLio and Montgomery
ATTORNEYS

Fig 11

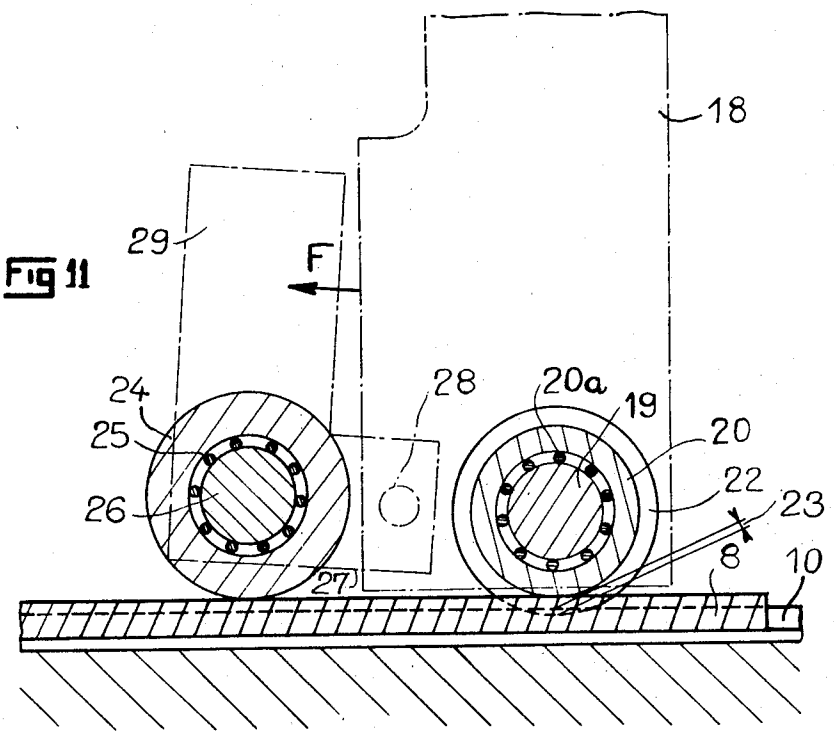
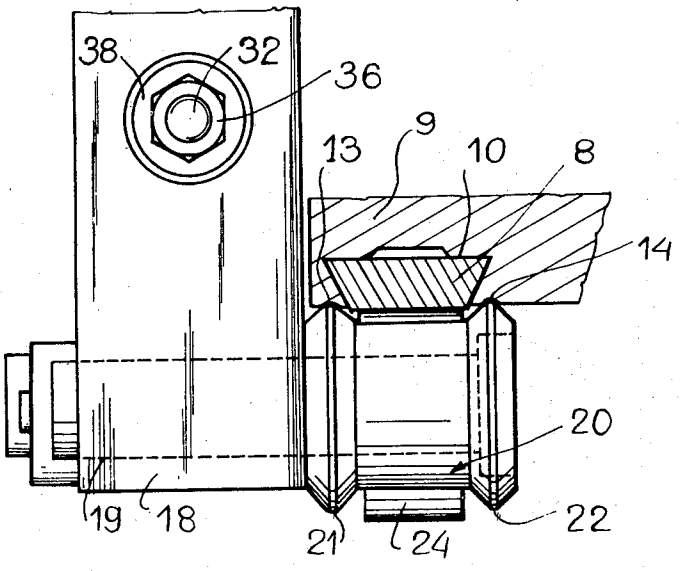


