May 19, 1970 M. GALBARINI ET AL 3,512,738

PRESTRESSING OF SUPPORT MEMBERS FOR SLIDE BENCHES OF LARGE MACHINE TOOLS

Filed Feb. 19, 1968 2 Sheets-Sheet 1

Fig. 1

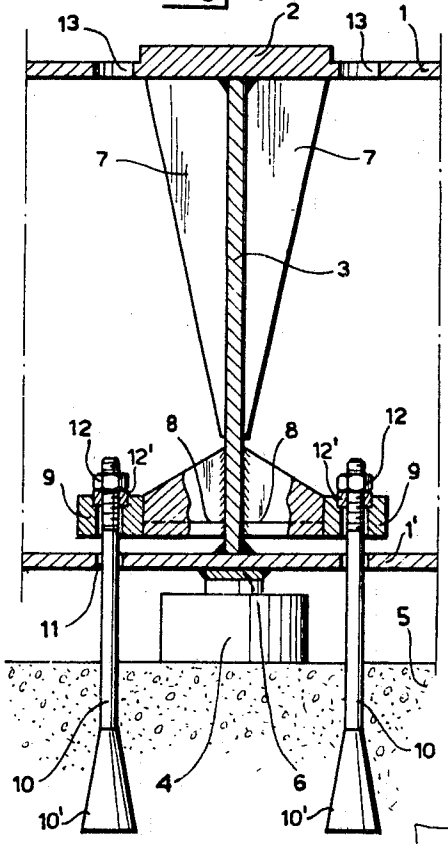


Fig. 2

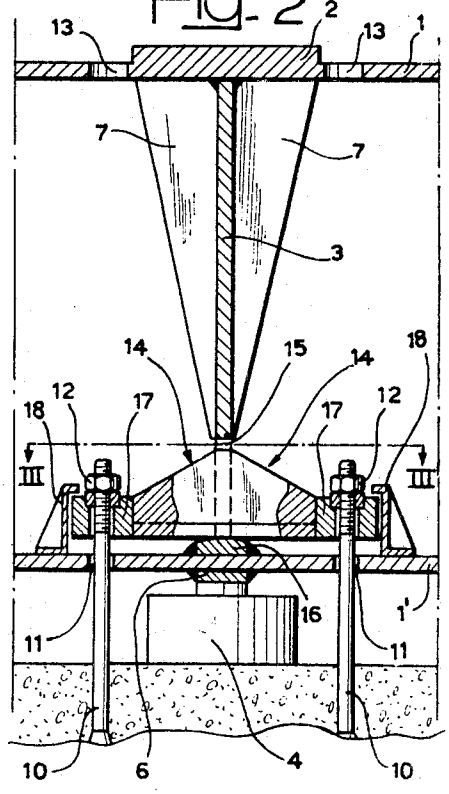
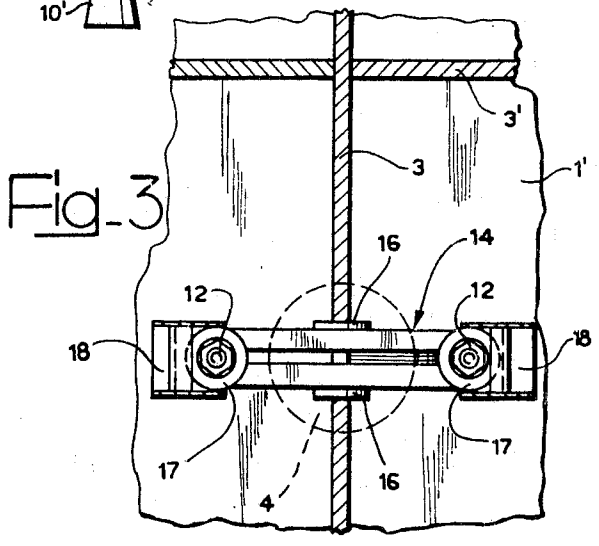


