Jan. 8, 1963 F. R. E. LAWRY ET AL 3,071,848

EXTRACTOR TOOL

Filed March 22, 1961 3 Sheets-Sheet 1

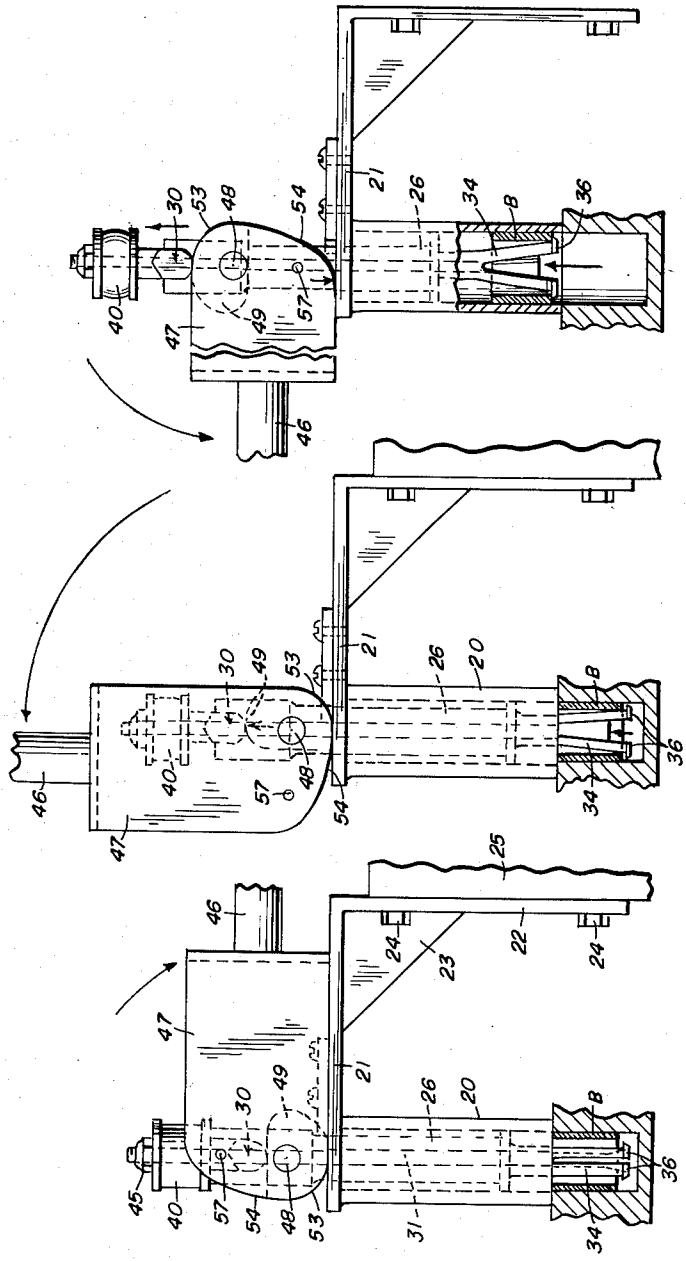


FIG. 1b

FIG. 1a

FIG. 1

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EXTRACTOR TOOL

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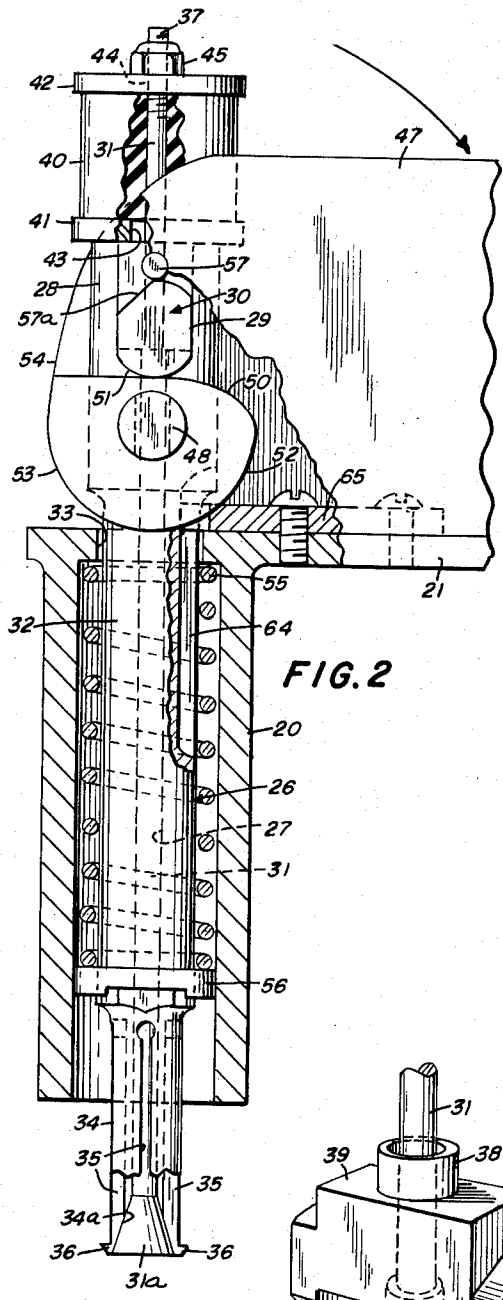


