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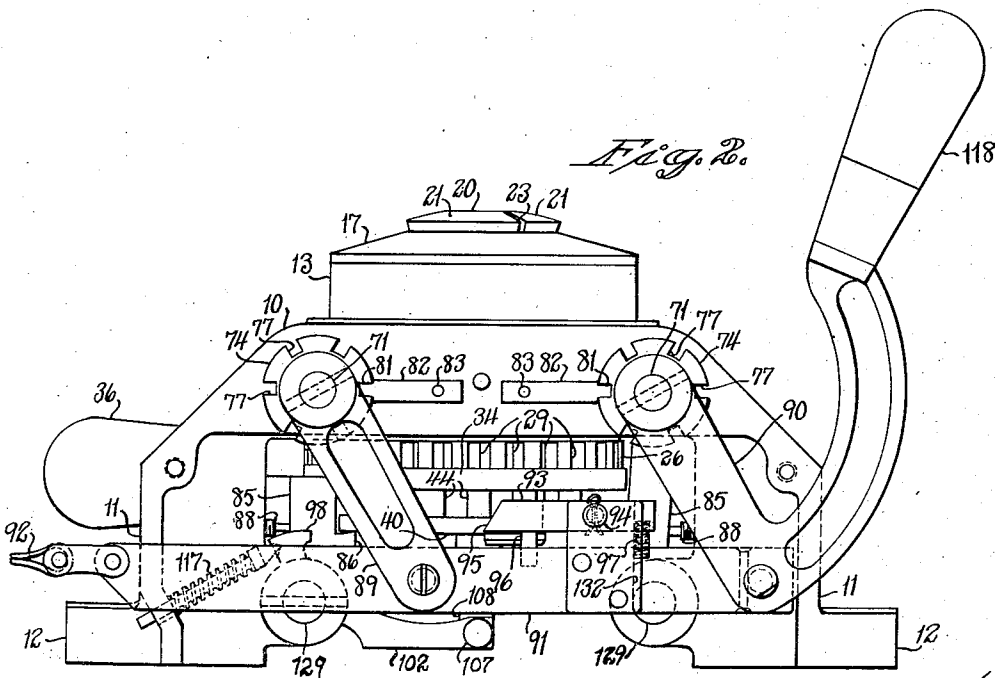
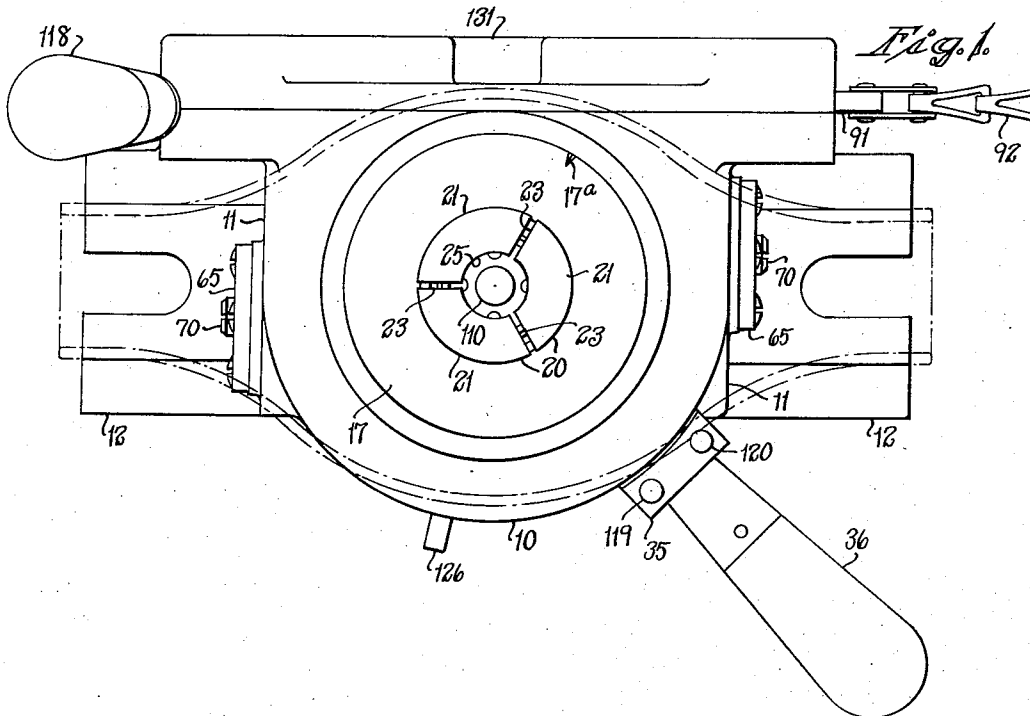
J. W. DEARBORN

2,186,236

WORK-HOLDING FIXTURE

Filed Dec. 8, 1938

4 Sheets-Sheet 1



Inventor
J. W. Dearborn
Seymour Park Nichols
Attorneys

Jan. 9, 1940.

