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EXPANSIBLE MANDREL

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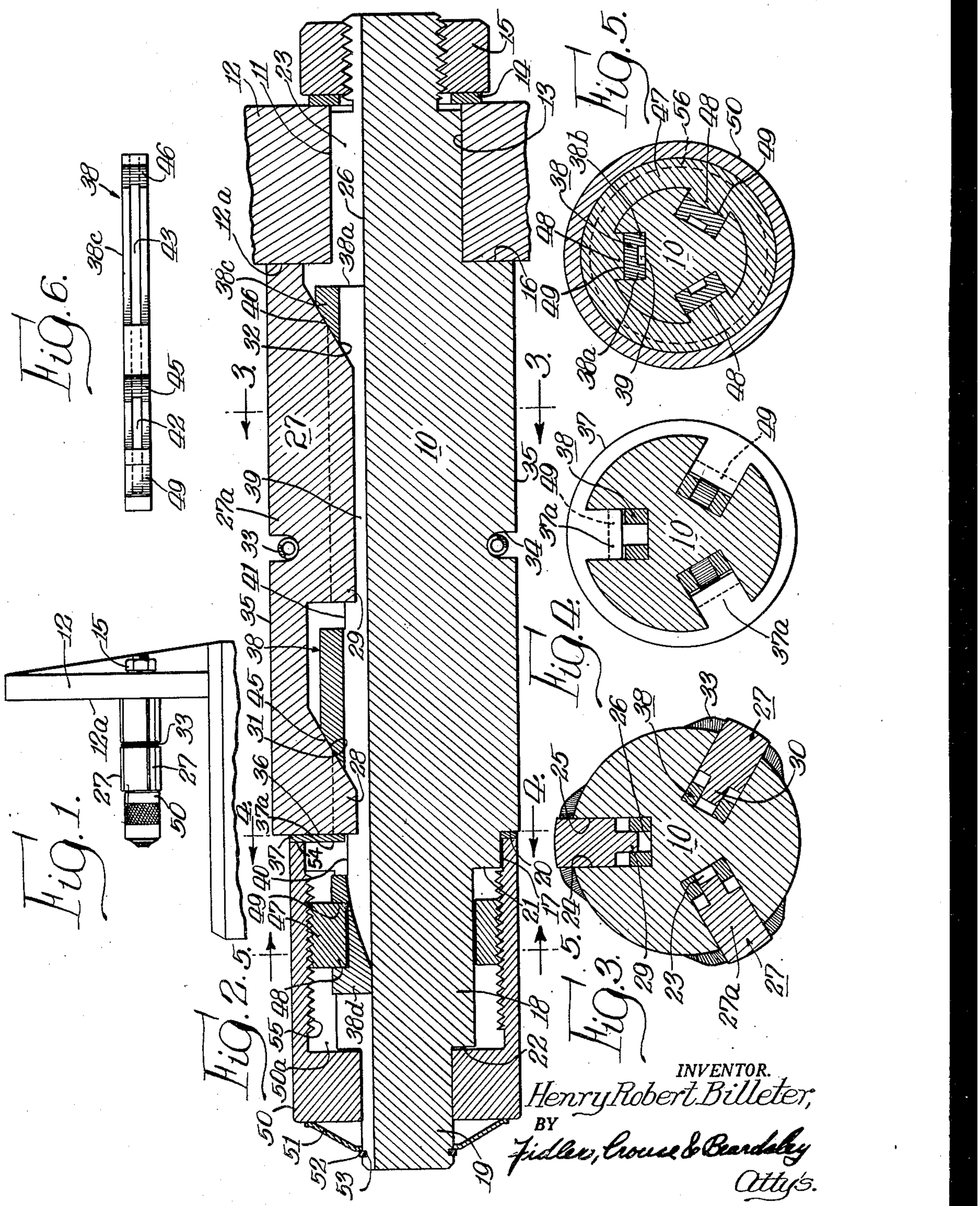

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EXPANSIBLE MANDREL

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10 Claims. (Cl. 279—2)

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My invention relates to mandrels and it has to do particularly with an expansible and contractible mandrel suitable for use as a work piece support, for example a connecting rod support in connection with connecting rod aligners, machines for boring or honing connecting rod bearings, and the like.