FIG. 2

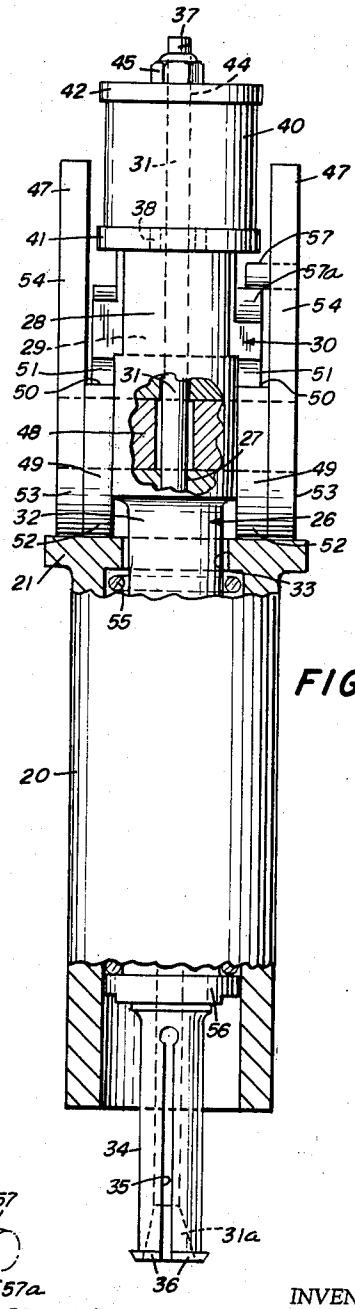


FIG. 3

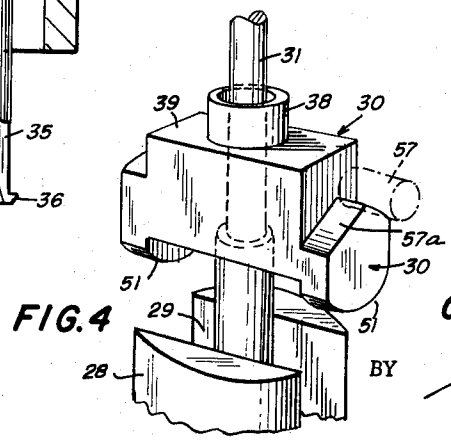


FIG. 4

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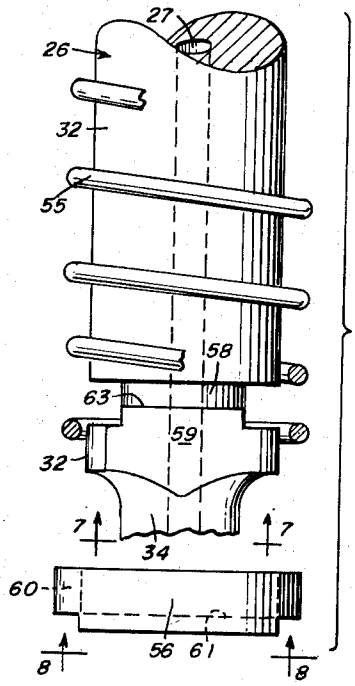