J. W. DEARBORN
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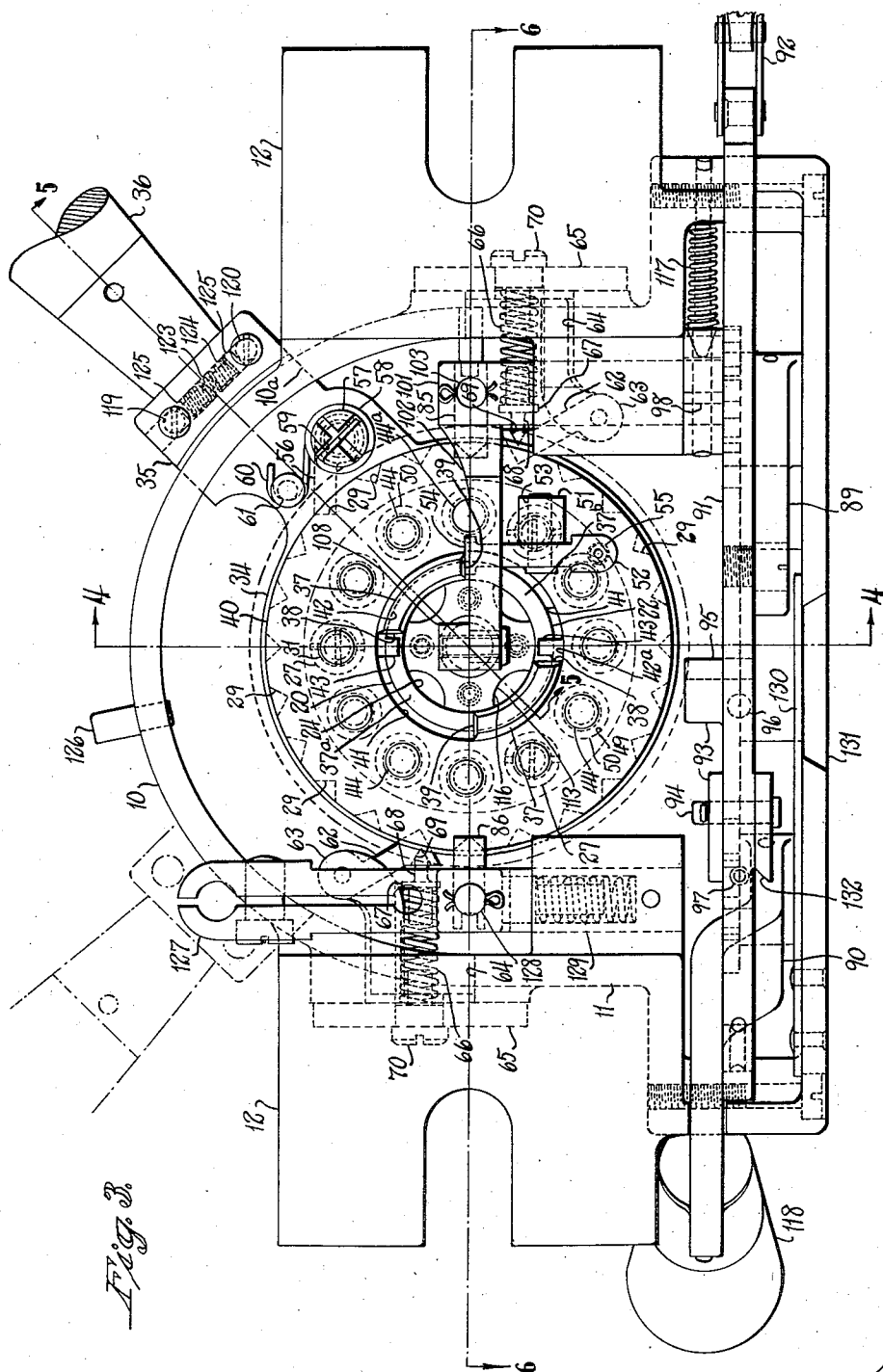


Fig. 2.

Inventor
by John W. Dearborn
Seymour Earl Nichols
Attorneys

Jan. 9, 1940.

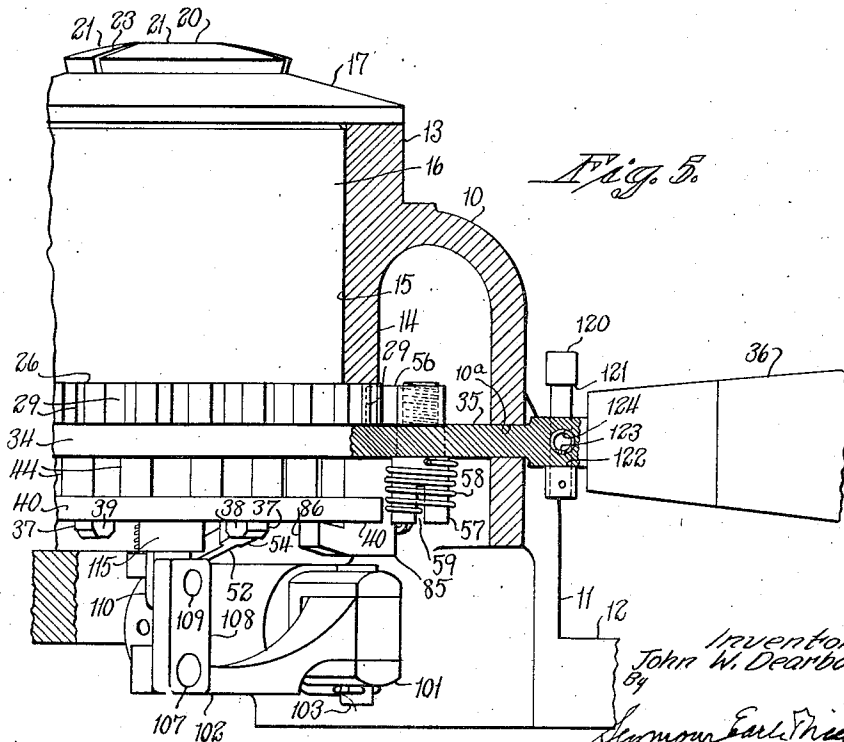
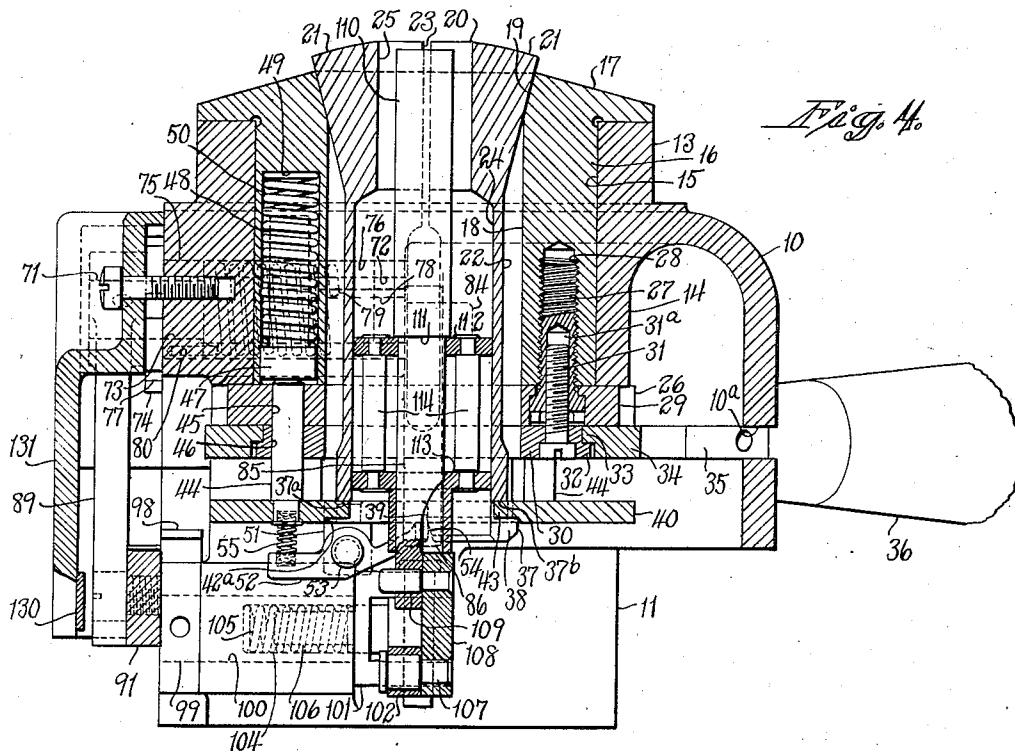
J. W. DEARBORN

