

March 22, 1949.

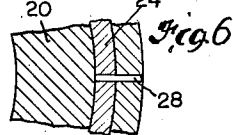
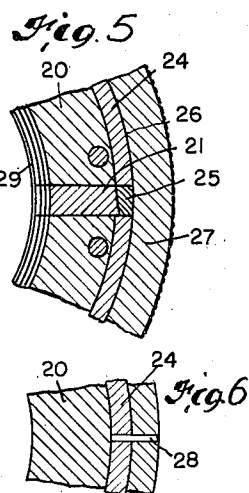
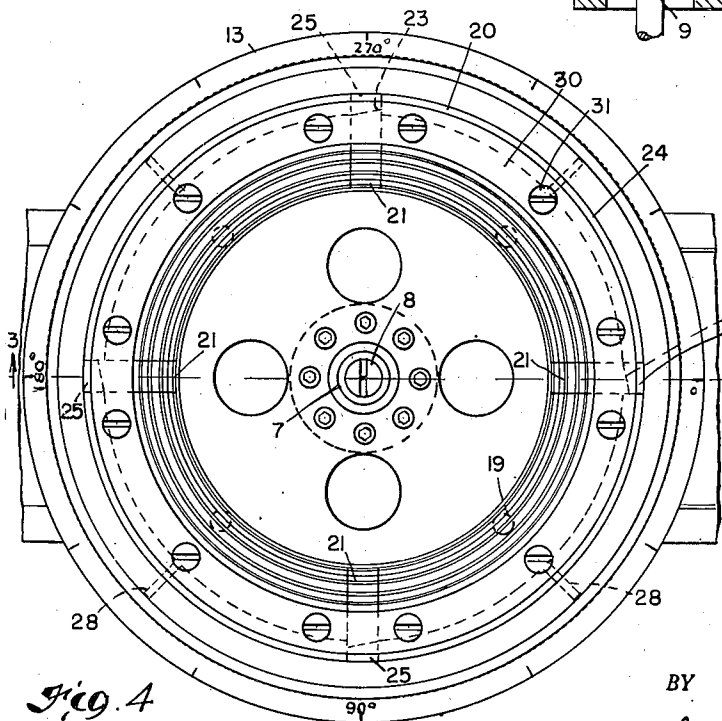
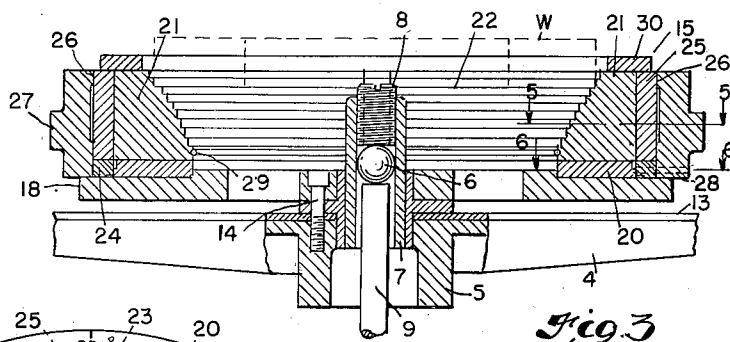
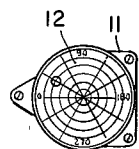
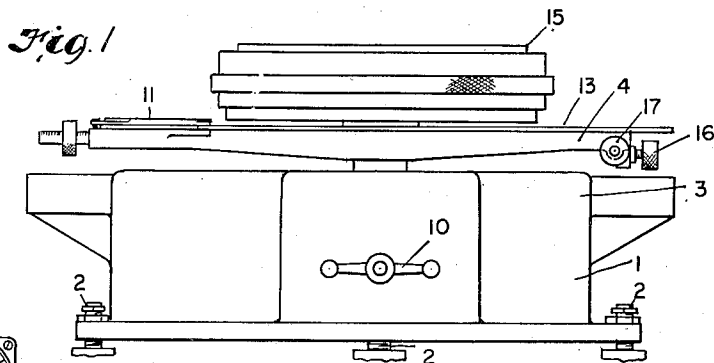
D. KELLEHER

2,464,871

BALANCING MACHINE CHUCK

Filed Feb. 27, 1946

2 Sheets-Sheet 1



INVENTOR.
DANIEL KELLEHER

BY

Oberlin & Limbach
ATTORNEYS

March 22, 1949.