FIG. 5

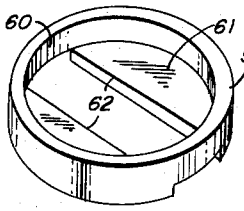


FIG. 6

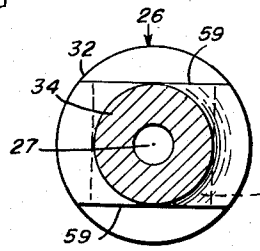


FIG. 7

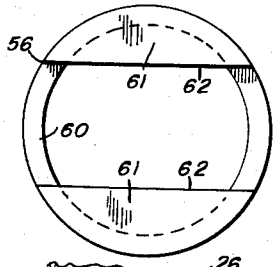


FIG. 8

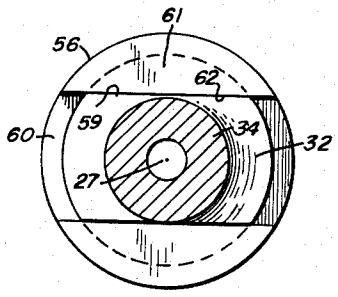


FIG. 9

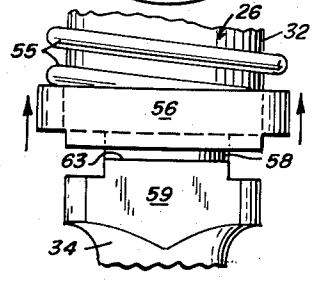


FIG. 11

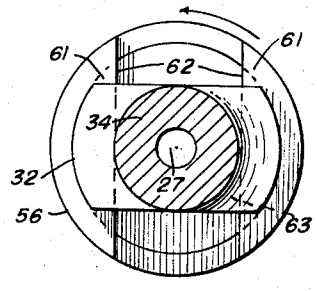


FIG. 10

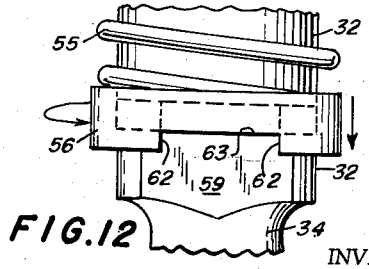


FIG. 12

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3,071,848

EXTRACTOR TOOL

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Filed Mar. 22, 1961, Ser. No. 97,561
9 Claims. (Cl. 29—267)

This invention relates to extractor tools and consists more particularly in new and useful improvements in a hand operated tool for removing bronze or other alloyed bushings and similar elements from blind holes or open-end holes.

An object of the invention is to provide a device of this character which, by the operation of a single lever, sequentially grips the interior of the bushing or bearing and extracts it from its supporting end bell or sleeve, thus eliminating the necessity of separately operated elements which have heretofore been required in conventional extracting tools.

Another object of the invention is to provide an extracting tool which is extremely simple in operation and greatly expedites the extraction of bushings and the like.

A further object is to provide an extractor device having a specially designed arrangement of combined cams, operated by a single lever action which first firmly secures the drawbar nose within the bushing to be extracted and then, with the continued operation of the lever, extracts the bushing with no interruption of the lever action.

A still further object of the invention is to provide in an extracting tool of this type, a specially arranged resilient bushing unit built into the drawbar assembly whereby excessive expanding movement of the drawbar nose is avoided and the pressure is absorbed in the resilient bushing, thus protecting the drawbar nose from overloading or breaking and likewise, protecting the bushing housing from breakage.

Still another object of the invention is to provide in an extractor tool a specially arranged locking assembly which prevents shifting or turning of the drawbar nose and enables the tool to be manufactured in a minimum size while maintaining maximum speed in operation.

With the above and other objects in view which will appear as the description proceeds, the invention consists in the novel features herein set forth, illustrated in the accompanying drawings and more particularly pointed out in the appended claims.

Referring to the drawings in which numerals of like character designate similar parts throughout the several views:

FIGURE 1 is a side elevational view partly broken away, showing the tool mounted on a suitable support with its drawbar nose inserted in a bushing;

FIGURE 1*a* is a similar view showing the position of parts at the conclusion of the first phase of the operation and with the drawbar nose expanded in the bushing;

FIGURE 1*b* is a similar view showing the positions of the parts at the conclusion of the second phase of the operation with the bushing extracted;

FIGURE 2 is an enlarged longitudinal sectional view of the tool with the parts in the positions indicated in FIGURE 1;

FIGURE 3 is a view at right angles to FIGURE 2, showing certain parts in section;

FIGURE 4 is a detailed fragmentary perspective view showing the crosshead which actuates the drawbar;

FIGURE 5 is an enlarged fragmentary elevational view of the return spring and locking assembly for the extractor bar;

FIGURE 6 is a detailed perspective of the locking ring;

FIGURE 7 is a transverse sectional view taken on line 7—7 of FIGURE 5;

FIGURE 8 is a similar view taken on line 8—8 of FIGURE 5;

FIGURE 9 is a plan view of the locking ring in its first position, showing the extractor bar in section;

FIGURE 10 is a similar view showing the locking ring in its second or locked position;

FIGURE 11 is a fragmentary plan view showing the first position of the locking ring; and

FIGURE 12 is a similar view showing the locking ring in locked position.

