United States Patent

[11] 3,604,700

[72] Inventor **Robert Gault**
Sheffield, England

[21] Appl. No. **831,387**
[22] Filed **June 9, 1969**
[45] Patented **Sept. 14, 1971**
[73] Assignee **R. Gault Developments Limited**

[54] **WORK-SUPPORTING DEVICES**
17 Claims, 13 Drawing Figs.

[52] **U.S. Cl.** **269/288,** 269/266
[51] **Int. Cl.** **B23q 3/02**
[50] **Field of Search** ..... 269/287, 266, 265, 288, 107, 108, 130, 131; 24/11 CT, 155 SD

[56] **References Cited**

UNITED STATES PATENTS

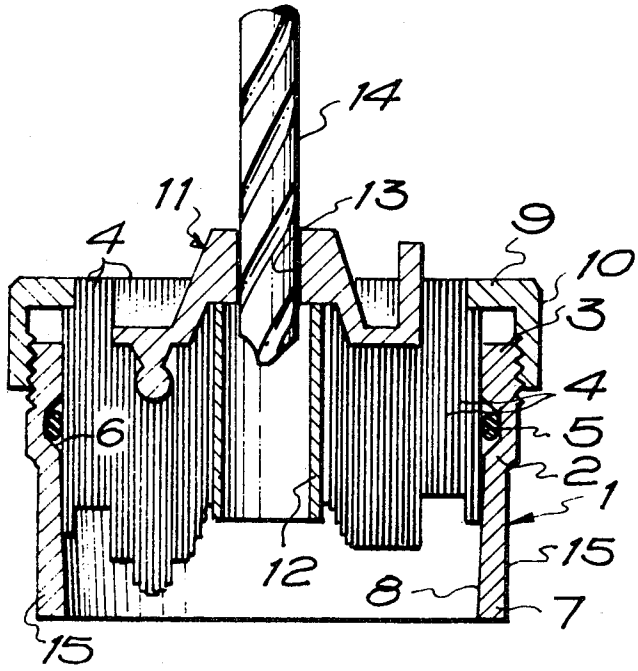
952,890	3/1910	Edlavitch	24/155

FOREIGN PATENTS

28,997	1909	Great Britain	24/155 SD
76,279	1919	Austria	269/266
617,720	1961	Canada	269/266

Primary Examiner—Andrew R. Juhasz
Assistant Examiner—Donald D. Evenson
Attorney—Lowe and King

ABSTRACT: An engineering device which may serve as a work-holding device or as a work-machining tool comprises an enclosure open at one end at least packed with a multiplicity of rodlike elements, enabled to grip a workpiece pushed into the mass of elements, by a wedging action provided by a taper in the enclosure itself or by adjustable inner walls or by small balls within a space between a closed end of the enclosure and the inner ends of the elements and also extending round the sides of the mass of elements, two such devices being capable of incorporation in the jaws of a vice with the rodlike elements in the two jaws extending towards each other, or enabled to provide a multiplicity of teeth conforming to a profile or contour of a workpiece by pressing the protruding ends of the mass of elements against the workpiece with the elements inclined to the surface of the workpieces, the elements being held in such positions by small balls within a space between the inner ends of the elements and a closed end of the enclosure.