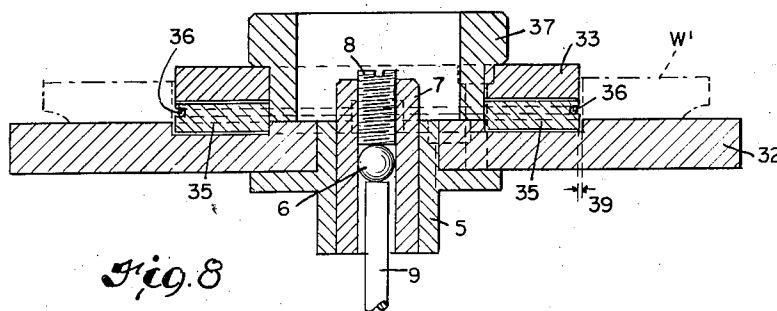
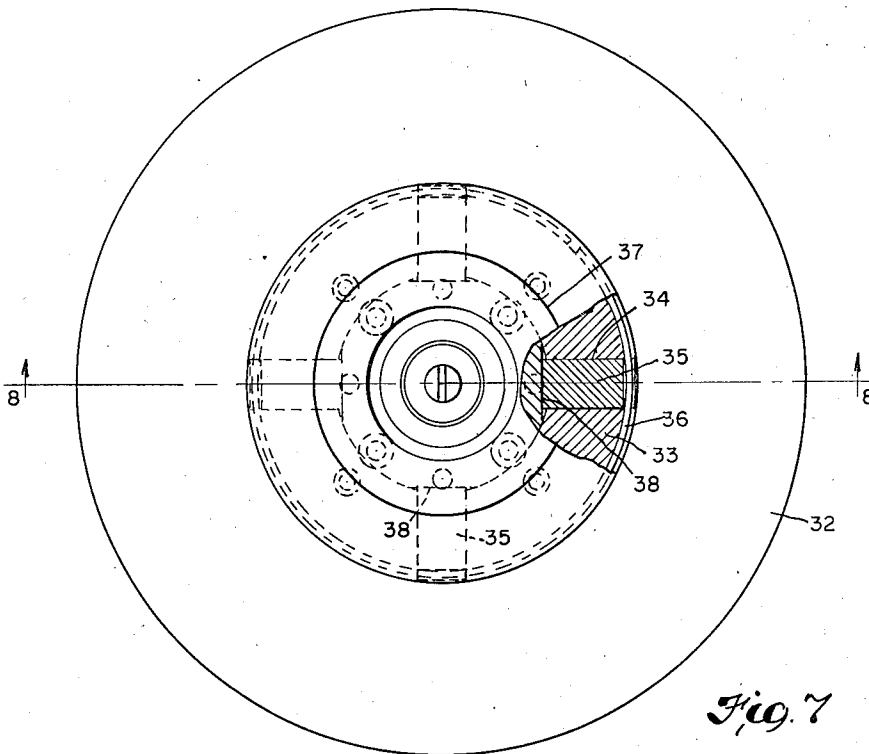
D. KELLEHER

2,464,871

BALANCING MACHINE CHUCK

Filed Feb. 27, 1946

2 Sheets-Sheet 2



INVENTOR.

DANIEL KELLEHER

BY

Oberlin & Limbach
ATTORNEYS

UNITED STATES PATENT OFFICE

2,464,871

BALANCING MACHINE CHUCK

Daniel Kelleher, Berea, Ohio, assignor to Ira Saks,
Shaker Heights, Ohio

Application February 27, 1946, Serial No. 650,433

4 Claims. (Cl. 279-71)

1

The present invention relates to improvements in a balancing machine and more particularly to improvements in the workpiece holding means thereof. This invention has for one of its principal objects the provision of workpiece holding means which assures accurate coaxial positioning of a particular surface of a workpiece with the tilt axis or fulcrum of the universally tiltable table of a balancing machine.

In balancing machines heretofore used, as for example those of the type disclosed in the John Leonard Taylor Patent No. 2,110,343, dated March 8, 1938, the accuracy with which a workpiece can be positioned relative to the fulcrum of the universally tiltable table thereof depends on the closeness of the fit between a spindle fixed to said table and a workpiece having a bore into which said spindle extends. Thus, it can be seen that for accurate balancing, such machines are limited to use with only such workpieces that have what might be termed a close sliding fit with the spindle or else a very large number of different sizes of the spindles will have to be stocked in order to accommodate workpieces having different sizes of bores therein.