2,186,236

WORK-HOLDING FIXTURE

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4 Sheets-Sheet 3



Inventor
John W. Dearborn
By
Seymour Earl Friesche
Attorneys

Jan. 9, 1940.

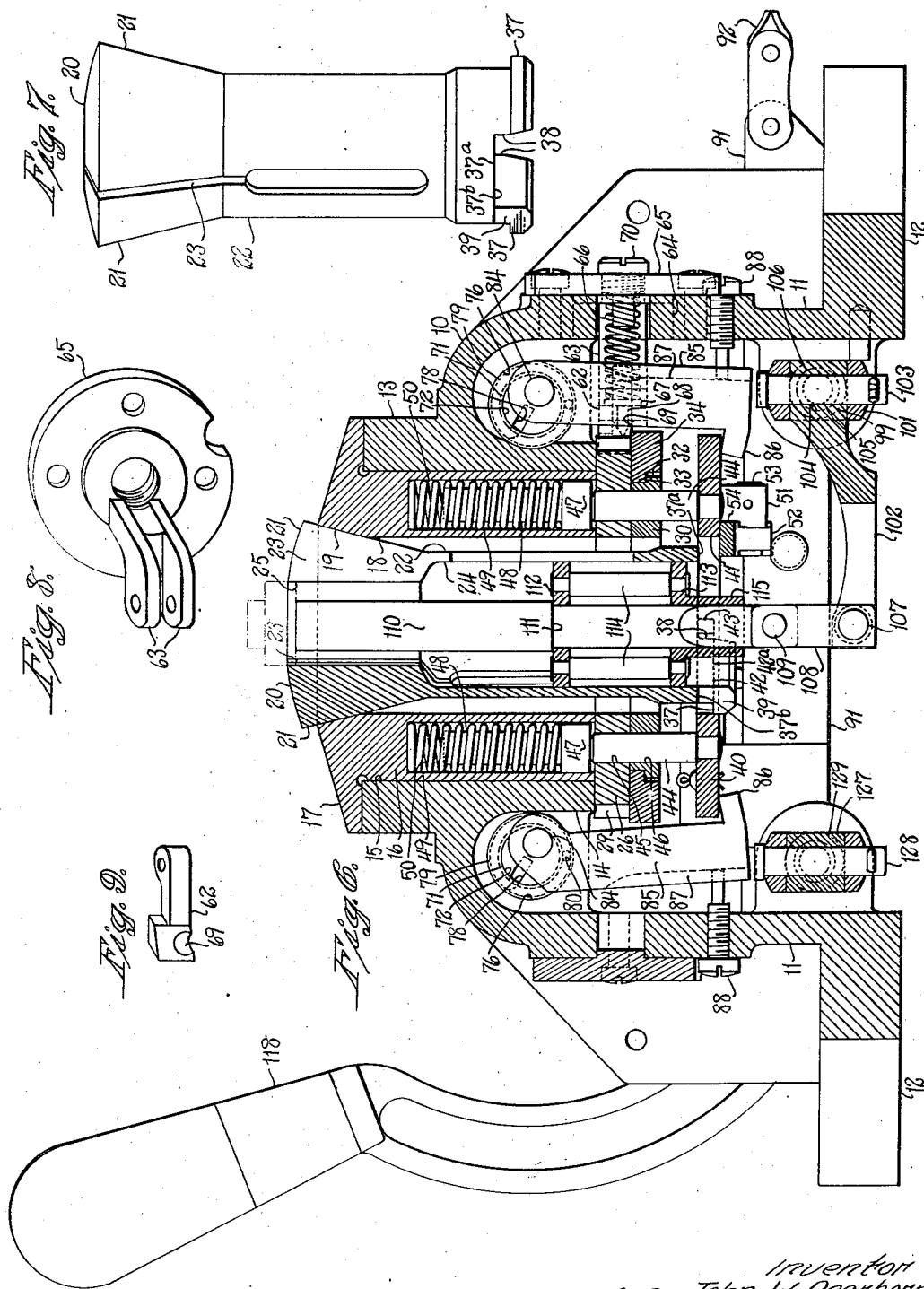
J. W. DEARBORN

2,186,236

WORK-HOLDING FIXTURE

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4 Sheets-Sheet 4



Inventor
by John W. Dearborn
Symon & Nichols
Attorneys

UNITED STATES PATENT OFFICE

2,186,236

WORK-HOLDING FIXTURE

John W. Dearborn, Ansonia, Conn.