Fig. 3

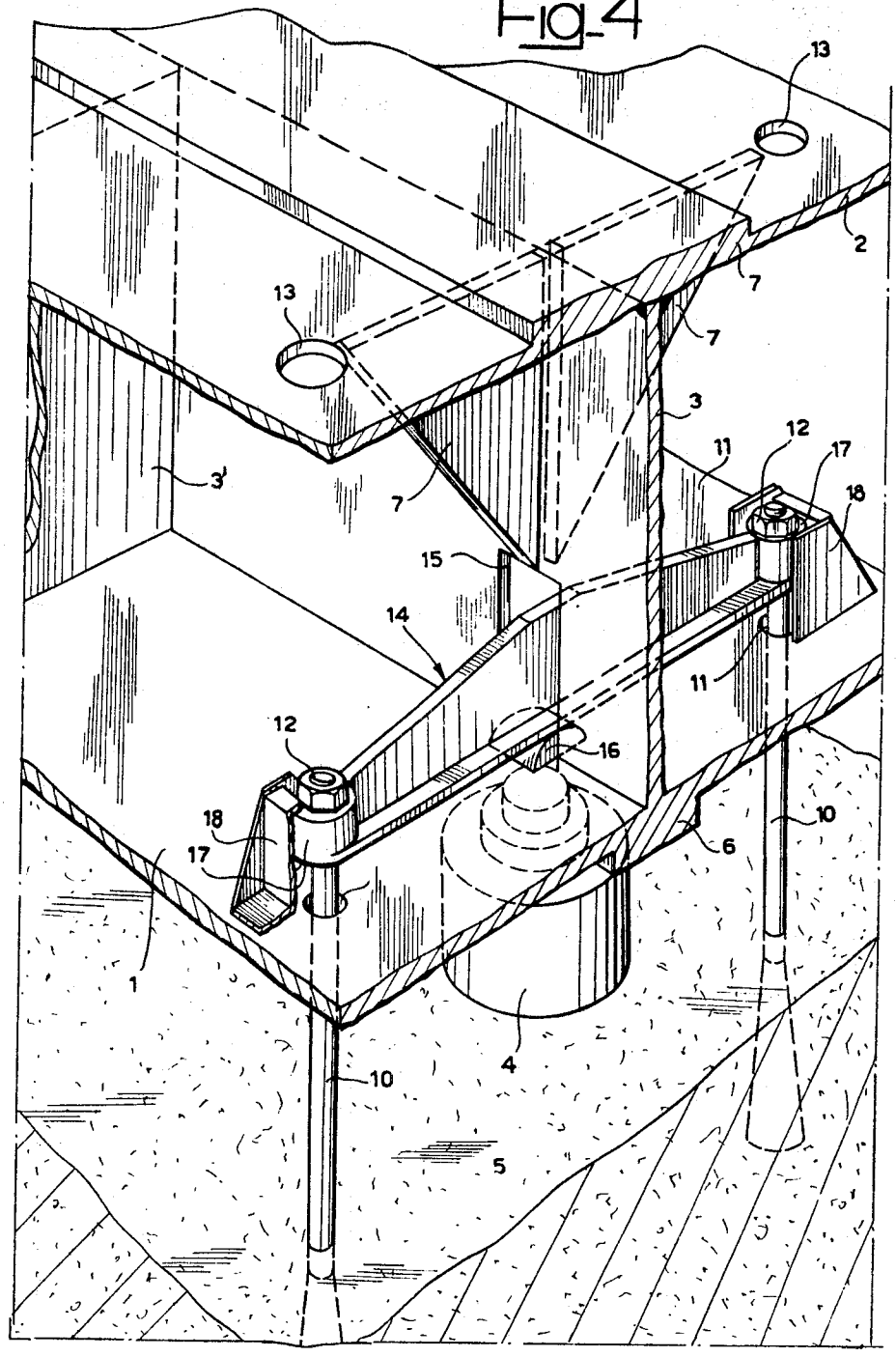


May 19, 1970 M. GALBARINI ET AL 3,512,738

PRESTRESSING OF SUPPORT MEMBERS FOR SLIDE BENCHES OF LARGE MACHINE TOOLS

Filed Feb. 19, 1968 2 Sheets-Sheet 2

Fig_4



United States Patent Office 3,512,738 Patented May 19, 1970

3,512,738

PRESTRESSING OF SUPPORT MEMBERS FOR SLIDE BENCHES OF LARGE MACHINE TOOLS

Maso Galbarini, Pavia, and Francesco Cotta Ramusino, Milan, Italy, assignors to Innocenti Societa Generale per l'Industria Metallurgica e Meccanica, Milan, Italy

Filed Feb. 19, 1968, Ser. No. 706,334
Claims priority, application Italy, Oct. 20, 1967, 53,436-A/67
Int. Cl. E02d 27/44; F16m 17/00
U.S. Cl. 248—25 3 Claims

ABSTRACT OF THE DISCLOSURE

A central support jack for a machine tool slide bench to which vertical loads are transmitted by a vertical web is preloaded by two vertical tie-rods disposed symmetrically on opposite sides of the web and engaging respective cross arms attached to or pivoted on the web.

The invention relates to preloading of support members for slide benches of large machine tools.