Therefore, it is another object of this invention to obviate the above-mentioned difficulty by providing a single holding means which can be effectively used with a wide range of different sizes of workpieces.

Another object of this invention is the provision of workpiece holding means which in addition to being usable with different sizes of workpieces is operative to actually clamp or hold the workpiece therein with one of its surfaces bearing fixed relation to the fulcrum of the table of the balancing machine.

Other objects and advantages of the invention will become apparent as the following description proceeds.

To the accomplishment of the foregoing and related ends, said invention then comprises the features hereinafter fully described and particularly pointed out in the claims, the following description and the annexed drawings setting forth in detail certain illustrative embodiments of the invention, these being indicative, however, of but a few of the various ways in which the principle of the invention may be employed.

In the drawings:

Fig. 1 is a front elevation view of a balancing machine with the beam portion thereof in raised balance indicating position;

Fig. 2 is a plan view of the universal bubble level which is attached to the beam;

2

Fig. 3 is a vertical cross section of the workpiece holding means with the workpiece shown dotted therein and showing in addition the fulcrum of the beam and a portion of the beam;

Fig. 4 is a plan view of the workpiece holding means as viewed from the top of Fig. 3;

Figs. 5 and 6 are fragmentary, horizontal sectional views of the workpiece holding means taken along lines 5-5 and 6-6 respectively of Fig. 3;

Fig. 7 is a plan view partly in horizontal section of a modified form of workpiece holding means; and

Fig. 8 is a vertical cross section view of the modified form of workpiece holding means of Fig. 7 taken along line 8-8 of Fig. 7.

Inasmuch as the specific internal mechanism of the balancing machine is preferably similar to that shown in the above mentioned Taylor Patent No. 2,110,343 and forms no part of the present invention, such machine has not been shown in cross section in the accompanying drawings. However, to fully comprehend the present invention, such machine will now be briefly described with reference to the parts thereof shown in the drawings.

The balancing machine comprises a base portion 1 which may be adjusted to a level position on a bench or table or the like by manipulation of the screws 2 therein. The upper end of the base 1 is provided with a guideway 3 into which a beam 4 may be lowered when the machine is not in use to relieve any load on the fulcrum about which the beam can freely tilt when in a raised position out of engagement with the guideway 3.

The beam 4 is provided with a hub 5 which engages in a recess in the base 1 to hold the beam from displacement relative to the fulcrum when the beam is in its lowermost position. The fulcrum in one of its simple forms is shown in Fig. 3 and comprises a ball 6 closely but slidably fitted in a bore of a sleeve member 7 secured relative to the beam. An adjustable abutment screw 8 is threaded into sleeve 7 and the end face thereof serves as an abutment for the ball 6. A vertical lifting rod 9 is engageable with the ball 6 and through the ball 6 the beam can be raised to the operative position shown in Fig. 1. There is a sizable clearance space between rod 9 and sleeve 7 so that when the beam is in a raised position, it can freely partake of universal tilting means relative to the base 1 and rod 9. The engagement of the ball 6 with the end of rod 9, in point contact the ball 6 being rollable thereon by tilting of the beam, assures substantially frictionless tilting of

the beam so that extremely small amounts of unbalance in the beam and the workpiece carried thereby can be detected. The rod 9 can be raised or lowered by rotation of a ball crank handle 10 connected thereto as by bevel gear or the like, not shown.

Attached to the upper face of one end of the beam 4 is a universal level 11 which comprises a transparent convex face 12 under which a fluid and a trapped air bubble is confined. The face 12 is marked with a plurality of radial lines to indicate the vertical plane about which the beam has tilted and with a series of concentric circles to indicate the moment which produced such tilting. The former is marked in degrees and the latter is preferably marked in inch-ounces. A dial plate 13 is also attached to the upper surface of beam 4 and is provided with markings to indicate angles in degrees and, as will be noted by a comparison of Figs. 2 and 4, the markings in degrees are 180° out of phase from one another. The reason for this out of phase marking is that by so marking the level and the dial plate the angle reading of the bubble will correspond with the same reading on the dial plate to indicate along which radial line metal should be removed from the workpiece to put it into balance.