Application December 8, 1938, Serial No. 244,522

10 Claims. (Cl. 90—57)

This invention relates to improvements in work-holding fixtures and more particularly to that type of fixtures adapted for holding small parts, such for instance as screws, nuts, bolts, etc., during the operation of milling, drilling, sawing, or machining, and is a continuation in part of an application filed by me October 21, 1936, Ser. No. 106,810.

One of the main objects of this invention is to provide a superior work-holding fixture which will firmly grip an article to be operated upon and which is provided with means for ejecting the said article when the operation being performed thereon is completed.

Another object of this invention is to provide a work-holding fixture so constructed and arranged as to firmly hold an article to be operated upon, the said fixture having incorporated therein superior means for effecting the automatic release and ejection of the article upon the completion of the operation thereon.

A still further object is to provide a superior work-holding fixture having indexing means incorporated therein whereby the positioning of an article held by the said fixture may be accurately met for any number of operations noted on an indexing-ring and means whereby the said article may be either automatically or manually released and ejected therefrom.

Still another object of the present invention is to provide a work-holding fixture having superior means for releasably holding a removable collet therein and means for permitting the ready removal of the said collet from the said work-holding fixture for replacement by a similar one of different size.

With the above and other objects in view, as will appear to those skilled in the art from the present disclosure, this invention includes all features in the said disclosure which are novel over the prior art and which are not claimed in any separate application.

In the accompanying drawings, in which certain modes of carrying out the present invention are shown for illustrative purposes:

Fig. 1 is a top or plan view of a work-holding fixture embodying my invention;

Fig. 2 is a rear elevational view thereof with the closure-plate removed;

Fig. 3 is an under-side elevational view thereof;

Fig. 4 is a sectional view taken on the line 4—4 of Fig. 3;

Fig. 5 is a fragmentary sectional view taken on the line 5—5 of Fig. 3;

Fig. 6 is a sectional view taken on the line 6—6 of Fig. 3;

Fig. 7 is a side elevational view of the collet detached;

Fig. 8 is a perspective view of the detent-supporting member detached; and

Fig. 9 is a similar view of the detent detached.

In the embodiment of the invention as herein chosen for illustration, the work-holding fixture includes a casing 10 provided with legs 11 and with feet 12 by which the device may be adjustably mounted upon any suitable bed or carriage. The casing 10 is formed with a centrally-located upwardly-extending neck 13 and with a depending-boss 14. Extending vertically through the neck 13 and boss 14 is a bore 15 which accommodates a sleeve 16 mounted with freedom for rotation therein and depending from and forming part of a flange-like head 17. The head 17 just referred to is also provided with a vertically-extending axial passage 18 provided at its upper or outer end with an outwardly-tapering seat 19.

Passing axially through the passage 18 above referred to, is a work-holding collet 20 including three, more or less, outwardly-tapering spring gripping-jaws 21, the said jaws being adapted to seat against the tapered seat 19 at the outer end of the vertical passage 18 formed in the head 17. The collet 20 also includes a shank 22 extending downwardly through the passage 18 and which is provided with slots 23 resulting in the formation of the gripping-jaws 21 above referred to. Extending axially through the collet 20 is a passage 24 which at its upper end 25 is reduced in diameter for the reception of an article to be operated upon, as is indicated by broken lines in Fig. 6 of the drawings.

Returning to the head 17 above described, the depending-sleeve 16 has secured thereto at its lower end an index-ring 26, the said index-ring being rigidly secured in place by a plurality of bolts 27 extending therethrough into threaded engagement with threaded-bores 28 formed in the depending-sleeve 16 of the head 17, as is clearly shown in Fig. 4 of the drawings. The index-ring 26 is provided on its outer periphery with a series of V-shaped notches 29 which, in the instance shown, are 24 in number, for the purpose as will hereinafter appear.

The index-ring 26 has in turn secured to the under side thereof a mounting-ring 30 rigidly held in place by bolts 31 which pass upwardly therethrough and thread into internally-threaded bores 31a provided in the bolts 27 above re-

ferred to, for that purpose. The mounting-ring 30 is provided on its outer periphery with an annular retaining-lip 32 upon the upper face of which rests an annular mounting-lip 33 formed on an operating-ring 34 encircling the said mounting-ring 30 with freedom for rotation with respect thereto, and which has extending radially outwardly therefrom, through a clearance-slot 10a in the side wall of the casing 10, an extension 35 terminating in an indexing-handle 36. It will thus be seen from the foregoing that the head 17, index-ring 26 and mounting-ring 30 are coupled together for concurrent rotation, as will be later described.

Returning to the collet 20, it will be seen by reference to the drawings that the said collet is provided at its lower end with coupling-lugs 37—37 arranged diametrically opposite from each other, the said coupling-lugs being of a length less than one-quarter of the circumference of the shank 22. It will also be noted that the circumferential area lying between the coupling-lugs 37—37 is notched as at 37a—37a, forming stop-shoulders 38—38 and thrust-shoulders 39—39.