Fig 12



INVENTORS

Marcel L. Neuman
Louis F. Colomb

BY DeLio and Montgomery
ATTORNEYS

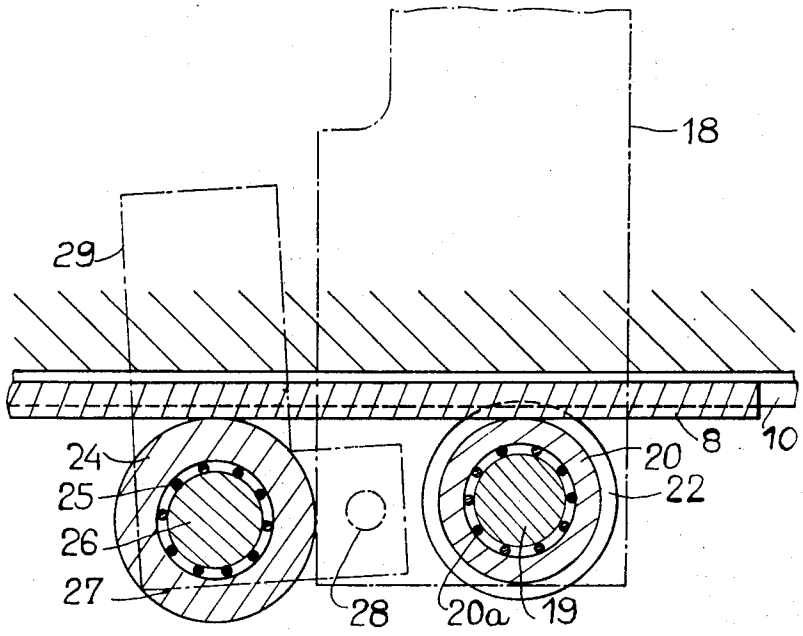


Fig 13

INVENTORS
Marcel L. Neuman
Louis F. Colomb

BY DeLio and Montgomery
ATTORNEYS

METHOD AND APPARATUS OF MOUNTING AND SECURING A RECTILINEAR ELEMENT ON A SUPPORT MEMBER OF A MACHINE

This is a divisional application of patent application Ser. No. 715,841 filed Mar. 25, 1968, now abandoned.

This invention relates to machine tools and particularly to an apparatus for mounting and securing a rectilinear element, such as a guide bar, rack or similar element, on a machine.

In the particular field of guideways for machine tools, in order to reduce wear of the slideways and, in certain cases, to enable rolling members to be used, it is necessary to provide extremely hard sliding or rolling paths. The best results are obtained by using hardened steel and, to this effect, the current practice is to mount guide bars on the cast or welded steel elements of the machine.

These hardened steel guide bars are most often assembled on the corresponding elements by screwing or clamping. In order to avoid the guide bars bearing imperfectly between the assembly elements, it is necessary to use more of these elements and to increase the section of the guide bars, which is generally impractical and undesirable.

Furthermore, in the specific field of toothed racks for machine tools, each rack must be mounted on its support member in such a way that its primitive plane is exactly parallel to the guide slideways. Such a rack must also be very firmly secured, to avoid any risk of movement under the action of the forces to which it is subjected.

Generally the rack is located by cylindrical or tapered pins or again by locking clamps at its ends and it is secured by screws.

In a first well known method shown in FIG. 1, the rack 1, which must rest on the bearing surface 2 of its support member 3, is held tightly against a perpendicular face 4 by means of screws 5, extending parallel to the primitive plane of the teeth 6 of this rack.

The disadvantage of this construction is that the screws cannot eliminate the play occurring on the bearing surface 2. It is, moreover, necessary to provide the holes for these screws in the thickness of the rack itself, which necessitates increasing the thickness of the latter beyond that which would normally be necessary to give sufficient resistence to the teeth.

In a second known construction shown in FIG. 2, the fixing screws 5 extend perpendicularly to the primitive plane of the teeth to hold the rack tightly against the bearing surface 2 of the support member 3. In this case, however, it is necessary to provide on the rack, on both sides of the teeth 6, lateral flanges 7 in which the screws holes are formed.

The disadvantage of this construction is that the width of the rack is considerably increased.

In both cases the method of fixing by screws almost doubles the bulk of the racks, and this is all the more undesirable since the racks usually have to be mounted between slideways where little room is available.

A main object of the present invention is to remedy the aforesaid drawbacks in the mounting of a rectilinear element, whether this be a guide bar or a toothed rack.

According to the present invention a method of mounting a rectilinear element on a support member comprises imparting a trapezoidal section to the rectilinear element, forming a groove of complementary section in the support member, the two sections being such that when the rectilinear element is inserted in the groove slight play will exist between the inclined sides of the groove and those of the element, introducing the rectilinear element freely into the groove and exerting a high pressure on the wedge shaped edges of the groove to bed the rectilinear element in the groove.

In effect, the bedding applies the concealed face of the rectilinear element strongly and uniformly against the bearing face of the groove cut in the support member. Thus, when the rectilinear element is a guide bar, the planeness and parallelism of the sliding or rolling path of the bar depends on the precision of the machining of the groove and no longer on the manner of fixing. Moreover, when the rectilinear element is a toothed rack, its primitive plane is, for the same reason as before, accurately parallel to the sliding or rolling paths of the guide bars.