PATENTED SEP 1 4 1971

3,604,700

SHEET 1 OF 4

FIG. 1

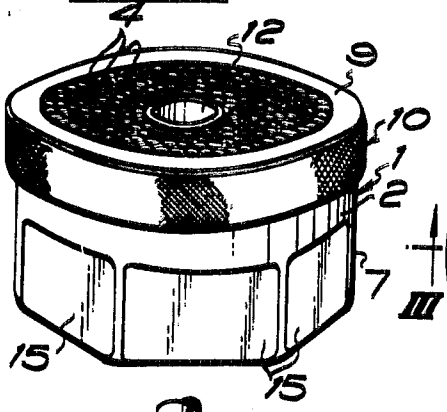
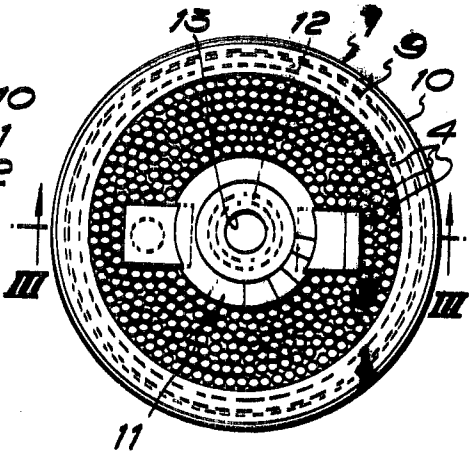


FIG. 2



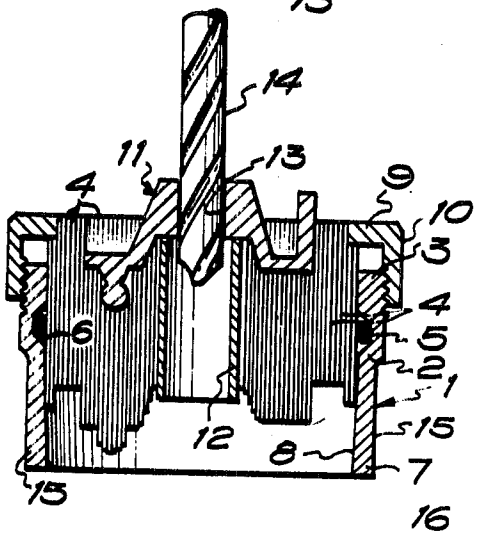
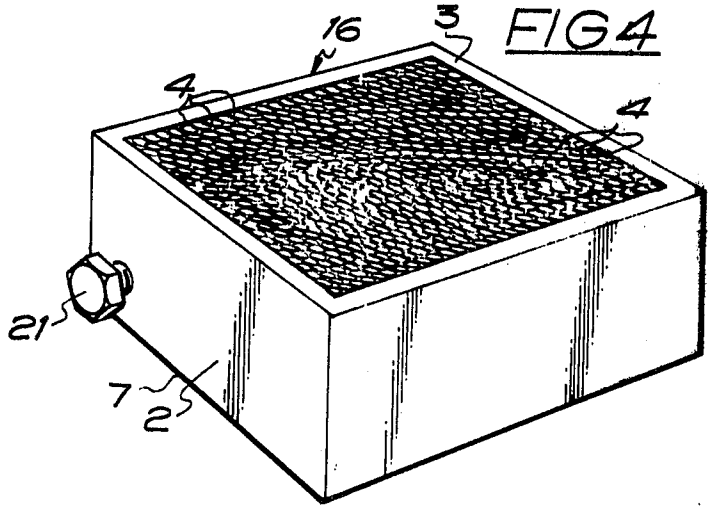