One of the objects of my invention is to provide an improved mandrel of the foregoing character which is simple in construction, comprised of but few and rugged parts, more rigid, subject to less wear even with rough usage, and assures accuracy in the maintenance of relationship of parts and adjustment thereof.

Another object is to provide an expansible mandrel in which the expanding pressure is applied uniformly to the expansible elements so that the elements are maintained in alignment and are expanded without binding and with a minimum of effort.

Still another object is to provide a tool of the foregoing character in which all clearance or looseness between relatively movable parts of the tool is eliminated throughout its entire range of expansion.

A further object is to provide a tool of the foregoing character wherein the range of expansion of any tool of particular size is materially increased with all of the advantages hereinabove just stated.

An additional object is to provide an improved tool expanding means which insures the accomplishment of all of the foregoing advantages.

A more specific object is to provide a tool of the foregoing character in which a one-piece expanding element is used having channel and cam portions respectively receiving and underlying complementary-shaped cam portions spaced on an expansible element of the tool and extending radially inwardly of the tool to the bottom of the guide slot for the expansible element when the expansible element is in its fully contracted position to provide increased expanding surfaces connected with the expanding element.

Other objects and advantages will become apparent from the following description taken in conjunction with the appended drawing wherein—

Figure 1 is a side elevational view showing one form of expansible mandrel embodying the invention and supported on an angle plate such as may be used for a connecting rod aligner or the like;

Fig. 2 is an enlarged longitudinal vertical sectional view of the mandrel shown in Fig. 1;

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Fig. 3 is a transverse sectional view taken along the line 3—3 of Fig. 2;

Fig. 4 is a transverse sectional view taken along the line 4—4 of Fig. 2;

Fig. 5 is a transverse sectional view taken along the line 5—5 of Fig. 2; and

Fig. 6 is a reduced top plan view of an expander element for the mandrel shown in Fig. 2.

Referring to the drawing, the mandrel illustrated comprises a body member 10 having a reduced end portion 11 adapted to be received and supported in any suitable fixture with which the tool is to be used, for example, the upright plate 12 constituting part of a connecting rod aligner such as shown in Letters Patent No. 2,013,374 of Herman W. Zimmerman, granted September 3, 1935. The reduced end portion 11 snugly passes through an opening 13 in the plate 12 where it is secured by a washer 14 and a nut 15 threaded on the end portion 11. The reduced end portion 11 provides a shoulder 16 on the body member 10, the surface of which is disposed at 90° with respect to the axis of the body member and insures that the axis of the mandrel will be disposed at right angles to the face 12*a* of the supporting plate 12. The other or outer end of the body member 10 has successively reduced diameters providing three step-like portions 17, 18 and 19, respectively, forming shoulders or abutment surfaces 20, 21 and 22 which will be referred to hereinafter.

The body member 10 is cut away longitudinally thereof from end to end to form three circumferentially disposed guide slots 23 having their opposite side walls 24 and 25 (Fig. 3) disposed on opposite sides of and similarly spaced from an axial plane passed through the body member and are arranged parallel therewith. A bottom surface 26 of each guide slot 23 connects the opposite side walls 24 and 25 of the guide slot and is disposed normal to the said axial plane. Each guide slot 23 is adapted to snugly receive and support an elongated clamping blade 27 for radial expansive and contractive movements therein.