In the drawings, referring first to FIGURES 2 and 3, **20** represents the cylindrical body or housing of the tool which is suitably secured at its upper end to a right angularly disposed platform **21**, the latter being integral with or fastened to a mounting bracket **22** and disposed at right angles thereto, as best seen in FIGURE 1. A reinforcing gusset **23** may be provided at the junction of the platform **21** and the bracket **22**, and the bracket may either be designed for securing in a vise or, as shown in the drawings, drilled to receive mounting screws **24** for securing to the rigid support **25**.

Coaxially arranged within the cylindrical body **20** is a tubular extractor bar generally indicated by the numeral **26**, having a central longitudinally extending bore **27** running throughout its length. The enlarged upper end **28** of the extractor bar is transversely slotted as at **29** to accommodate a crosshead **30** which actuates a concentric drawbar **31** mounted for longitudinal sliding movement within the bore **27**, as hereinafter described more in detail. The reduced intermediate portion **32** of the extractor bar extends through an opening **33** located in the platform **21** in concentric relation to the cylindrical body **20**, said reduced portion being adapted to vertically reciprocate through said opening **33**.

The opposite or lower end of the extractor bar **26** is preferably further reduced as at **34** and its wall is provided with a series of annularly spaced, longitudinal slots **35** forming a corresponding series of expandable and contractable wall sections. As best seen in FIGURE 2, the lower end of the bore **27** is flared outwardly to provide an annular wedge surface **34***a* on the inner periphery of the wall of the reduced end **34** of the extractor bar, said wedge area **34***a* being designed to coact with a complementary flaring nose **31***a* formed at the lower extremity of the draw bar **31**. Thus, the elevation of the drawbar **31** within the bore **27** of the extractor bar will cause the radial expansion of the gripping end **34** of the extractor bar.

As will later appear, this gripping end **34** is designed to internally engage a bushing or the like B, whether it is located in a blind hole or an open hole. Therefore, said lower gripping end is provided at its extremity with a radially extending chisel-like flange **36** adapted to either engage beneath the bushing in an open hole, or firmly engage the inner periphery of a bushing in a blind hole, upon expansion of the gripping end **34**.

As seen in FIGURES 2 and 3, the upper end of the drawbar **31** projects vertically beyond the corresponding end **28** of the extractor bar **26** and is threaded as at **37**. The drawbar **31** extends vertically through a central opening in the crosshead **30** which, as best seen in FIGURE 4, is bounded adjacent the upper end of the crosshead by an annular neck **38** formed integrally with the upper face **39** of the crosshead, sufficient clearance being provided between the neck and the drawbar to permit vertical movement of the latter therein. Returning to FIGURES 2 and 3, it will be seen that a resilient bushing **40** formed of rubber or other suitable material, is carried at the upper end of the drawbar **31** and secured between two concen-

tric washers 41 and 42. The inner washer 41 is centrally apertured at 43 to receive the neck 38 fixed to the crosshead 30, while the outer washer 42 is centrally apertured and internally threaded at 44 to engage the threads 37 on the end of the drawbar 31. A nut 45 also engages the threads 37 on the drawbar to firmly secure the resilient bushing assembly in place on the drawbar with the inner washing 41 in abutment with the top face 39 of the crosshead.

Longitudinal movement of the drawbar 31 within the extractor bar 26 for expansion of its gripping end 34 and of the extractor bar 26 with respect to the cylindrical housing 20, for extracting a bushing or the like B, is accomplished by means of a novel combined cam arrangement actuated by a single operating lever 46, terminating at its pivoted end in a bifurcated yoke 47. The parallel bifurcations of the yoke 47 are transversely spaced to receive therebetween the crosshead 30 and the adjacent upper end 28 of the extractor bar and are pivotally connected to the latter by pins 48 which extend through the bifurcations and partially into the upper end 28 of the extractor bar. FIGURE 2 has been cut away to illustrate the contours of the combined cams and when considered together with FIGURE 3, clearly represent the cam arrangement and its relationship to the crosshead 30 which controls the drawbar 31 and the upper end 28 of the extractor bar 26 which actually affects the extraction of the bushing.