FIG. 3

FIG. 4



INVENTOR
ROBERT GAULT
BY Lowe & King

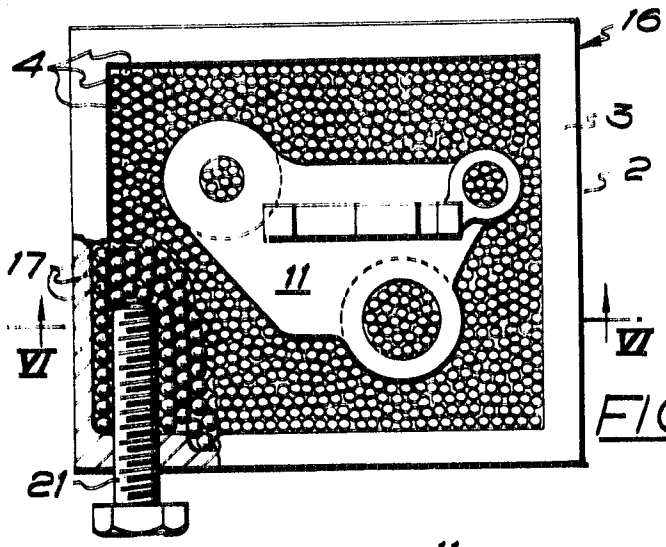


FIG 5

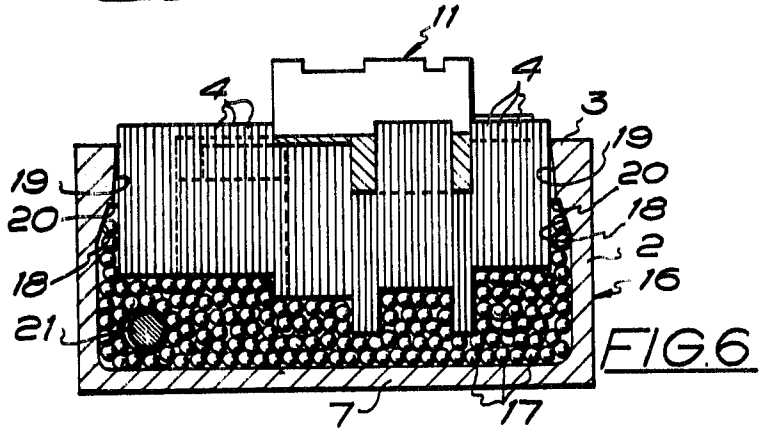


FIG 6

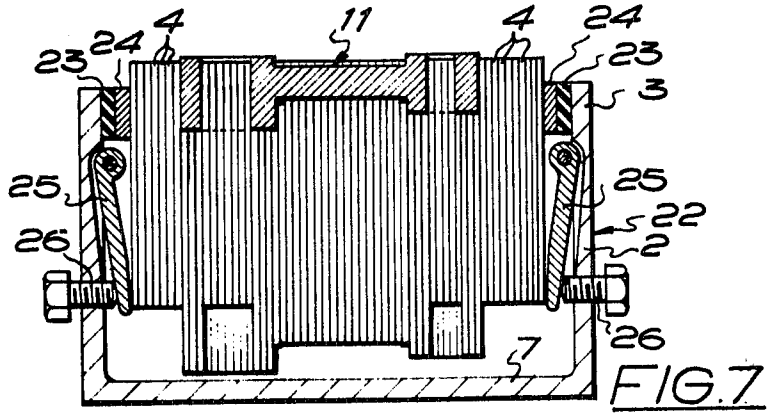


FIG 7

INVENTOR
ROBERT GAULT
BY Lowe & King

FIG. 8

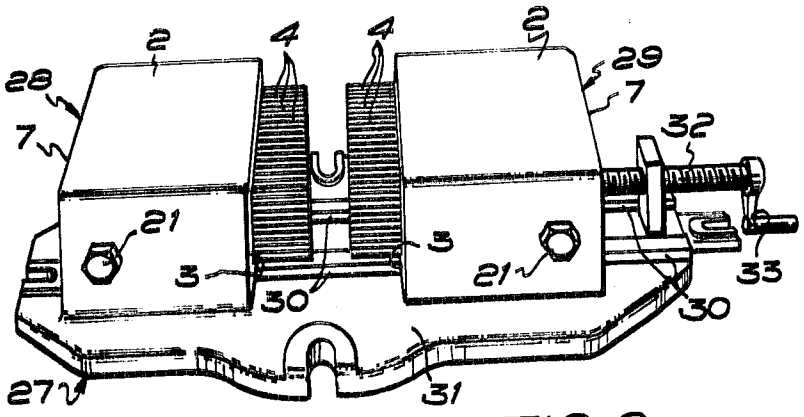
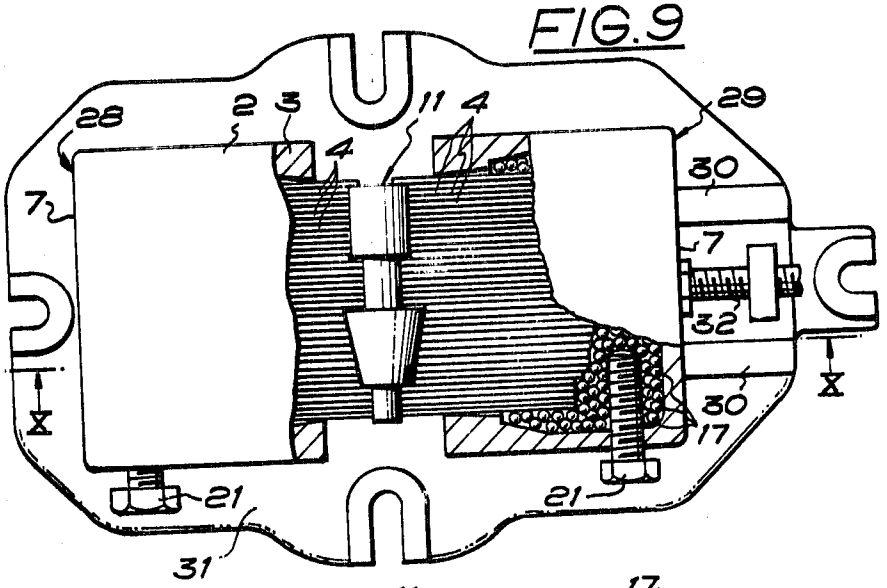