Clamping blades 27 are generally T-shaped in cross-section and have two cutout portions opening at the bottom side of the blade and extending upwardly into the head portion of the blade to form two downwardly extending tongue-like portions 28 and 29, the bottom edges of which are adapted to seat upon the bottom surface 26 of the guide slot 23 when the clamping blades are in their fully contracted position. Each of the notch portions of the blade 27 has a corre-

spondingly located end wall **31** and **32**, similarly inclined with the inner edge of the blade providing cam surfaces thereon extending from the top of the notch portion to the bottom of the respective tongue-like portions **28** and **29**. The cam surfaces **31** and **32** are adapted to cooperate with expanding means to impart expanding movement to the clamping blades **27** or to allow the blades to be contracted in the guide slots **23**. A garter spring **33** encircles the clamping blades **27** and is received in a notch portion **34** in each blade to an extent to lie wholly inwardly of a clamping surface **35** on the blades for the purpose of urging the blades radially inwardly in contracting direction in the guide slots **23**. The blades **27** are disposed in relative longitudinal alignment in the guide slots **23** between the face **12***a* of the fixture with which the tool is used and an inner face **36** of a thrust plate **37** disposed in abutting relation with the shoulder **20** on the body member **10**. The thrust plate **37** has radially inwardly directed lug portions **37***a* (Figs. 2 and 5) extending inwardly of the guide slots **23** to an extent to prevent relative angular displacement of the thrust plate on the body member **10** and to terminate short of the bottom wall **26** of the guide slot to accommodate expanding means therebetween later to be described. Expansive movement of the clamping blades **27** between the faces **12***a* and **36** is used for the purpose of clamping the work piece, for example a connecting rod (not shown) so that all portions of the connecting rod will be in accurately aligned relation with that portion of the rod being supported by the clamping blades.

Means for imparting expansive movement to the clamping blades **27** comprises an elongated expander element **38** of general inverted U-shape in cross-section and disposed for adjustable longitudinal slide movement along the bottom surface **26** of the guide slot **23**. Each expander element **38** has a longitudinal channel **39** (Figs. 2 and 5) along its under or innermost side and extending throughout the length of the expander element, except for the outermost end thereof, which channel has a width slightly greater than the width of the portions **28** and **29** on the clamping blades. The channel **39** provides leg portions **38***a* and **38***b* (Fig. 5) for the expander element **38**, which rest upon the bottom **26** of the guide slot and equally distribute expanding pressures received on the expander element. The web portion **38***c* of each expander element **38** is also cut through transversely to form openings or orifices **42** and **43** therein. The openings **42** and **43** are adapted to telescopically receive the portions **28** and **29** of the clamping blades so as to allow these portions to freely extend into the channel **39** and to the bottom **26** of the guide slots **23** when the clamping blades are fully contracted. The innermost end wall of each of the openings **42** and **43** of the expander element **38** has a similarly inclined cam surface **45** and **46** shaped complementally to the cam surfaces **31** and **32**, respectively, on the clamping blade **27** whereby longitudinal outward movement of the expander element will cause such cam surfaces to cooperate to radially expand the clamping blades. The arrangement of the clamping blade **27** and the expander element **38** is such that the guide slot **23** is substantially filled and the medially disposed cooperating cam surfaces equally distribute expanding pressures through the leg portions **38***a* and **38***b* on each side of the bottom wall **26** to prevent angular

displacement and binding of the parts in the guide slot. It will be noted that the cam surfaces **31** and **32** of the clamping members **27** are considerably longer than the respective cooperating cam surfaces **45** and **46** on the expander element **38** so that the expander element is adapted to impart expanding movement to the portions **28** and **29** of the clamping blades which is telescopically received in the channel portions **39** as well as those portions of the cam surfaces **31** and **32** which are disposed in the head of the clamping blades, whereby the range of expansion of the tool is increased by the extent of the portion of the cam surfaces located on the respective portions **28** and **29** of the clamping blade. It will also be noted that the length of the openings **42** and **43** is such as to permit the portions **28** and **29** of the clamping blade to move longitudinally therein when the blade is telescopically received in the channel portion **39** so that the innermost edge of the blade may substantially contact the bottom surface **26** of the guide slot when the blades are fully contracted. The expander elements **38** are longer than the clamping blades **27** and extend through the thrust plate **37** providing end portions **38***d* projecting beyond the outer face of the thrust plate and to which are connected a means for longitudinally moving the expander elements in the guide slots **23**.