As is well known, slide benches of large machine tools usually rest on underlying foundations through support members which transmit loads to the foundations.

When a heavy carriage slides on guideways provided on the bench the guideways undergo a deflection which is due in part to compression strain on the bench, and in part to distortion of the foundation, but which is mainly due to deformation of the support members under the compressive load.

In order to reduce such deformation the support members should be preloaded. It is well known that, if the variation in load on the support member takes place from an initially low value near zero, the member is deformed by a much greater extent than if a similar variation were to take place starting from a high initial load.

Preload of the support members should be effected when the members are assembled in their final position either before or after final adjustment thereof.

Preloading of support members arranged at the sides of the bench may be effected easily by means of straps and screw-threaded tie-rods embedded in the foundation and arranged externally of the jack, or by means of tie-rods coaxial with the support members.

It is difficult, however, to preload centrally disposed support members spaced from the peripheral edges of the bench, especially since such support members are usually arranged vertically beneath one of the guides on the bench accurately aligned with a vertical web in order to receive the load directly without inducing bending of the bench structure. It is not practicable in this case to provide a tie-rod coaxial with the support member, as this would entail an interruption of the continuity of the vertical web, the effectiveness of which for stiffening the bench structure against bending would be adversely affected.

An object of the present invention is to obviate the above drawbacks by providing means for simply and quickly preloading central support members for the benches of machine tools, without deforming the bench, boring guideways on the bench, or interrupting the continuity of vertical supporting webs.

The main characteristic feature of the prestressing means according to the invention is that the said means comprise, in combination with a central support member to which vertical loads are transmitted directly through a vertical web, two tie-rods embedded in and extending vertically upwardly from an underlying foundation, said tie-rods being disposed symmetrically on opposite sides of the web and the upper ends of the tie-rods engaging respective cross arms extending outwardly with respect to opposite sides of the web and arranged to exert a downwardly directed preload centrally on the bench support member in response to pre-tensioning of the tie-rods.

Preferably respective nuts are screw-threaded on the upper ends of the tie-rods, and pretensioning of the latter is effected by screwing down of the respective nuts to exert a downward force on the respective cross arm.

Further characteristic features and advantages of the invention will be understood from the following description, given by way of example only, with reference to the accompanying drawings, in which:

FIG. 1 is a vertical cross sectional view of a slide bench of a large machine tool, provided with means for preloading a central support member according to one embodiment of the invention;

FIG. 2 is across sectional view similar to that of FIG. 1 showing another embodiment of the invention;

FIG. 3 is a longitudinal horizontal sectional view on line III—III of FIG. 2; and

FIG. 4 is a partly broken-away perspective view of the embodiment shown in FIGS. 2 and 3.

The same reference numerals are used in the drawings to indicate like parts.

In the drawings, reference numerals **1**, **1'** denote upper and lower horizontal plates respectively of a slide bench for a large-sized machine tool. The upper plate **1** carries a plurality of parallel guideways **2**, one only of which is shown, and is connected with the lower plate **1'** by a vertical web **3** extending longitudinally beneath the centre-line of the guideway **2**, and by transversely extending vertical cross webs **3'**. Pairs of gussets **7** interconnect opposite faces of the web **3** with the upper plate **1** to stiffen the web **3** against bending.

Support members in the form of levelling jacks **4** are arranged vertically beneath the guideway **2** and are accurately aligned with the web **3** in order to receive the vertical load directly without causing bending of the bench structure. In the drawings only one jack **4**, in the central region of the bench, is shown.

A longitudinal ridge **6** is provided beneath the lower plate **1'** and rests on the upper end of the levelling jack **4**. The latter bears in turn on a concrete foundation **5**.

Two tie-rods **10** are embedded in the foundation **5** and extend vertically upwardly, being disposed symmetrically on opposite sides of the web **3**. The lower ends of the tie-rods **10** have frusto-conical foot portions **10'** which are embedded in the foundation **5** and which increase in cross section vertically downwardly. The upper ends of the tie-rods **10** are screw-threaded and extend with clearance through holes **11** in the lower plate **1'**.

In the embodiment of FIG. 1 the web **3** has two cross arms **8** welded to and extending symmetrically outwardly from its opposite faces. The cross arms **8** carry at their ends eye-shaped portions **9** through which the screw-threaded upper ends of the respective tie-rods **10** pass. Respective nuts **12** are screwed on the screw-threaded ends of the tie-rods **10** and engage through respective washers **12'** the upper surfaces of the respective eye-shaped end portions **9** of the cross arms **8**. The nuts **12** can be adjusted from the outside through access apertures **13** provided in the upper plate **1** on each side of the guideway **2**.