FIG. 9



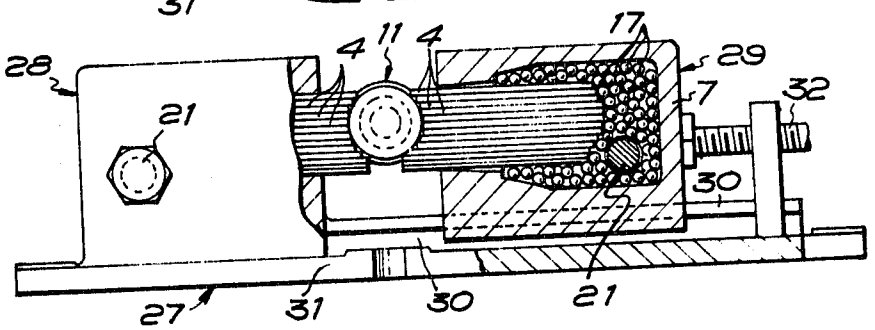


FIG 10

INVENTOR
ROBERT GAULT
BY Lowe & King

FIG 11

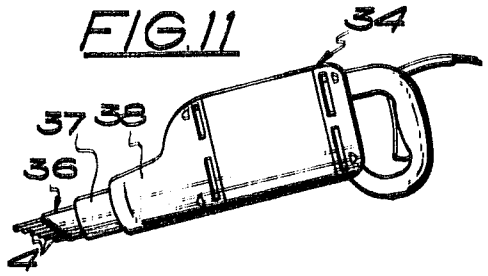


FIG 12

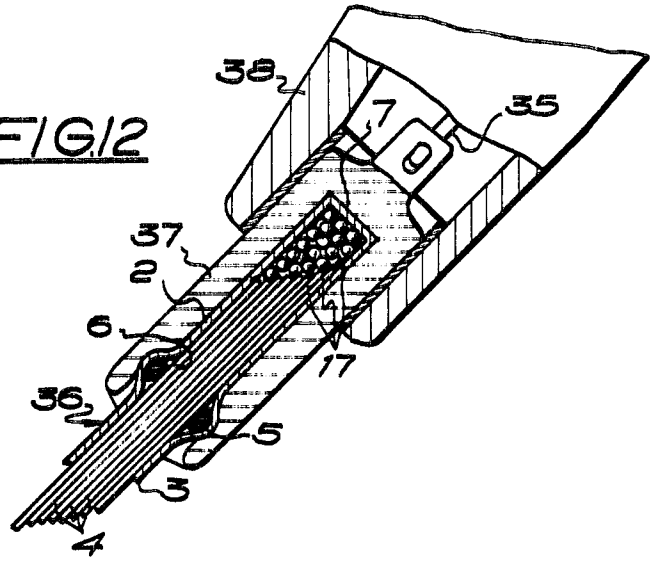
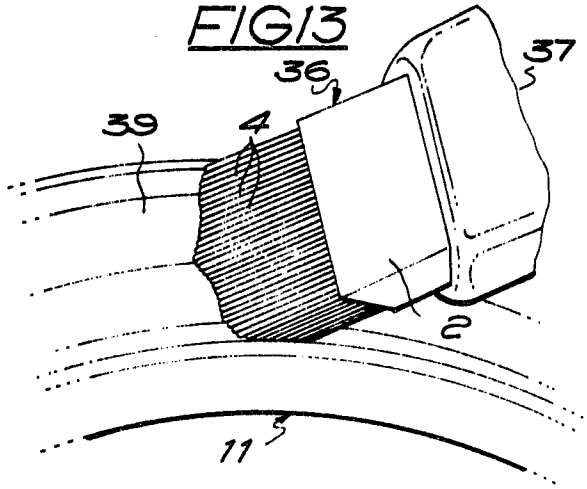


FIG 13



INVENTOR
ROBERT GAULT
BY Lowe & King

WORK-SUPPORTING DEVICES

This invention relates to engineering devices, more particularly for holding small or irregularly shaped workpieces, but also applicable to the machining of workpieces.

According to the present invention, an engineering device comprises an enclosure open at one end at least and with its cross section at that end packed with a multiplicity of rodlike elements having a length enabling any of them to protrude appreciable from the enclosure, together with means for urging the elements together in consequence of movement of some of the elements inwards relative to the enclosure. The rodlike elements may be rods or tubes or wires, and preferably hard drawn wires of small diameter, say 1½ mm., and individually substantially rigid or only slightly resiliently flexible, so that the elements together can simulate a contour and/or profile by small increments.

In the primary application of the invention to a work-holding device, a workpiece pressed into contact with the protruding ends of the elements moves all the contacts elements into the enclosure, while the remainder of the elements surround the workpiece and prevent its lateral movement with respect to the device, the means for urging the elements together being brought into play so as to grip the workpiece through the imperceptible sideways movement of those elements surrounding the workpiece.

In the secondary application of the invention to a work-machining device, some or all of the elements are displaced by pressing the protruding ends against a workpiece with the elements inclined to the surface of the workpiece, the means for urging the elements together being brought into play so as to hold the elements in their set positions for the protruding ends of the elements to act as the teeth of a rasp, file or scraper.