Means for longitudinaly moving the expander elements axially outwardly of guide slots **23** to expand the clamping blades **27** is provided by a cage-like member **47** having radially inwardly directed tongue portions **48** (Figs. 2 and 5) adapted to be freely received in the guide slots **23** at least to an extent to prevent relative angular movement of the cage member with the body member **10**. The inner end of each tongue-like portion **48** is keyed in a transverse notch portion **49** (Figs. 2, 5 and 6) adjacent the end of the expander element **38** so that axial movement of the cage member **47** results in simultaneous longitudinal movement of all the expander elements **38**.

The cage member **47** is adjusted axially of the body member **10** by a knurled adjusting nut **50** which is rotatably supported on the reduced end portion **19** of the body member and is yieldably retained thereon by an annular, cup-like spring washer **51** yieldably held in engagement with the outer end of the nut **50** by a split ring **52** disposed in a circumferential groove **53** adjacent the outer end of the body member. The inner end of the nut **50** is yieldably held against an outer face **54** of the thrust plate **37** by the spring washer **51**. An enlarged bore portion **50***a* is provided in the inner end of the adjusting nut **50** and has an internal thread **55** which is threadedly engaged with an external thread **56** on the cage member **47** whereby rotational adjustment of the nut will cause the cage and the expander element **38** to be moved longitudinally of the body member **10** in accordance with the direction of rotation of the adjusting nut to expand or to allow the clamping blades **27** to contact in the guide slots **23**.

In the use of the tool of this invention to support a connecting rod or other work piece, one bearing of the connecting rod or work piece is placed in registration with the clamping blades **27** and the adjusting nut **50** is rotated in a direction to move the cage **47** axially outwardly of the body member **10**. Because of the keyed connection provided by the lugs **56** with the expander element **38**, all expander elements are moved simultaneously outwardly with the cage **47** caus-

ing the cam surfaces 45 and 46 to cooperate with the respective cam surfaces 31 and 32 on the clamping blades 27 to radially expand the clamping blades into contact with the inner wall of the connecting rod bearing or work piece. By means of the three-point suspension provided by the clamping blades, the connecting rod bearing or work piece is fixedly clamped on the mandrel at right angles to the face of plate 12. Pressures exerted on the clamping surfaces 35 of the clamping blades are directed radially inwardly of the tool causing the cam surfaces 31, 45 and 32, 46 to hold the expander elements 38 against the bottom wall 26 of the guide slot 23 and further hold each of the expander elements axially inwardly of the body member 10 to take up all looseness or play of the expander element with the cage 47 and the threaded connection of the cage with the adjusting nut 50 to hold the adjusting nut against the side 54 of the thrust plate 37. The cam surfaces 31, 45 and 32, 46 further cooperate to hold the clamping blades axially outwardly of the body member 10 and in contact with the side 36 of the thrust plate so that all parts of the tool are rigidly maintained in accurate alignment.

When it is desired to remove a work-piece that has been clamped on the expanded mandrel or when it is desired to contract the mandrel for any reason, the adjusting nut 50 is rotated in the opposite direction to move the cage 47 axially inwardly of the guide slots 23, whereby the cam surfaces 45 and 46 on the expander elements are moved in contracting relation with the respective cam surfaces 31 and 32 on the clamping blades 27 so that the garter spring 33 is effective to contract each clamping blade 27 to an extent determined by the extent of inwardly directed movement of the expander elements. It is apparent that by arranging the tongue-like portions 30 on each clamping blade 27 to be received telescopically in the expander elements, the clamping blades may be expanded and contracted a greater extent with uniformity throughout their entire range of movement and they will retain their respective parallel alignment with the axis of the tool in all positions.