Bearing against the upper faces of the coupling-lugs 37—37 is a collet-actuating or pressure-transmitting ring 40 having a central opening provided with clearance-notches 41—41 which results in the formation of a pair of coupling-ribs 42—42 respectively formed at one end thereof with stop-fingers 43—43 adapted to be engaged by the stop-shoulders 38—38 formed at the lower end of the collet 20. The thickness of the coupling-ribs 42—42 is less than the thickness of the actuating-ring 40 which results in the formation of shoulders 42a, as is particularly well shown in Fig. 4, having a diameter substantially equal to the diameter of the clearance-notches 41—41 and the external diameter of the coupling-lugs 37—37. The coupling-lugs 37—37 are adapted to engage with a free fit the shoulders 42a. The provision of the notches 41—41 in the actuating-ring 40 permits the passage of the coupling-lugs 37—37 through the said actuating-ring to bring the upper faces of the said coupling-lugs beneath the lower surface of the coupling-ribs 42—42. With the coupling-lugs 37—37 brought beneath the surface of the coupling-ribs 42—42 the collet 20, and hence the coupling-lugs 37—37, may be rotated substantially 90° in a counterclockwise direction, as viewed in Fig. 3 of the drawings, so as to bring the coupling-lugs 37—37 into proper position beneath the coupling-ribs 42—42.

As will be apparent the coupling-lugs 37—37 are guided by the annular walls of the clearance-notches 41—41 and the shoulder 42a during the rotation of the collet 20 to assure the proper alignment of the said coupling-lugs 37—37 with respect to the coupling-ribs 42—42. Further rotation of the collet 20 will be prevented by the engagement of the stop-shoulders 38—38 thereof with the stop-fingers 43—43 formed at the ends of the coupling-ribs 42—42, as above described. When the collet has been securely coupled to the actuating-ring 40 the stop-fingers 43—43 are positioned in the notches 37a—37a their upper faces in engagement with the upper wall 37b of the said notches.

By adapting the collet 20 to be hooked beneath the coupling-ribs 42—42 forming part of the actuating-ring 40, downward pressure imposed upon the said actuating-ring will be transmitted to the collet 20 which will in turn be pulled

downwardly, thereby forcing the gripping-jaws 21 forming part thereof against the seat 19 in the head 17, causing the said jaws to be contracted about an article placed therein to firmly grip the same.

To provide the necessary downward pressure for gripping an article as just above described, the actuating- or transmitting-ring 40 is provided with a series of upwardly-extending pressure-transmitting and coupling-pins 44, preferably nine in number, one of which 44a is of a size different from the others for the purpose as will later be set forth. The said pins 44 are rigidly secured to the actuating-ring 40. The pressure-transmitting and coupling-pins 44 just referred to, extend upwardly through passages 45—46 respectively formed in the index-ring 26 and mounting-ring 30 to bring the upper ends thereof into position to be engaged by the heads 47 of a corresponding number of actuating-plungers 48. The plungers 48 just referred to, are mounted with freedom for longitudinal movement in a corresponding number of vertically-extending spring-pockets 49 formed in the sleeve 16 of the head 17, as is particularly well shown in Figs. 4 and 6 of the drawings. Each plunger 48, as is shown in the figures referred to, is encircled by a helical actuating-spring 50 which exerts a constant but yielding pressure downwardly, the said pressure being transmitted through the pressure-transmitting and coupling-pins 44 to the collet-actuating ring 40 for effecting the downward movement of the collet 20 for gripping an article between the jaws 21 thereof.

To effect the rotation of the collet 20, the actuating-ring 40 is provided on its under side with a depending-stud 51 rigidly secured thereto, which supports a coupling-member 52 pivotally-mounted upon a pivot-pin 53 secured to the said stud 51. At its inner end the said coupling-member 52 is provided with a coupling-nose 54 adapted to engage the adjacent one of the thrust-shoulders 39—39 formed on the lower end of the collet 20. At its outer end the coupling-member 52 is engaged by a helical-spring 55 constantly urging the outer end of the said coupling-member downwardly to hold the coupling-nose 54 thereof normally in engagement with the thrust-shoulder 39 as above described.

In the arrangements just above described, the coupling-member 52 in effect serves as a coupling-means between the actuating-ring 40 and the collet 20 to couple the said actuating-ring and collet together for concurrent rotation. It may here be noted, that the pressure-transmitting and coupling-pins 44 effectively couple the actuating-ring 40 to the index-ring 26 and mounting-ring 30, and hence to the head 17 for rotation therewith, in a manner as will herein-after appear.

Returning to the operating-ring 34, the radial extension 35 thereof has mounted upon its upper face an index-ring-actuating pawl 56 adapted to engage with the notches 29 formed in the outer periphery of the said index-ring 26. The actuating-pawl 56 is rigidly secured to the upper end of a stud 57 which passes through the extension 35 with freedom for rotation therein and has its lower end encircled by a helical-spring 58, one end of which is seated in a transverse slot 59 formed in the lower end of the said stud 57. The opposite end of the spring 58 is formed with a hook 60 which engages with a depending-pin 61 rigidly secured to the under face of the extension 35. As will be apparent, the spring 58 constantly

urges the free end of the pawl 56 into engagement with the outer periphery, and hence the notches 29 of the index-ring 26, to couple the operating-ring 34 to the said index-ring 26 for concurrent rotation in one direction which, as viewed in Fig. 3 of the drawings, would be counterclockwise.