To prevent the rodlike elements from falling out a resilient band may be provided round the inside of the enclosure, housed in a recess round the inside of the wall of the enclosure or stuck round the inside of the end of the enclosure from which the elements protrude.

The means for urging the elements together in consequence of movement of some of the elements inwards relative to the enclosure may take various forms, depending on the purpose for which the device is intended and the amount of grip required on a workpiece.

Thus, the enclosure may be tubular and provided towards its other end with a slight inward taper against which the outermost elements can be urged by an inwardly flanged ring or cap screwing on to the end from which the elements protrude, the outside of the ring preferably being knurled. The tapered end may be an open end, through which the elements are accessible for pushing free from the taper to restore them to their initial position, but in general restoration of the elements to their initial positions can be effected by banging the device inverted on to a suitable surface, e.g., a workbench. A rubber O-ring is preferably provided in a groove round the inside of the tubular enclosure to prevent the elements from falling out of either end, and the outside of the enclosure is preferably provided with at least one pair of opposed flats, to enable the device to be gripped in a vise. A tube may be inclined in the mass of elements, to permit drilling through a workpiece appropriately located in the device.

Alternatively, the enclosure may be rectangular and be provided with at least one inner wall (but preferably at least two) pivoted close to and parallel to the corresponding side of the open end of the enclosure, with a screw through the outer wall of the enclosure for adjustment of the angle of inclination of the inner wall to the rodlike elements, to set the amount of grip afforded by the device on a workpiece pushed into the mass of elements. The other end of the enclosure may be open or closed.