Secured to the inner face of each of the bifurcations of the yoke 47 and underlying respective lateral ends of the crosshead 30, are a pair of inner cams 49. Each of these cams is similarly contoured to provide eccentric camming surfaces 50 which underlie and frictionally engage respective arcuate abutments 51 on the underside of the crosshead 30, the cam surfaces 50 terminating in contiguous concentric portions 52, the radii of which conform to the corresponding radii 53 of the adjacent portions of the yoke 47. Thus, when the operating lever 46 is initially turned in counterclockwise direction from the position shown in FIGURE 1 to that shown in FIGURE 1*a*, the camming surfaces 50 engage the arcuate abutments 51 of the crosshead 30, withdrawing the crosshead from the slot 29 in the extractor bar, and by contact with the inner washer 41 of the resilient bushing assembly 40, causing the drawbar 31 to slide longitudinally in the bore 27. This longitudinal movement of the drawbar 31 causes a wedging action between the nose 31*a* and the wedge surface 34*a* to expand the gripping end 34 of the extractor bar. When the camming surface 50 has completed a 90° rotation as shown in FIGURE 1*a*, the concentric surface 52 of each of the inner cams 49 has reached the arcuate abutments 51 so that upon further rotation of the cams 49, the relative positions of the crosshead 30 and the extractor bar 26, remain constant. In other words, having effected a gripping action on the bushing B, the gripping end 34 of the extractor bar ceases to expand so that damage to the bushing or the extractor tool is avoided. Up to this point, the longitudinal position of the extractor bar 26 in the body 20, has been unchanged because of the concentric areas 53 of the yoke 47 which ride on top of the platform 21 and thereby have no effect on the pivot pins 48 which engage the extractor bar.

As seen in FIGURES 2 and 3, the end edges of the bifurcations of yoke 47 adjacent the pivots 48, are extended from their concentric portions 53 to provide contiguous cam portions 54 which are concentric with respect to the pivot pins 48 and extend to the upper edges of the yoke 47. Thus, the continued rotation of the lever 46 and yoke 47 about the pivot pins 48 to the position shown in FIGURE 1*b*, causes the eccentric cam portions 54 of the yoke to forcefully engage the platform 21, with the result that the extractor bar 26 is withdrawn from the cylindrical body 20, taking with it the bushing engaged by the gripping end 34 of the extractor bar.

In the course of this operation, the resilient bushing assembly 40 absorbs the remainder of the stroke of the yoke 47 which protects the nose 36 from overloading or breaking. Also, this resilient assembly 40 makes it possible to handle more than one size of bushing or the like which is to be extracted, through its compensating effect.

Upon the clockwise return of the operating lever 46 and yoke 47 from the position shown in FIGURE 1*b* to that shown in FIGURE 1, the extractor bar 26 and drawbar 31 are returned to normal position by a coil spring assembly 55 which surrounds the intermediate reduced portion 32 of the extractor bar within the cylindrical housing 20 and is compressible between the underside of the platform 21 and a locking ring 56 secured to the extractor bar in the manner to be described. The return movement of the drawbar is facilitated at the conclusion of the clockwise rotation of the yoke 47, by means of a transversely extending return pin 57 projecting from the inner face of one of the bifurcations of the yoke 47. This return pin engages a cam surface 57*a* on an upper edge of the crosshead 30 and affects a final inward push on the crosshead and the drawbar which permits the expandable gripping end 34 of the extractor bar to contract to normal position.

Returning to the coil spring assembly 55 which is best seen in FIGURES 5 through 12, it will be seen that at the lower extremity of the reduced portion 32 of the extractor bar 26, immediately above the gripping end 34 of the latter, there is provided an annular recess 58 immediately beneath which the periphery of the cylindrical extractor bar is machined to provide two oppositely disposed flat surfaces 59. The locking ring 56 as seen in FIGURE 6, is provided with a cup-shaped recess 60 which when assembled, receives the lower extremity of the coil spring 55. The bottom of the locking ring is closed by a web 61 which is provided with a transversely extending central slot 62 of a width to accommodate the base of the recess 58 with a sliding and rotatable fit and to receive the oppositely disposed flats 59 which are spaced a distance equal to the dimension of that portion of the extractor bar at base of the recess 58.