As just above described, the counterclockwise rotation, as viewed in the drawings, of the operating-ring 34 which is effected by the indexing-handle 36 thereof, results in the similar rotation of the index-ring 26 and hence the head 17, mounting-ring 30, and actuating-ring 40 which, due to its coupled relation to the collet 20 by means of the coupling-member 52, rotates the said collet and the article gripped thereby. During the return movement of the indexing-handle and operating-ring 34 in a clockwise direction, as viewed in Fig. 3 of the drawings, the indexing-pawl 56 moves freely outwardly from engagement with the notches 29 in the periphery of the index-ring 26 to, in effect, ratchet back over the periphery of the said index-ring, which is permitted by its yielding engagement with the said index-ring, as above described. During the return movement of the operating-ring 34, the index-ring 26 and associated parts, including the actuating-ring 40 and collet 20, remain stationary until the operating-ring 34 is again rotated in a counterclockwise direction to again effect the rotation of the index-ring which in turn through the chain of parts, including the coupling-pins 44, actuating-ring 40, and coupling-member 52, again effects the rotation of the collet 20 to a degree corresponding to any number of given notches in the index-ring 26 which may be arbitrarily selected by the operator.

To prevent any inadvertent displacement of the index-ring 26 and hence the collet 20 during the return movement of the operating-ring 34 to its normal position, the said index-ring is engaged at diametrically-opposite points by detents 62—62, each of which is pivotally-mounted at the inner end of arms 63—63 projecting inwardly through clearance-passages 64—64 provided in the side walls of the casing 10. The arms 63—63 just referred to project inwardly from and form an integral part of annular plates 65—65 rigidly secured to the casing 10. To maintain the detents 62—62 in yielding engagement with the index-ring 26, helical-springs 66—66 are provided which bear at their inner ends against flanges 67—67 formed on spring-plungers 68—68 having their inner ends seated in recesses 69—69 formed in the outer faces of the detents 62—62. At their outer ends, the springs 66—66 bear against shoulders formed on retaining-screws 70—70. It will thus be seen that the detents 62—62 are held in constant but yielding engagement with the notches 29 in the outer periphery of the index-ring 26 to prevent the rotation of the said index-ring in a clockwise direction, as viewed in Fig. 3 of the drawings, but that the said detents will yield to permit the index-ring 26 to ride by when the said index-ring is rotated in a counterclockwise direction, as viewed in the figure just referred to. The tension of the springs 66—66 is, however, sufficient to prevent the detents 62—62 from yielding under pressure exerted against them during the performance of an operation on the article held by the collet.

To effect the automatic ejection and release of an article held by the gripping-jaws 21 of

the collet 20, a pair of similarly-formed shafts 71—71 are transversely arranged at diametrically-opposite points between the boss 14 and the side walls of the casing 10. The shafts 71—71 just referred to are rotatably mounted in bearing-passages 72—72 at their inner ends, and at their outer ends bear in the axial-bores 73—73 of spring-adjusting rings 74—74, the said rings 74—74 being provided with bearing-hubs 75—75 rotatably mounted in spring-receiving pockets 76—76, the said adjusting-rings 74—74 being provided in their outer peripheries with a series of radial notches 77—77. The shafts 71—71 are provided at their inner ends with longitudinal grooves 78—78 for the reception of one end of tension-springs 79—79 encircling the said shafts and which have their opposite ends axially bent to fit into pockets 80—80 formed in the inner faces of the bearing-hubs 75—75 of the adjusting-rings 74—74.

As thus constructed and arranged, it will be apparent that any rotation imparted to the adjusting-rings 74—74 will, in turn, effect the tension of the springs 79—79, which may thereby be adjusted to any required degree of tension. After the desired tension has been acquired by the rotation of the adjusting-rings 74—74, the said rings may be secured in proper position against rotation by the engagement of a retaining-finger 81 formed at the outer ends of bars 82—82 secured to the side wall of the casing 10 by means of pins 83—83.

At the extreme inner end of each of the shafts 71—71, an eccentric-stud 84 is provided, upon each of which is pivotally mounted a lifting-arm 85, as is particularly well shown in Fig. 6 of the drawings. Each of the arms 85 at its lower free end is provided with a finger 86 which may engage with the under face of the adjacent actuating-ring 40 to raise the same, for the purpose of opening the collet. At its outer edge opposite to the finger 86, each of the arms 85 is provided with a longitudinal groove 87 in which bears the inner end of screws 88—88 for the purpose of maintaining the lower dependent end of each of the arms 85—85 in its proper position for engagement with the actuating-ring 40 when the shafts 71—71, and hence the eccentric-studs 84—84, are rotated. As before noted, the outer ends of the shafts 71—71 extend outwardly through the adjusting-rings 74—74 and have mounted thereon connecting-arms 89 and 90, the lower ends of which are pivotally secured to a horizontal coupling-bar 91.

The coupling-bar 91 has secured to one end thereof a chain or its equivalent 92, the opposite end of which may be secured to any stationary point forming part of the particular machine upon which the fixture being described may be employed, for effecting the automatic release of an article gripped by the jaws of the collet 20 for subsequent ejection therefrom. As the fixture, and consequently the article held thereby, passes beneath the cutting-tool of the machine upon which the fixture is employed by the reciprocation of the bed or carriage of the machine, and the required operation is performed upon the said article, the bar 91 will, near the end of the stroke of the bed or carriage, be held stationary, due to the chain 92 preventing any further bodily movement of the said bar 91, while the body of the device herein shown and described is moved a slight distance further so as to in effect cause the arms 89 and 90 to swing from right to left, as viewed in Fig. 2 of the

drawings, to effect the rotation of the shafts 71—71 against the tension of the springs 73—79, thus causing the eccentric-studs 84—84 to be raised above their normal position.

5 The upward movement of the eccentric-studs 84—84 as just above described, also raises the lifting-arms 85—85 pivotally connected thereto to cause the fingers 86—86 thereof to raise the actuating-ring 40, together with the pressure-transmitting and coupling-pins 44 secured there-
10 to, and the collet 20. The upward displacement of the actuating-ring 40 causes the stop-fingers 43—43 thereof, in engagement with the upper wall 37b of the notches 37a—37a formed in the
15 collet 20, to move the said collet upwardly against the tension of the helical-springs 50, which upward movement results in the jaws 21 expanding sufficiently to permit the removal of the article held thereby, in a manner as will be hereinafter
20 described.