I claim:

1. An expansible mandrel comprising a body having at least one longitudinally extending slot of rectangular shape in cross-section, a clamp member having a head portion radially slidable in said slot, and a depending portion of reduced width adapted to be disposed adjacent the bottom of said slot in its fully contracted condition, said member having notches in and extending through said depending portion into said head portion providing depending sections corresponding edges of which are angularly shaped to provide spaced cam surfaces, an expander member mounted for slide movement in the bottom of said slot and having longitudinally spaced openings therein through which said depending sections pass to permit them to move to the bottom of said slot, corresponding ends of said openings having walls shaped complementally to said cam surfaces and engaged therewith, and means for adjusting said expander member longitudinally to expand said clamp member.

2. An expansible mandrel comprising a body having a longitudinally extending slot of rectangular shape in cross-section, an expansible member of T-shape in cross-section having its head portion slidably fitted in said slot and its stem portion projecting to the bottom of said slot in its fully contracted condition, said expansible member being notched through its stem portion into said head portion providing longitudinally spaced sections, the corresponding end of each said section being angularly inclined to provide spaced cam surfaces, an expander member of inverted channel shape in cross-section having a depth greater than the depth of said stem portion mounted in the bottom of said slot and having longitudinally spaced openings through its channel-bottom portion adapted to receive said stem sections, the walls of said openings adjacent said cam surfaces being shaped complementally thereto and seated thereagainst, said expansible member cam surfaces being longer than said expander member cam surfaces, and means for moving said expander member longitudinally.

3. An expansible mandrel comprising an elongated body having a plurality of longitudinal, circumferentially spaced slots therein, an expansible member of less length than said slots mounted in each thereof, an expander member mounted in the bottom of each said slot and adapted for longitudinal movement thereof to move said expansible members in expanding direction, and means for moving said expander members longitudinally comprising an adjusting member mounted on the end of said body for rotation without longitudinal movement, a second member mounted on said body member between said adjusting member and said expander members for longitudinal movement without rotation, a drive connection between said adjusting and second member whereby rotation of the former moves the latter longitudinally, and means connecting said second member to said expander members.

4. An expansible mandrel comprising an elongated body having a plurality of longitudinal, circumferentially spaced slots therein, an expansible member of less length than said slots mounted in each thereof, an expander member mounted in the bottom of each said slot and adapted for longitudinal movement thereof to move said expansible members in expanding direction, a thrust plate at one end of said expansible members confining them against longitudinal displacement in the direction of such plate, said plate having portions extending part way into said slots to prevent rotation thereof and to provide opening therepast along the bottom of said slots, a manually operable adjusting member rotatably mounted on said body outwardly of said plate and having a cylindrical, internally threaded skirt portion adapted to seat against said plate to prevent longitudinal displacement thereof, a motion transmitting member mounted on said body portion and threadedly engaged with the threaded portion of said skirt portion, said transmitting member having elements extending into said slots to prevent rotation of such member, said expander member being extended through said openings past said thrust plate, and means connecting said expander member to said transmitting member within the skirt portion of said adjusting member.

5. An expansible mandrel comprising a body member having a plurality of circumferentially spaced and longitudinally disposed radial guide slots therein, expansible clamping means disposed in each said guide slot for expansion and contraction movements therein, spring means disposed to urge said clamping means in contractive direction in said guide slots, expanding means disposed for axial slide movement in each said

guide slot and operatively connected to said clamping means, manually operable actuating means supported on said body member and operable to impart said slide movement to said expanding means, and a thrust element disposed between said actuating means and said clamping means, whereby said spring means urges said clamping means against one side of said thrust means and urges said actuating means against the other side of said thrust means to remove all operating clearances between relatively movable parts of the tool.