The workpiece holding means is generally designated 15 and it is secured to the beam as by screws 14 therethrough threaded into beam 4. When the rod 9 is moved upward to raise the beam 4, the beam can be adjusted to perfect level or balanced position by turning the screws 16 and 17 and when so adjusted, the air bubble in the universal level 11 will be at the origin of the radial lines and the concentric circular lines on the face 12. Now, if a workpiece W is placed into the workpiece holding means 15 and as a result thereof the beam tilts, the bubble in the level will shift, for example, to the position shown in Fig. 2, in which case metal along the 30° line of the workpiece, as indicated by the 30° line on the dial plate 13, can be removed to attain perfect balance of the workpiece. The amount of metal to be removed from the workpiece W is determined by the position of the bubble relative to the concentric circles on the face 12, each of which indicates for example the inch-ounces or the moment of the excess metal multiplied by its distance from the fulcrum of the beam.

If desired the balancing machine may include a calculator, such as disclosed in Leonard Patent No. 2,067,068 dated Jan. 5, 1937, in order to facilitate the determination of where to remove the metal from the workpiece and how much.

Now referring particularly to the present improvement in the workpiece holding means and first to the form shown in Figs. 1-6, there is shown therein a base plate 18 to which is secured, as by bolts 19, a locating member 20. Locating member 20 is annular in form and includes four spaced upstanding annular portions between which four clamping members 21 are slidable radially toward and away from the axis of said locating member 20. The outer surface of locating member 20 is preferably cylindrical as shown and the inner surface thereof is provided with a plurality of longitudinally spaced cylindrical surfaces 22 each of different diameter. The inner face of each clamping member 21 is provided with similar cylindrical surfaces and the outer surface of each is beveled as at 23, such bevel preferably lying in a plane parallel to the axis of the locating member 20 but bearing non-perpendicular relation to a plane between said axis and said bevel

surface. The clamping members 21 are of such length that when the cylindrical surfaces thereof are coaxial with the cylindrical surfaces 22 of the locating member 20, the bevel faces 23 will project radially outward beyond the outer periphery of the locating member 20.

Rotatable about the locating member 20 is a cam ring 24 which has four radial slots there-through corresponding in width and in spacing to the spaces between the upstanding portions of locating member 20. In each of such slots is a cam insert 25 having a beveled end engageable with the beveled ends 23 of the clamping members 21. Movement of the cam inserts 25 radially outwardly is precluded by the inner surface 26 of a backing ring 27 which surrounds the cam ring 24 and which is fixed thereto as by dowel pins 28 through each. The longest dimension of each cam insert 25 is preferably equal to or slightly less than the annular space between the outer diameter of the locating member and the inner surface 26 of the backing ring 27.

Each clamping member 21 and the locating member 20 is provided with a groove in which a split spring ring 29 is fitted and which is operative when the parts are in the position shown in the drawings to urge the clamping members 21 radially outward so that the cylindrical stepped portions thereof will be in alignment with the cylindrical stepped portion 22 of the locating member 20. A cover plate 30 is attached, as by screws 31, to the locating member 20 and overlies locating member 20 and cam ring 24 to hold the clamping members 21 and the cam inserts 25 against longitudinal displacement from their respective slots.

Having thus described the structure of one form of workpiece holding means, the manner of operation thereof will now be described. A workpiece W is inserted within the locating member 20 in a position against one of the horizontal ledges between the different diameter cylindrical surfaces 22. These cylindrical surfaces and ledges serve to approximately locate the outer cylindrical surface of the workpiece W coaxial with locating member 20 and, of course, the particular ledge upon which the workpiece will rest will depend on its outside diameter. Having approximately located the workpiece, the cam ring 24 is then rotated clockwise, as viewed in Fig. 4 relative to the locating member 20 whereupon movement of the cam inserts 25 therewith will cause the clamping members 21 to be moved radially inward. Each clamping member 21 will move inwardly the same distance inasmuch as the bevels 23 of each are the same and thus the cylindrical steps on each clamping member will at all times be coaxial with the axis of the locating member 20. When the cam ring 24 is so rotated, the clamping members 21 will move inward until the workpiece is clamped therebetween. By reason of the movement of the clamping members 21 so that the inner surfaces thereof are always coaxial with locating member 20, the outer cylindrical surface of the workpiece relative to the axis of the locating member 20 will be accurately located coaxial therewith. With the workpiece so clamped or held, the reading on the universal level 11 can be taken to determine along what line the excess weight is on and the moment thereof. Thus, the excess metal can be removed as by drilling so that the workpiece will ultimately be in perfect balance. To remove the workpiece, the cam ring 24 is rotated counter-clockwise relative to the locating member 20, whereupon movement of

5

the cam inserts 25 therewith will permit the split spring ring to expand and thereby move the clamping members 21 radially outward out of engagement with the workpiece.