Within the confines of the annular recess 58, the periphery of the reduced portion 32 of the extractor bar is inwardly offset between the flats 59 to provide a substantially square raised shoulder 63 shown in dotted lines in FIGURE 7, the four flat edges of which are contiguous with the periphery at the base of the recess 58.

Thus, when assembled, the spring 55 is first slipped onto the reduced portion 32 of the extractor bar and the cup-shaped locking ring 56 is slipped over the gripping end 34 with its slot 62 positioned to receive and slide past the oppositely disposed flats 59 as shown in FIGURES 5 and 9. With the ring in this position, it is forced onto the extractor bar until it engages and compresses the spring 55 sufficiently to cause the slot 62 to clear the upstanding shoulder 63 so that the inner edges of the web bounding the slot, lie in the recess 58 and may be rotated freely therein as shown in FIGURE 11. By turning the ring 56 to the position shown in FIGURE 10 while the spring is compressed, the web 61 overlies the arcuate areas of the extractor bar and when pressure on the spring is released, its expansion causes the locking ring to fall into place with the edges of the slot 62 embracing the adjacent edges of the square shoulder 63, as shown in FIGURE 12.

It will be apparent that with the ring thus locked in place under the tension of spring 55, the entire assembly is held against shifting or turning by the spring pressure. The periphery of the ring 56 is in sliding engagement with the inner periphery of the cylindrical housing 20 and thus acts as a centering device for the extractor bar, as will be seen in FIGURE 2. Also, the spring is held in a position to act as a return spring during the operation of the combined cam mechanism previously described.

In order to prevent rotation of the extractor bar **26** within the housing **20**, there is provided in one side of the periphery of the extractor bar, a longitudinal slot **64** as shown in FIGURE 2, which embraces the end of a guide key **65** bolted to the top face of the platform **21**. With this arrangement, longitudinal movement of the extractor bar is permitted, but the engagement of the key **65** in slot **64** secures the structure against rotation.

In the use of this extractor tool, the mounting bracket **22** may be secured to a vertical support with the tool in the position shown in the drawings, or it may be secured to a horizontal support so that the body of the tool lies in a horizontal position. In any event, with the various parts of the tool in normal position with the operating lever **46** and yoke **47** in their extreme clockwise locations, the element containing the bushing B to be extracted is placed immediately beneath the lower extremity of the cylindrical body **20** with the gripping end **34** positioned within the bushing B and the surface surrounding the bushing abutting the lower end of the body **20**, as shown in FIGURE 1. As previously explained, rotation of the yoke **47** through a 90° turn to the position shown in FIGURE 1*a*, withdraws the drawbar **31** and through the wedging action of nose **31***a* and surfaces **34***a*, the gripping end **34** is caused to expand, either within or beneath the bushing B. The continued rotation of the yoke **47** causes a camming action between outer cams **54** and the platform **21**, withdrawing the extractor bar **26** and with it the bushing B as shown in FIGURE 1*b*. The reverse rotation of the lever **46** and yoke **47** permits the spring **55** to retract the drawbar **31** and the extractor bar **26**, releasing the gripping end **34** from the bushing B.

It will thus be seen that we have provided an extremely simple and effective extractor tool which can be operated with a minimum of effort due to the combined action of the composite cam arrangement and the fact that the entire operation is accomplished with a single lever action.

From the foregoing, it is believed that the invention may be readily understood by those skilled in the art without further description, it being borne in mind that numerous changes may be made in the details disc'osed without departing from the spirit of the invention as set forth in the following claims.

We claim:

1. A tool for extracting bushings or the like, comprising an open-ended housing, a longitudinally slidable extractor bar coaxially disposed in said housing, a normally contracted, radially expandable gripping element carried by said extractor bar and projectable and retractable by the latter through the open end of said housing, a coaxial, longitudinal bore extending through said extractor bar and gripping element, a drawbar slidable in said bore, wedge means on said drawbar operable upon longitudinal movement thereof, to expand said gripping element within a bushing or the like located adjacent the open end of said housing, and a composite cam assembly operable by a common lever, for sequentially shifting said drawbar with respect to said extractor bar and gripping element to effect expansion of the latter by said wedge means and retracting said extractor bar and gripping element within said housing, said open end of the housing serving as an abutment for the surface bounding the bushing or the like to be extracted, whereby said bushing is withdrawn upon retraction of said extractor bar.