Again, the enclosure may be circular, rectangular or any other shape, with its other end (i.e., remote from the end from which the rodlike elements protrude) closed, and a space between that closed end and the inner ends of the elements and also extending round the sides of the mass of elements appreciably filled with small balls (e.g., shot, preferably of a diameter about 1½ times the diameter of the rodlike elements so that as some of the elements are forced inwards by a workpiece the displaced balls force other balls round the sides of the mass of elements and/or into more pressing contact with the outermost elements to create the grip on the workpiece. The inside of the wall of the enclosure preferably converges upwardly over at least an upper part of its height (say 10° each side) so as to provide a wedging effect of the balls round the sides of the mass of elements. The inside of the open end of the enclosure may have a slight taper (say 2° each side) so that the outermost elements contact the sides of the open end right at the rim of the enclosure, but an inward step of less than the diameter of the balls is preferably provided between the converging inside of the wall of the enclosure and the tapered inside of the open end to prevent any balls being trapped in the open end of the enclosure. A screw may protrude through the wall of the enclosure, into the space filled with balls, to permit further displacement of balls for adjustment of the grip on a workpiece or to enable the load to be taken off the balls for release of a workpiece.

Because the balls fill the space completely when a workpiece is being gripped, the balls become in effect a solid backing for the rodlike elements, and therefore, for the workpiece itself, and two such devices may be incorporated in the jaws of a vise with their rodlike elements extending towards each other, for exceptionally firm gripping of a workpiece of irregular shape not suited to gripping in an ordinary vise with uniformly profile jaws.

Five embodiments of the invention will now be described, by way of example only, with reference to the accompanying drawings, in which

FIG. 1 is a perspective view of a small circular work-holding device;

FIG. 2 is a plan of FIG. 1 with a workpiece held in the device;

FIG. 3 is a section on the line III—III of FIG. 2;

FIG. 4 is a perspective view of a larger rectangular work-holding device;

FIG. 5 is a plan of FIG. 4 with a workpiece held in the device;

FIG. 6 is a section on the line VI—VI of FIG. 5;

FIG. 7 corresponds to FIG. 6 but is a section through another embodiment of rectangular work-holding device;

FIG. 8 is a perspective view of a vise in accordance with the invention;

FIG. 9 is a plan of FIG. 8 partly in section and with a workpiece shown held in the vise;

FIG. 10 is a part sectional side elevation of the vise, the section being on the line X—X of FIG. 9;

FIG. 11 is an elevation of a power scraper incorporating another embodiment of the invention;

FIG. 12 is a fragmentary longitudinal section of the operative end of the power scraper of FIG. 11, and

FIG. 13 is a fragmentary perspective view showing the embodiment of FIGS. 11 and 12 in action.

In FIGS. 1 to 3 a work-holding device 1 comprises a tubular enclosure 2 with one (upper) end 3 packed with a multiplicity of rodlike elements 4 having a length enabling any of them to protrude appreciably from the enclosure, the elements being prevented from falling out by a rubber O-ring 5 housed in a groove 6 round the inside of the enclosure. The other end 7 of the enclosure 2 is provided with a slight inward taper 8 against which the outermost elements can be urged by an inwardly flanged ring or cap 9 screwing on to the end 3 of the enclosure, the outside 10 of the cap being knurled to afford a good grip.

With the outermost elements urged against the taper 8, as shown in FIG. 3, a workpiece 11, pressed into contact with the ends of some of the elements protruding from the end 3 of the enclosure 2 so as to make them recede below other of said elements is gripped through the imperceptible sideways or lateral movement of said other elements surrounding the workpiece.

A tube 12 is included in the mass of elements, to permit a hole 13 to be bored through the workpiece by a drill 14, as is also shown in FIG. 3.