The modified form of workpiece holding means illustrated in Figs. 7 and 8 differs from that of Figs. 1-6 in that the inner cylindrical surface of a workpiece is located or positioned coaxial with the locating member, whereas in Figs. 1-6, the outer cylindrical surface of the workpiece was so located. In this modified form, there is a base plate 32 to which is secured a locating member 33, the outer surface of which is adapted to be projected into or within a workpiece W_1 to approximately coaxially locate the inner cylindrical surface thereof relative to the axis of the locating member 33. The locating member 33 is provided with four equally spaced radial slots 34 in each of which is a clamping member 35 radially slidable therein. The outer surface of each clamping member 35 is preferably cylindrical and of the same diameter as the outer surface of the locating member and such surfaces are held coaxial by means of a split spring ring 36 disposed in a groove in each clamping member 35 and in locating member 33.

Rotatable within a bore in locating member 33 is a cam ring 37 having flat surfaces 38 thereof engaged by the flat inner ends of the clamping members 35. It can be seen that rotation of the cam ring 37 in either direction from the position shown in Fig. 7 will cause uniform radial outward movement of each clamping member 35. Thus, in placing a workpiece W_1 over the locating member 33, as shown dotted in Fig. 8, and rotating the cam ring 37 relative to the locating member 33, the clamping members 35 will be caused to move radially outward and will engage the inner diameter of the workpiece W_1 and thereby accurately locate the same coaxial relative to the axis of locating member 33. With the workpiece W_1 being so held, the machine may be operated as described above to determine where and how much metal is to be removed from the workpiece W_1 to balance it relative to the inner surface thereof. After the workpiece W_1 is properly balanced, the cam ring 37 can be rotated in an opposite direction to a position where the surfaces 38 thereof will be opposite the ends of the clamping members 35, whereupon the clamping members 35 will be moved radially inward by the split spring ring 36 out of engagement with the workpiece W_1 .

In the modified form of workpiece holding means shown in Figs. 7 and 8, the range of inside diameters which can be accommodated by a single holding means is limited to those between the dimension line 39 but obviously those skilled in the art may readily adapt a stepped structure for handling a much wider range of diameters such as shown in Figs. 1-6. In such case the stepped surfaces would be placed on the outer surface of locating member 33 and the outer surfaces of the clamping members 35, whereupon a workpiece W_1 would rest on a ledge defined by the diameter approximately the same as that of the bore in the workpiece and the next largest diameter.

While the above description relates to accurately locating the cylindrical inner or outer surface of a workpiece relative to a fulcrum, it is not necessary that such surface be cylindrical. For example, it might be conical, in which case the large end would be placed downward in using the form of Figs. 1-6 and the small end down-

6

ward in using the form of Figs. 7 and 8. Likewise, instead of providing four equally spaced clamping members, it will be obvious that accurate location of a workpiece can be attained by providing unequally spaced clamping members or with any number of clamping members. It is to be noted that at least two clamping members are deemed necessary in order to provide for accurate location.

In the above description where the axis of the locating member is referred to, it is to be understood that it is essential that the workpiece be held coaxial with the fulcrum of the beam and that for such holding it is preferred that the axis of the locating member be coaxial therewith, although it is not necessary that the axis of the locating member be coaxial with the fulcrum. In other words, the locating member may be eccentric of the fulcrum and the balance of the beam and the holder thereon obtained by manipulation of the adjusting screws 16 and 17, in which case it is only necessary that the ends of the clamping members bear coaxial relation to the fulcrum of the beam.

While my improved fixture has been more particularly described in relation to a balancing machine, it will of course be understood that its utility is not limited to such combination but that said fixture may be advantageously used as a chuck for the purpose of holding a work-piece in accurately centered relation with other types of machines, e. g. grinding machines. Thus the first described form of fixture can be very advantageously used as a work-holding chuck in a so-called centrifugal grinding machine.

Other modes of applying the principle of the invention may be employed, change being made as regards the details described, provided the features stated in any of the following claims or the equivalent of such be employed.