To effect the ejection of an article gripped by the collet 20, the bar 91 has pivotally mounted thereon a tripper 93 pivoted upon a pivot-pin 94 intermediate its ends and beveled at its forward
25 or inner end to provide a tripping-nose 95. As shown in Fig. 2 of the drawings, the tripper 93 is mounted above the upper face of the bar 91 and is normally held in the horizontal position, shown in the figure referred to, by a stop-pin 96 mounted
30 in the upper face of the bar 91 and with which the forward portion of the tripper normally is held in engagement by a spring 97. The spring 97 is interposed between the outer end of the tripper 93 and the upper face of the bar 91 and
35 exerts a constant effort to hold the forward portion of the said tripper in engagement with the stop-pin 96.

The tripper 93 is adapted to have its tripping-nose 95 engage with a tripping-lug 98 mounted
40 upon a shaft 99 when the bar 91 is in effect shifted from right to left, as viewed in Fig. 2 of the drawings as previously described. The shaft 99 is mounted in a bearing-passage 100 formed in the lower portion of the casing 10 and is
45 provided at its inner end with a U-shaped head 101 which pivotally mounts a horizontally-arranged arm 102, as is particularly well shown in Fig. 6 of the drawings. The arm 102 is pivotally mounted to the head 101 by means of a pivot-
50 pin 103 and is adapted, upon occasion, as will later appear, to be moved through an arc of 90° clockwise, as viewed in Fig. 3 of the drawings. To yieldingly hold the arm 102 in the position in which it is shown in the drawings, the shaft
55 99 is formed with a spring-pocket 104 accommodating a helical-spring 105, the said spring encircling a plunger 106, the outer end of which bears against the adjacent face of the arm 102 to yieldingly hold the latter in the position shown.
60 At its free end, the arm 102 is provided with a pivot-pin 107 and has pivotally mounted upon the said pin a link 108, the said link being also provided at its upper end with a coupling-stud 109 which has in turn pivotally mounted thereon an
65 ejecting-rod 110.

As is particularly well shown in Fig. 6 of the drawings, the ejecting-rod 110 extends vertically into the passage 24 formed in the collet 20 and is in axial alignment therewith, its upper end
70 terminating below the outer face of the collet 20 in position to serve as a support for an article held by the said collet. About midway of its length, the ejecting-rod 110 is provided with a downwardly-facing shoulder 111 which bears
75 against the upper face of a plate 112, the latter

being connected to a plate 113 by pillars 114. The plate 113 is provided on its lower face with a hub 115 and, together with the plate 112, serves to form a guide-bearing for the ejecting-rod 110
5 which passes freely therethrough. The outer periphery of the plates 112, 113 are notched to form chip-clearance notches 116, as is particularly well shown in Fig. 3 of the drawings, the said plates being mounted with freedom for longitudinal
10 movement in the passage 24 formed in the shank 22 of the collet 20. It will thus be seen that the ejecting-rod 110 is held in its proper axial position in respect to the passage 24 in the collet 20, though free to reciprocate therein.

As has been before stated, the tripper 93 mount-
15 ed upon the bar 91 effects the release of the article held in the jaws 21 of the collet 20 through the chain of parts including the arms 89 and 90, shafts 71—71, dependent-arms 85—85, and actu-
20 ating-ring 40. When the bar 91 is held stationary as above described, the tripping-nose 95 is formed at the inner end of the tripper 93 engages with the tripping-lug 98 to cause the latter to rotate counter-clockwise, as viewed in Fig. 2 of the draw-
25 ings, against the counterurge of a spring 117 to thus rotate the shaft 99.

As the shaft 99 is rotated, the arm 102, car-
ried by the head 101, will also be rotated, thus causing its free end to be moved upwardly, there-
30 by raising the ejecting-rod 110. As the tripper 93 continues its travel, the tripping-lug 98 will be swung to a point where it will be beneath the lower face of the said tripper, thus enabling it to ride free of the tripping-nose 95 and assume
35 its normal inoperative position under the urge of the spring 117. The tripping-lug 98 is permitted to return to its normal position, once it is free of the tripping-nose 95 by virtue of the tripper 93 being pivotally mounted, which allows
40 the tripping-nose 95 at the inner end thereof to be raised against the urge of the spring 97. The return of the tripping-lug 98 to its normal position causes the arm 102, mounted at the inner end of the shaft 99, to also assume its normal
45 inoperative position, with the result that the ejecting-rod 110 is withdrawn to its normal position in the collet 20.

In the construction of the tripping mechanism just described, it will be understood that the relative position of the tripping-nose 95 and the tripping-lug 98, when they are in engaged position,
50 is such that the effect of the tripping nose 95 upon the lug 98 is a short, abrupt movement, so as to, in effect, cause the ejecting-rod 110 to abruptly eject the article held by the jaws 21 of the collet 20. It will also be understood that the ejecting operation takes place substantially
55 simultaneously with the release of the article by the collet 20.

Preferably, and as is shown in the drawings, the arm 90 is provided with a manual operating-handle 118, so that the bar 91 may be longitudi-
60 nally moved to effect the opening of the jaws 21 of the collet 20. The operating-handle 118 also enables the device to be employed on a drill-
65 press or the like, in which case the release and ejection of the article is accomplished by the manual operation of the said operating-handle.