On the other hand, bedding ensures extremely forceful gripping of the guide bars and toothed racks, such that these elements can, without deformation or displacement, support very high forces better than when they were connected to their support member by fixing elements of small area.

Finally, the bedding operation enables the section of the guide bars and the toothed racks to be considerably reduced by limiting their width to that of the guided members (guide blocks or rollers) and to that of the meshing elements (pinions) and by decreasing their thickness solely to satisfy resistance requirements.

The invention moreover covers equipment for carrying out the aforesaid method and which comprises a tool carrier on which is freely mounted at least one bedding roller having two projecting flanges which have a substantially V-shaped profile and which are spaced apart by an amount greater than the free width of the guide bar. The tool carrier cooperates with a pressure roller which precedes the bedding roller.

The movable component carrying the pressure roller is pivotally mounted about an axis of the tool carrier parallel to that of the bedding roller, this component being connected to at least one spring bearing on the tool carrier.

The invention also covers a manner of fixing a guide bar and a toothed rack on a support member of a machine and more particularly of a machine tool, whereby the bar and the rack have a trapezoidal section housed in a groove of similar section in the support member and are flanked by two bedding channels.

In order that the invention may be more fully understood, various embodiments in accordance therewith will now be described, by way of example, with reference to the accompanying drawings in which:

FIG. 1 is a view in section of a conventional method of mounting a rack defining member to a support member; and

FIG. 2 is a view in half section of another known method of mounting a rack defining member to a support member;

FIGS. 3 and 4 are schematic partial sections showing two phases of the method of the invention for mounting and securing a guide bar;

FIG. 5 is a similar view to FIGS. 3 and 4 showing the application of the method to the mounting of a toothed rack;

FIGS. 6 and 7 are partial longitudinal sections showing one of the end abutment members of the aforesaid bar and rack;

FIG. 8 is an elevation in the same plane as that of FIGS. 3 and 4 and showing the bedding equipment;

FIG. 9 is a section along the line IX—IX of FIG. 8;

FIG. 10 is a section along the line X—X of FIG. 8 and showing the equipment in rest position;

FIG. 11 is a section along the line XI—XI of FIG. 8 and showing the equipment in bedding position, the main elements of this equipment situated behind the sectional plane being defined by the broken lines;

FIGS. 12 and 13 are views similar to FIGS. 8 and 11 showing respectively the operation of this equipment for retaining slideways or for toothed racks accessible from below.

As will be seen from FIG. 3, the guide bar 8 to be mounted, whether it be in one piece or several portions placed end to end, has a trapezoidal section. The support member 9 of the machine, on which the bar is to be mounted, contains a groove 10 whose section is also trapezoidal and complementary to that of the bar.

Slight lateral play is provided at 11 and 12 between the inclined sides of the bar and those of the groove. When the concealed face of the bar bears in suitable manner against the bottom of the groove this play is preferably between 0.01 and 0.1 mm. and shown exaggerated in FIG. 3 solely to enable the invention to be better understood. This play is intended to make it extremely easy to place the bar 8 in position.

In a second step in the method of the invention, the metal forming the edges of the groove 10 at 13 and 14 (FIG. 4) is compressed to cause it to flow towards the sides of the groove. There is thus created a permanent contact pressure of the sides of the groove on those of the bar at the point where there was previously play. The bar is then immobilized and by the effect of the slope of the sides is locked against the bottom of the groove. This imparts to the assembly the same rigidity as would be found in a single piece construction.

It can, moreover, be advantageous to exert a pressure on the bar to apply it against the bottom of the groove before causing the metal to flow at 13 and 14.

The method described above is in the same way applicable to the mounting of a toothed rack 1. As will be seen from FIG. 5, the underlying portion 15 of the rack 1 has a trapezoidal section. It is freely introduced into a groove 10 of the support member 9 because of the existence of the play 11, 12 and it is firmly immobilized therein by causing the metal to flow at 13 and 14.

This embodiment enables the thickness of the rack to be limited to that which is strictly necessary for the resistance of the base of the teeth, i.e., to two or three times the standard. It also enables the real width of the rack to be limited to the width of the teeth and finally enables the thickness of the support member to be reduced since there are no longer any threaded holes.