The tie-rods **10** are pretensioned, by adjustment of the nuts **12**, to the same extent, so that they exert preload on the jack **4** without deforming the bench structure.

Equality of the pretensioning of the tie-rods **10** may be achieved by using a level placed on the guideway **2** and extending laterally during adjustment of the nuts **12**. Inequality of the tensions in the rods **10** will cause a departure of the guideway **2** from the horizontal, which will be indicated by the level.

In the embodiment shown in FIGS. 2, 3 and 4 the two tie-rods **10** act on respective cross arms which are integral parts of a common yoke member **14**. The yoke member **14** has eye-shaped ends **17** engageable by the respective tie-rods **10** through respective nuts **12** in the same manner as in the embodiment of FIG. 1. The yoke member **14**, which is fully independent of the bench structure, extends through an aperture **15** in the vertical web **3** and exerts a downward force resulting from pretensioning of the tie-rods **10** on a bearing block **16** secured to the lower plate **1'** of the bench in the aperture **15**. The block **16** has an upper surface which is convexly curved in a plane perpendicular to the plane of the web **3**.

Flanged retaining members **18** are secured to the lower plate **1'** in juxtaposition to the opposite ends of the yoke member **14** to check rocking movement thereof in a vertical plane, and to retain the yoke member **14** in the absence of the nuts **12**.

In the embodiment of FIGS. 2 to 4, deformation of the bench by an unbalanced tension in the tie-rods **10** is avoided, since the yoke member **14** is capable of limited rocking movement in response to such unbalanced tensions.

It will be appreciated that the arrangements herein described permit preloading of levelling packs **4** at central positions without interrupting the continuity of the guideways **2** or of the vertical webs **3**, and without causing deformation of the slide bench.

It will be understood that constructional details of the invention may be widely varied with respect to those specifically described without departing from the scope of the invention.

We claim:

1. In a slide bench of a machine tool including an adjustable pack, the elements of said jack forming a central support member for the slide bench, a foundation on which said jack rests, and a vertical web through which vertical loads are transmitted to said jack, the improvement comprising: prestressing means for preloading the support member, said prestressing means comprising two tie-rods embedded in and extending vertically upwardly from the foundation, said tie-rods being secured to and disposed symmetrically on opposite sides of the web, respective cross arms extending outwardly with respect to opposite sides of the web and engaged by the upper ends of the respective tie-rods, and means pretensioning the tie-rods to cause the cross arms to exert a pre-load directly on said jack.

2. In a slide bench of a machine tool including a central support member for the slide bench in the form of an adjustable jack, a foundation on which the support member rests, and a vertical web through which vertical loads are transmitted to the support member, the improvement which comprises prestressing means for preloading the support member, said prestressing means comprising two tie-rods embedded in and extending vertically upwardly from the foundation, said tie-rods being disposed symmetrically on opposite sides of the web, respective cross arms extending outwardly with respect to opposite sides of the web and engaged by the upper ends of the respective tie-rods, and means for pretensioning the tie-rods, said pretensioning means comprising nuts screw-threaded on the upper ends of the tie-rods, pretensioning of said tie-rods being effected by screwing down of the respective nuts through access apertures on the upper surface of the slide bench to thereby exert a downwardly directed preload centrally on the bench support member.

3. In a slide bench of a machine tool including a central support member for the slide bench, a foundation on which the support member rests, and a vertical web through which vertical loads are transmitted to the support member, the improvement which comprises prestressing means for preloading the support member, said prestressing means comprising two tie-rods embedded in and extending vertically upwardly from the foundation, said tie-rods being disposed symmetrically on opposite sides of the web, a yoke member, respective cross arms being integral parts of the yoke member and extending outwardly with respect to opposite sides of the web and engaged by the upper ends of the respective- tie-rods, means defining an aperture in the vertical web above the support member through which aperture the yoke member passes, retaining members fixed to the machine tool slide bench and arranged in juxtaposition to opposite ends of the yoke member to check rocking movement thereof in a vertical plane, and means pretensioning the tie-rods to cause the cross arms to exert a downwardly directed preload centrally on the bench support member.

References Cited

UNITED STATES PATENTS

1,973,427	9/1934	Brock	52—295
2,881,876	4/1959	Williams	52—295 X
3,289,369	12/1966	Marcus	52—295

FOREIGN PATENTS

244,695	10/1962	Australia.

ROY D. FRAZIER, Primary Examiner

J. F. FOSS, Assistant Examiner

U.S. Cl. X.R.

52—295; 248—23; 248—361