The elements 4 can be pushed free from the taper, to release the workpiece 11 and to restore the elements to their initial position, but restoration of the elements to their initial position can be effected by banging the device 1 inverted on to a suitable surface, e.g., a workbench, after the workpiece has been pulled out.

The outside of the enclosure is provided with pairs of opposed flats 15, formed by the faces of a hexagon, to enable the device 1 to be gripped in a vise.

In FIGS. 4 to 6 a work-holding device 16 comprises a rectangular enclosure 2 with one (upper) end 3 open and packed with a multiplicity or rodlike elements 4, the other (lower) end 7 being closed, and a space between that closed end and the inner ends of the elements and also extending round the sides of the mass of elements is appreciably filled with small balls 17, so that as some of the elements 4 are forced inwards by a workpiece 11 pressed into the protruding ends of the elements the displaced balls force other balls round the sides of the mass of elements and/or into more pressing contact with the outermost elements to create a grip on the workpiece.

The inside of the wall of the enclosure converges upwardly at 18 each side at an angle of 10° each side, so as to provide a wedging effect of the balls 17 round the sides of the mass of elements. The inside 19 of the open end 3 of the enclosure has a taper of 2° each side, so that the outermost elements contact the sides of the open end right at the rim of the enclosure, but an inward stop 20 between the converging inside 18 of the enclosure and the tapered inside 19 of the open end prevents any balls being trapped in the open end of the enclosure.

A screw 21 protrudes through the wall of the enclosure 2, to permit further displacement of balls 17 for adjustment of of the grip on the workpiece 11 or to enable the load to be taken off the balls for release of the workpiece.

Because the balls 17 fill the space completely when a workpiece is being gripped, the balls become in effect a solid backing for the rodlike elements, and therefore, for the workpiece itself.

In FIG. 7 a work-holding device 22 has a rectangular enclosure 2 with an open upper end 3 and closed lower end 7, and a multiplicity of rodlike elements 4 prevented from falling out (if the device should be inverted) by a resilient band 23 round the inside of the open end provided with a hard facing 24. Inner walls 25 are pivoted close to and parallel to the corresponding sides of the open end 3, and screws 26 through the outer walls of the enclosure 2 enable the angles of inclination of the inner walls to the rodlike elements 4 to be adjusted, to set the amount of grip afforded by the device on a workpiece 11 pushed into the mass of elements.

In FIGS. 8 to 10 a vise 27 has a fixed jaw 28 and a movable jaw 29 slidable along guides 30 on a base 31 under the control of a screw 32 rotatable by a handcrank 33, and each jaw 28, 29 comprises a device similar in principle to that of FIGS. 4 to 6, like reference numerals denoting like parts, with the rodlike elements of the jaws extending towards each other so as to be able to grip, exceptionally firmly, an irregularly shaped workpiece 11 not suited to gripping in an ordinary vise with uniformly profiled jaws.

In FIGS. 11 to 13 a power scraper 34 has its reciprocatory connecting rod 35 engaged with a device 36 according to the invention comprising a sheet metal enclosure 2 with an inclined open end 3 packed with a multiplicity of rodlike elements 4, which are prevented from falling out by a rubber band 5 in a groove 6 formed by a bulge in the wall of the enclosure. The other end 7 of the enclosure is closed, and the bulge for the groove 6 enables the device to be retained in a carrier 37 reciprocable in the nose 38 of the scraper 34 by means of the rod 35. A space between the inner ends of the elements 4 and the closed end 7 of the enclosure is filled with small balls 17. The protruding ends of the elements are pressed against a workpiece 11 with the elements inclined to the surface 39 of the workpiece, for some or all of the elements to be displaced so that the protruding ends act as the teeth of a rasp, file or scraper conforming to the profile of the surface of the workpiece. Those balls 17 that are displaced by the inner ends of the elements 4 bear on the sides of the inner ends of the elements to hold the elements in their set positions, but firm endwise pressure on the leading protruding ends is sufficient to loosen the balls and free the elements when a change in profile is to be accommodated.