Regarding more particularly the guide bar 8, this can be in one piece or in several relatively short portions which are more easily accurately machinable. The ends of these portions may be perpendicular to the longitudinal edges, but it is advantageous, in order to avoid any variation, notably when the rollers running on this bar are simple and not multiple, to provide oblique ends. The various portions of the bar are then engaged end to end in the groove 10 so that their ends are in contact.

Whether it is a guide bar 8 or a rack 1 which is to be mounted, at least one abutment member is positioned near at least one of the ends of the bar or the rack.

Each abutment member may be constituted by a stud 16, forcibly engaged in the element 8 or 1 so as to project into the groove 10 (FIG. 6).

Alternatively, each abutment member may be constituted by a collar 17 cooperating with a screw 17*a* screwed tightly into the member 9. The collar can moreover enable the guide bar portions to be compressed together.

The metal at 13 and 14 can be caused to flow by hand by means of a riveting hammer, but it seems preferable for this to be done automatically by means of the bedding equipment described hereafter with reference to FIGS. 8 to 13. The results obtained are more certain, more uniform and have the appearance of being better finished.

The equipment has a tool carrier 18 having a laterally projecting shaft 19. A bedding roller 20 is mounted on the protruding portion of this shaft by means of a needle bearing race or other bearing means. The bedding roller can thus rotate freely, but is prevented from axial movement by means of shoulders provided thereon and on its shaft, for example.

The bedding roller has two projecting annular flanges 21 and 22, which are substantially V-shaped in profile and which are spaced apart by an amount greater than the free width of the bar 8 or the rack 1. Thus, if the bedding roller 20 is disposed so that its flanges are situated to either side of the bar or rack, at equal distances from the sides thereof, if the bedding roller is pressed against the support member 9 and the tool carrier 18 is moved to cause the bedding roller to roll, two channels 13 and 14 are formed in the said support member 9, causing the metal to flow towards the inclined sides of the groove.

These operations can easily be carried out by mounting the tool carrier 18 in the head of the planing or milling machine used to machine the groove 10. In fact, by means of the transverse carriage of one or other of these machines, the bedding roller 20 can be centered to bring its diametric plane of symmetry into coincidence with the longitudinal plane of symmetry of the element 1 or 8. By means of the cutting carriage of the machine, it is easy to press the bedding roller against the element containing the groove 10 and to determine the bedding depth 23. Finally, by means of the longitudinal carriage of the machine, the bedding roller is caused to move in translation and bedding is effected over the whole length of the element 1 or 8. The tool carrier 18 can of course be mounted on a machine other than that which was used for machining the grooves 10. It can for example be mounted on a specially designed independent machine which has a pressure device and a driving device, as well as guiding and bearing means adapted to be connected to the machine element which is to be equipped with the element 1 or 8.

The equipment can also have in combination with the bedding roller 20 a pressure roller 24, preceding the bedding roller since it is intended to apply the element 1 or 8 against the bottom of the groove 10 before the bedding is carried out.

In the embodiment shown, the pressure roller 24 is freely mounted, by means of a needle bearing race 25

or other bearing, on a spindle **26** mounted in a movable element **27**. This movable element is in fact a yoke (FIG. **9**) hinged on a spindle **28** engaged in the tool carrier **18**. The spindles **19**, **26** and **28** are mutually parallel, so that by causing the element **27** to pivot, the level of the pressure roller **24** is altered with respect to that of the bedding roller **20**. The pressure roller **24** is also prevented from transverse movement with respect to the spindle **26** and the extent of its projection is determined so that its diametric plane of symmetry coincides with that of the bedding roller **20**.

As is clearly shown in FIGS. **8** to **10**, the diameter of the pressure roller **24** is slightly greater than that of the bedding roller **20**, as during relative approach of the equipment and the element **8** or **1**, this pressure roller must come into contact with these latter before the flanges **21** and **22** of the bedding roller come into contact with the edges of the groove **10**. During approach of the equipment, the roller **24** must exert a large pressure on the element **8** or **1** in order to apply it against the bottom of the groove **10**. To this effect, the pivoting element is connected to at least one resilient member such as a spring.