2. A tool for extracting bushings or the like, comprising an open-ended housing, a longitudinally slidable extractor bar coaxially disposed in said housing, a normally contracted, radially expandable gripping element carried by said extractor bar and projectable and retractable by the latter through the open end of said housing, a coaxial longitudinal bore extending through the extractor bar and

gripping element, a drawbar slidable in said bore, wedge means on said drawbar operable upon longitudinal movement thereof relative to said extractor bar, to expand said gripping element within a bushing or the like located adjacent the open end of said housing, a crosshead connected to and extending transversely of said drawbar, a yoke pivotally connected to said extractor bar, an operating lever fixed to said yoke, first cam means fixed to said yoke and engageable with said crosshead for shifting said drawbar within said extractor bar to expand the gripping end thereof, second cam means fixed to said yoke and engageable with a portion of said housing to shift said extractor bar within the housing, the repective cam means being sequentially operable upon the rotation of said yoke about its pivot, and spring means opposing the action of said cam means for effecting the return movement of said extractor bar and drawbar.

3. A tool as claimed in claim 2, including a resilient bushing assembly at the point of connection between said drawbar and crosshead for cushioning the action of both of said cam means.

4. A tool as claimed in claim 2, wherein said first and second cam means are provided with co-extensive concentric areas respectively terminating in contiguous camming areas for sequentially acting upon said crosshead and extractor bar.

5. A tool as claimed in claim 2, wherein said first cam means is fixed to the inner face of said yoke and comprises an eccentric camming surface engageable with said crosshead and terminating in an arcuate surface concentric with said pivot, second second cam means being formed on the edge of said yoke and comprising a camming surface eccentric with respect to said pivot and terminating in a concentric surface co-extensive with the concentric surface of said first cam means.

6. A tool as claimed in claim 2, wherein said spring means comprises a coil spring surrounding said extractor bar within said housing, a locking ring engageable with said extractor bar for retaining said spring in said housing and means on said extractor bar coacting with said locking ring for securing the latter in place.

7. A tool as claimed in claim 6, wherein said locking ring is of a diameter to slidably engage the inner periphery of said housing to act as a centering device for said extractor bar.

8. In a tool for extracting bushings or the like including an open-ended housing, a longitudinally slidable extractor bar coaxially disposed in said housing, means on said extractor bar for internally gripping a bushing or the like and cam means for actuating said extractor bar; a compression spring assembly for opposing the action of said cam means, comprising a coil spring surrounding said extractor bar in said housing, an annular peripheral recess in said extractor bar, the periphery of said extractor bar adjacent said recess being provided with parallel, oppositely disposed flats, a locking ring having a transverse web, a slot in said web extending to the peripheral boundaries of said ring and of a width to accommodate said annular recess and the oppositely disposed flats, and a rectangular raised shoulder area contiguous on all sides with the base of said recess, whereby, after said locking ring has been slipped onto said extractor bar with the opposite edges of said slot passing over respective flats against the tension of said spring, said ring may be freely rotated in said recess to position said slot at right angles to said flats, the tension of said spring causing said slot to engage said shoulder portion preventing further rotation of said ring.

9. A compression spring and locking assembly for maintaining a longitudinally shiftable bar under tension in one longitudinal direction, comprising a coil spring surrounding said bar with one end engaging a fixed abutment slidably embracing the bar, a cup-shaped locking ring of an inside diameter adapted to embrace the periphery of said bar with a sliding fit, engaging the opposite end of said spring, an annular recess in the periphery of said bar,

oppositely disposed parallel flats on the periphery of said bar adjacent one edge of said recess, a square shoulder element concentric with said bar, lying within the confines of said recess and of transverse dimensions corresponding to the diameter of the recessed portion of said bar, the bottom of said cup-shaped ring being provided with a transverse slot of a width to slidably receive said oppositely disposed flats when the spring is slipped on said bar against the tension of said spring, said ring being rotatable

on said bar when said slot is aligned with said recess, whereby, when said ring is rotated through a 90° turn, the edges of said slot embrace said shoulder element upon release of the spring tension to prevent rotation of said ring.

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