6. An expansible mandrel comprising a body member having a plurality of circumferentially spaced and longitudinally disposed radial guide slots therein, expansible clamping means disposed in each said guide slot for expansion and contraction movements therein, spring means disposed to urge said clamping means in contractive direction in said guide slots, expanding means disposed for axial slide movement in each said guide slot and operatively connected to said clamping means, and manually operable actuating means for said expanding means to impart said slide movement thereto, each said clamping means having a medially disposed tongue portion extending radially inwardly of said guide slot, and each said expanding means being perforate to telescopically receive said tongue portion when said actuating means is operated in a direction to allow said spring means to fully contract said clamping means, and said clamping means and expanding means having complemental cam elements cooperating to effect expansion or contraction of said clamping means when said expanding means is actuated.

7. An expansible mandrel comprising a body having at least one longitudinally extending slot of rectangular shape in cross-section intersected by the body radius, an expansible member having a head portion snugly received for radial slide movement in said slot, and a depending portion of reduced cross-sectional area adapted to be disposed adjacent the bottom of said slot in its fully contracted position, said member having at least one notch in and extending through said depending portion into said head portion providing a depending section, said section having a wall angularly shaped to provide a cam surface thereon, an expander member mounted for slide movement in the bottom of said slot and having an elongated opening therein receiving said depending section to permit said section to move to the bottom of said slot, said opening having an end wall shaped complementally to said cam surface and engaged therewith, and means for adjusting said expander member longitudinally to expand said clamp member.

8. A tool of the class described comprising a body having at least one longitudinally extending slot of rectangular shape in cross section intersected by the body radius, an expansible member having a head portion radially slidable in said slot, an expander member mounted for slide movement in the bottom of said slot beneath said expansible member, one of said members having a projecting portion of reduced width with at least one notch therein having an edge angularly shaped to provide a cam surface, the other of said members having a longitudinally spaced opening through which said projecting portion passes to bring said members into telescopic relation enabling a maximum contraction movement of said expansible member, said opening having a part of its wall surface shaped complementally to the cam surface of said projecting portion to be engaged thereby and to cooperate therewith to effect expansion of said expansible member as said expander member is moved longitudinally in one direction, and means for moving said expander member longitudinally in said one direction to effect said expansion of said expansible member.

9. A tool of the class described comprising a body having at least one longitudinally extending slot therein, an expansible member having a head portion slidably fitting in said slot for radial expansion and contraction movements, an expander member mounted in the bottom of said slot, one of said members having a reduced projecting portion having thereon at least one angular cam surface, the other of said members having a longitudinally extending elongate opening therein adapted to receive the projecting portion of the other member so as to bring said members into telescopic relation, the wall of said opening in said other member having thereon a cam surface shaped complementally to the cam surface of said projection, said cam surfaces adapted to be engaged with each other for expansion movement of said expansible member as said expanding member is moved longitudinally, and means for moving said member longitudinally to effect said expansion of said expansible member.

10. A tool of the class described comprising a body having at least one longitudinally extending slot therein, an expansible member having a head portion slidably fitting in said slot for radial expansion and contraction movements, an expander member mounted in the bottom of said slot, one of said members having a plurality of projecting portions of reduced width, said projecting portions each having an angular cam surface similarly inclined, the other of said members having longitudinally extending elongate openings therein adapted to receive the projecting portions of said one of said members so as to bring said members into telescopic relation, the walls of said elongate openings having thereon cam surfaces shaped complementally to the cam surfaces of said projecting portions, said cam surfaces of said projecting portions being adapted to cooperate with the cam surfaces of the walls of said openings for expansion movement of said expansible member as said expanding member is moved longitudinally, and means for moving said member longitudinally to effect said expansion of said expansible member.

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REFERENCES CITED

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

UNITED STATES PATENTS

Number	Name	Date
465,075	Grantland	Dec. 15, 1891
867,175	Demarchi	Aug. 16, 1910
2,379,210	Alyea	June 26, 1945
2,478,447	Arp	Aug. 9, 1949

FOREIGN PATENTS

Number	Country	Date
469,302	Great Britain	July 22, 1937