In the embodiment shown in FIG. **10**, this element **27** is secured to an extension **29** substantially perpendicular to the plane of the axes **26** and **28**. On the end of the extension **29** is formed an apertured lug **30** on which is fitted a yoke **31**, a pivot pin **31***a* being engaged through the lug and the branches of the yoke. The yoke is provided with a rod **32** on which is disposed a spring **33** preferably constituted by a series of Belleville washers and bearing on a shoulder **34** of the tool carrier **18**. The rod **32** passes through a hole **35** leading to the shoulder **34** and its threaded end cooperates with a nut **36** limiting the travel of the rod, i.e., the amplitude of pivot of the element **27**.

In the rest position shown in FIG. **10**, the Belleville washers are relieved and the spindles **19**, **26** and **28** are situated in the same plane parallel to the element **8** or **1**. In this position and since the diameter of the pressure roller **24** is greater than that of the bedding roller **20**, the pressure roller can be brought into contact with the element **8** or **1** before the flanges **21** and **22** come into contact with the edges of the groove **10**. As will be seen from FIG. **11**, by exerting a pushing force on the tool carrier **18**, it is caused to descend and the flanges **21** and **22** of the bedding roller are caused to penetrate the edges of the groove **10**. However, since the roller **24**, which was initially in contact with the element **8** or **1**, cannot move downwardly, the element **27** pivots about the spindle **28** and causes the rod **32** to be pushed into the hole **35**. This has the effect of putting the Belleville washers **33** under tension, which then exert a high pressure on the roller **24**, which applies the element **8** or **1** against the bottom of the groove **10**. By then moving the tool carrier in the direction of the arrow F (FIG. **11**), the element **8** or **1** is applied closer and closer against the bottom of the groove by the pressure roller **24** and the bedding is then carried out by the bedding roller **20** (FIG. **11**).

The same equipment can also be used for bedding the element **8** or **1** in a downwardly open groove **10** (FIGS. **12** and **13**). For this, the cutting carriage of the planing or milling machine no longer acts by pushing, but by pulling. In effect, the bedding roller **20** and the pressure roller **24** no longer act respectively on the lower parts of the edges of the groove and the portions of the guide bar, but on their upper parts, this being possible because the bedding and pressure rollers are mounted on a projecting member.

Moreover, FIG. **13** clearly shows that, in this case, during the bedding operation the element **27** pivots in the opposite direction to that in the previous case. This element is, moreover, no longer subjected to the pressure forces of the Belleville washers **33**, but to those of other Belleville washers **38** disposed on the rod **32** and interposed between another shoulder **39** of the tool carrier and the nut **36**.

The bedding roller **20** may be in several parts, so that, by means of an intermediate washer, it is possible to adjust the distance between the flanges **21** and **22**. Moreover, these flanges have a different height depending on whether the bedding roller is intended to bed a guide bar **8** or a toothed rack **1**. Furthermore, several bedding rollers may be mounted in series to constitute a train, the bedding depth varying from one roller to the other. Again, several pressure rollers may also be mounted in series to constitute a train distributing the contact pressure over a greater length. Finally, the roller or rollers may be mounted on a movable element independent of the tool carrier and, in this case, the movable element is fixed to a pressure member which may simply be a helicoidal compression spring or a pneumatic or hydraulic jack or other suitable means.

The invention is not limited to the embodiments shown and described in detail as various modifications can be made thereto without exceeding its scope.

What is claimed is:

1. Apparatus for mounting and securing a rectilinear element on a support member of a machine comprising: a tool carrier having at least one bedding roller with two projecting flanges of substantially V-shaped profile separated by an amount greater than the free width of the rectilinear element.

2. Apparatus according to claim **1** wherein the tool carrier includes a pressure roller which precedes the bedding roller.

3. Apparatus according to claim **2**, further including a movable element guided on the tool carrier and connected to at least one pressure member; said movable element freely carrying said pressure roller.

4. Apparatus according to claim **3** wherein said tool carrier is provided with a shaft parallel to the bedding roller and on which the movable element is pivotally mounted; said movable element being connected to at least one spring bearing on the tool carrier.

5. Apparatus according to claim **4** wherein the movable element has a rod on which are mounted two opposed springs interposed between three abutments of which at least one is secured to the tool carrier.

6. Apparatus according to claim **5** wherein the springs are Belleville washers.

7. Apparatus according to claim **2** wherein the bedding roller and pressure roller are disposed on an element which projects from the tool carrier.

* * * * *