I therefore particularly point out and distinctly claim as my invention:

1. In a workpiece holder adapted to be supported for universal tilting movement on a balancing machine about a fulcrum along the central axis of the holder, the combination of a horizontally disposed workpiece locating member formed with a vertically extending annular portion, a cam ring about and rotatable on said member, said ring and member being formed with a plurality of aligned slots radially therethrough, a backing ring secured to said cam ring closing the outer ends of the slots in the latter, a clamping member in each of the slots in said locating member slidable radially in its respective slot into and out of gripping engagement with the outer surface of a workpiece adapted to be placed within said locating member, said clamping members extending into the slots in said cam ring, and a cam insert in each of the slots in said cam ring having its inner end engaged with the outer end of the corresponding clamping member and its outer end engaged with said backing ring, the juxtaposed ends of said clamping members and cam inserts being formed with cooperating cam surfaces operative upon relative rotation of said locating member and cam ring in one direction to move said clamping members radially inward into gripping engagement with such workpiece.

2. In a workpiece holder adapted to be supported for universal tilting movement on a balancing machine about a fulcrum along the central axis of the holder, the combination of a horizontally disposed workpiece locating member

formed with a vertically extending annular portion, a cam ring about and rotatable on said member, said ring and member being formed with a plurality of aligned slots radially therethrough, a backing ring secured to said cam ring closing the outer ends of the slots in the latter, a clamping member in each of the slots in said locating member slidable radially in its respective slot into and out of gripping engagement with the outer surface of a workpiece adapted to be placed within said locating member, said clamping members extending into the slots in said cam ring and having one side initially engaging one side of the slots in said cam ring whereby to preclude relative rotation of said locating member and cam ring in one direction, and a cam insert in each of the slots in said cam ring having its inner end engaged with the outer end of the corresponding clamping member and its outer end engaged with said backing ring, the juxtaposed ends of said clamping members and cam inserts being formed with cooperating cam surfaces operative upon relative rotation of said locating member and cam ring in an opposite direction to move said clamping members radially inward into gripping engagement with such workpiece.

3. In a workpiece holder adapted to be supported for universal tilting movement on a balancing machine about a fulcrum along the central axis of the holder, the combination of a horizontally disposed workpiece locating member formed with a vertically extending annular portion, a cam ring about and rotatable on said member, said ring and member being formed with a plurality of aligned slots radially therethrough, a backing ring secured to said cam ring closing the outer ends of the slots in the latter, a clamping member in each of the slots in said locating member slidable radially in its respective slot into and out of gripping engagement with the outer surface of a workpiece adapted to be placed within said locating member, said clamping members extending into the slots in said cam ring, and a cam insert in each of the slots in said cam ring having its inner end engaged with the outer end of the corresponding clamping member and its outer end engaged with said backing ring, the juxtaposed ends of said clamping members and cam inserts being formed with cooperating cam surfaces operative upon relative rotation of said locating member and cam ring in one direction to move said clamping members radially inward into gripping engagement with such workpiece, the inner surface of said locating member and the inner ends of said clamping members being of a stepped form in radial cross section thereby providing a plurality of ledges on one of which such work-

piece is adapted to be supported depending upon the size of the workpiece.

4. In a workpiece holder adapted to be supported for universal tilting movement on a balancing machine about a fulcrum along the central axis of the holder, the combination of a horizontally disposed workpiece locating member formed with a vertically extending annular portion, a cam ring about and rotatable on said member, said ring and member being formed with a plurality of aligned slots radially therethrough, a backing ring secured to said cam ring closing the outer ends of the slots in the latter, a clamping member in each of the slots in said locating member slidable radially in its respective slot into and out of gripping engagement with the outer surface of a workpiece adapted to be placed within said locating member, said clamping members extending into the slots in said cam ring, and a cam insert in each of the slots in said cam ring having its inner end engaged with the outer end of the corresponding clamping member and its outer end engaged with said backing ring, the juxtaposed ends of said clamping members and cam inserts being formed with cooperating cam surfaces operative upon relative rotation of said locating member and cam ring in one direction to move said clamping members radially inward into gripping engagement with such workpiece, the slots in said locating member and cam ring being open at the top, and a cover plate secured on said locating member for closing the tops of all of the slots and thus retaining said clamping members and cam inserts in their respective slots.

DANIEL KELLEHER.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
952,364	Schultis	Mar. 15, 1910
1,237,353	McGregor	Aug. 21, 1917
1,245,251	McGregor	Nov. 6, 1917
1,429,395	Barker	Sept. 19, 1922
2,016,652	Poole	Oct. 8, 1935
2,197,808	Mason	Apr. 23, 1940
2,270,657	Kraft	Jan. 20, 1942
2,301,958	Lannen	Nov. 17, 1942
2,436,096	Chubb	Feb. 17, 1948

FOREIGN PATENTS

Number	Country	Date
245,305	Great Britain	Jan. 7, 1926