What I claim is:

1. A work-holding device comprising an enclosure which is open at least at one end, a multiplicity of rodlike elements packed in said enclosure, said rodlike elements being individually movable lengthwise having a length enabling any of them to protrude from and thereby be exposed at said one open end, said elements further having a length enabling at least some of them to recede below other of said elements, and means provided within said enclosure for laterally urging said rodlike elements together in consequence of movement of some of said rodlike elements inwards relative to said enclosure, whereby a workpiece pressed into the mass of exposed ends of some of said rodlike elements is gripped by the other and surrounding rodlike elements being urged towards said workpiece.

2. A work-holding device as in claim 1 wherein the rodlike elements are hard-drawn wires.

3. A work-holding device as in claim 1, wherein a resilient band is provided around the inside of the enclosure to prevent the rodlike elements from falling out.

4. A work-holding device as in claim 3, wherein the resilient band is housed in a recess round the inside of the enclosure.

5. A work-holding device as in claim 3, wherein the resilient band is stuck around the inside of the end of the enclosure from which the elements protrude.

6. A work-holding device comprising

a tubular enclosure open at least at one end,

a multiplicity of rodlike elements packed into said one end of the enclosure and individually movable lengthwise and having a length enabling any of them to protrude appreciably from the enclosure,

the other end of the enclosure being provided with a slight inward taper,

said elements further having a length enabling at least some of them to recede below other of said elements,

a ring screwing on to the end of the enclosure from which the elements protrude,

and an inwardly projecting flange on the ring for urging the outermost elements against the taper when the ring is screwed further on to the enclosure, to enable a workpiece embedded at least partially into the mass of some of said rodlike elements to be gripped by the other elements surrounding it.

7. A work-holding device as in claim 6, wherein the outside of the ring is knurled.

8. A work-holding device as in claim 6, wherein the tapered end of the enclosure is an open end.

9. A work-holding device as in claim 6, wherein the outside of the enclosure is provided with at least one pair of opposed flats.

10. A work-holding device as in claim 6, wherein a tube is included in the mass of elements.

11. A work-holding device comprising

a rectangular enclosure open at one end at least,

a multiplicity of rodlike elements packed into the open end of the enclosure and individually movable lengthwise and having a length enabling any of them to protrude appreciably from the enclosure,

said elements further having a length enabling at least some of them to recede below other of said elements,

at least one inner wall pivoted close to and parallel to the corresponding side of the open end of the enclosure,

and a screw through the outer wall of the enclosure for adjustment of the angle of inclination of the inner wall with

respect to the rodlike elements, to enable a workpiece embedded at least partially into the mass of some of said rodlike elements to be gripped by the other elements surrounding it.

12. A work-holding device as in claim 11, wherein two inner walls and two screws are provided.

13. A work-holding device as in claim 11, wherein the end of the enclosure remote from the end through which the rodlike elements protrude is a closed end.

14. A work-holding device comprising

an enclosure with one open end and one closed end,

a multiplicity of rodlike elements packed into the open end of the enclosure and individually movable lengthwise and having a length enabling any of them to protrude appreciably from the enclosure,

said elements further having a length enabling at least some of them to recede below other of said elements,

and a multiplicity of small balls filling a space between the closed end of the enclosure and the inner ends of the elements and also extending around the sides of the mass of elements, means for forcing said balls around said sides to enable a workpiece embedded at least partially into the mass of some of said rodlike elements to be gripped by the other elements surrounding it, said elements being forced laterally towards each other by the balls forced around the sides of the the mass of elements.

15. A work-holding device as in claim 14, wherein the inside of the wall of the enclosure converges upwardly over at least an upper part of its height.

16. A work-holding device as in claim 15, wherein the inside of the open end of the enclosure has a slight taper so that the outermost elements contact the sides of the open end right at the rim of the enclosure, and an inward step of less than the diameter of the balls is provided between the converging inside of the wall of the enclosure and the tapered inside of the open end.

17. A work-holding device as in claim 14, wherein said forcing means includes a screw protruding through the wall of the enclosure into the space filled with balls.