In the operation of the device herein shown and described, an article to be operated upon
70 is placed in the jaws 21 of the collet 20. The article held by the jaws of the collet 20 is subjected to the action of a cutting-tool and an operation performed thereon, such, for instance, as the cutting of a flat face for the formation
75

of a square. When the operation of cutting one flat or face of a square has been completed, the operator will swing the indexing-handle 36 the required distance, or the limit of movement controlled by the clearance-slot 10a, to rotate the index-ring 26 one-quarter of a revolution, or six notches, as noted in the periphery of the said index-ring, so as to effect the turning of the article held by the collet 90°. The indexing-handle 36 is then returned to its normal position, as illustrated in the drawings, and the article is again subjected to the operation of the cutting-tool to cut the second flat or face at right angles to the one just previously formed. The above described operation is then repeated to form the third and fourth flats or faces to complete the square. After the formation of the square as just described, the operating-handle 118 may be depressed or, if preferred, the automatic release and ejection may be employed, to cause the coupling-bar 91, together with the arms 89 and 90, to effect the rotation of the shafts 71-71, to thereby release and eject the article held by the jaws 21 of the collet 20 and enable a fresh article to be placed therein.

From the foregoing, it will be obvious that the rotation of the index-ring 26 for one notch will turn the collet $\frac{1}{4}$ of a revolution, two notches will turn the collet $\frac{1}{2}$ of a revolution, three notches $\frac{3}{4}$, four notches $\frac{1}{2}$, six notches $\frac{3}{4}$, eight notches $\frac{1}{2}$, twelve notches $\frac{1}{2}$.

For convenience in forming hexagons and octagons, the extension 35 is provided with two spaced-apart transverse limit-pins 119 and 120 provided with stop-shoulders 121 and 122. The limit-pins 119 and 120 are yieldingly held in place by means of a spring 123 accommodated in a bore 124 intersecting the bearing-passages in which the said limit-pins are mounted for reciprocation. The spring 123 is interposed between a pair of retaining spring-plungers 125-125 adapted to bear against the adjacent limit-pins 119 and 120 to yieldingly retain the said pins in either a raised or depressed position. The limit-pins 119 and 120 are adapted, when in their raised position, to engage with a stop-pin 126 mounted in the side-wall of the casing 10 for the purpose of limiting the movement of the indexing-handle 36 in one direction.

When it is desired to form a hexagon, the limit-pin 120 is moved into its raised position, as shown in Fig. 5 of the drawings, so as to place the upper end thereof into position to engage with the stop-pin 126 when the indexing-handle 36 is swung to rotate the index-ring 26, which rotation will be limited to one-sixth of a revolution, or four notches on the said index-wheel. Whereupon the operating-handle 36 is returned to its normal position and again swung to the limit imposed thereon by the engagement of the limit-pin 120 with the stop-pin 126. This operation is then repeated the required number of times to form the desired hexagon. During the above described operation, the limit-pin 119 is placed in its depressed or inoperative position, thereby enabling the said pin to pass beneath the stop-pin 126.

To form an octagon, the limit-pin 119 is raised to bring the upper end thereof into position to engage with the stop-pin 126 so as to limit the movement of the indexing-handle 36 to one-eighth of a revolution, or three notches on the index-wheel. The procedure set forth in the formation of a hexagon is then repeated the required number of times to form an octagon. It will be obvious that the limit-pin 120 may be

set for forming a hexagon and the indexing-handle 36 moved twice for the rotation of the indexing-ring 26 eight notches or one-third revolution, which will result in the formation of a three-sided figure.

In the construction shown, both limit-pins 119 and 120 may be depressed at the same time so as to permit both the said pins to pass beneath the stop-pin 126 so as to enable the indexing-handle 36 to be swung through 90° or one-quarter of a revolution, which will result in the formation of a four-sided figure.

To enable articles of varying lengths to be held by the device herein described, the ejecting-rod 110 may be removed by uncoupling the link 108 from the said ejecting-rod. With the uncoupling of the link 108 from the ejecting-rod 110, the latter may be bodily removed from within the collet 20, which removal will allow the arm 102 to be swung clockwise, as viewed in Fig. 3 of the drawings, to a position axially in line with the shaft 99 upon which it is mounted. Oppositely located from the shaft 99 is a clamping-arm 127 pivotally mounted upon a pivot-pin 128 supported by the inner end of a stud 129. The clamping-arm 127 is adapted, upon occasion, to be swung clockwise, as viewed in Fig. 3 of the drawings, to a position beneath the collet 20, in which position a work-supporting rod (not shown) of the desired length may be clamped therein to replace the ejecting-rod 110.

It will be understood that in employing the clamping-arm 127 and the work-supporting rod carried thereby, that the removal of the article from the collet 20 must be effected by hand, though the release of the said article from the fixture may be accomplished in the manner previously described by the operation of the operating-handle 118. It will be apparent that the ejecting-rod 110 may be replaced by a similar one of any desired length capable of ejecting the article held by the collet 20, so as to enable articles of various lengths to be held by the said collet.

To hold the collet 20 in its open position, so as to facilitate its removal and replacement by one of a different size, a spring-blade 130 is mounted on the inner face of a closure-plate 131, the said closure-plate enclosing the coupling-bar 91, arms 89 and 90, and associated parts. The closure-plate 131 is provided at its respective opposite ends with the necessary clearance-notches for the passage of the handle 118 and the coupling-bar 91, the said plate being rigidly secured to the casing 10 by means of suitable screws. To hold the collet 20 in its open position, the blade 130 is pressed inwardly, as viewed in Fig. 3 of the drawings, in which position the free end thereof may engage with a latching-shoulder 132 provided on the outer face of the coupling-bar 91 when the said bar is in its collet-opening position. With the engagement of the spring-blade 130 with the latching-shoulder 132 when the coupling-bar 91 is in its collet-opening position, the collet 20 may be kept in its open position as long as is desired, with the pressure that normally tends to hold the said collet in its closed position removed.

Should it be desired to remove the collet 20 to be replaced by a similar one of a different size, the operating-handle 118 is depressed to release the tension on the said collet, as previously described, and the blade 130 engaged with the latching-shoulder 132, as above set forth. The coupling-member 52 is then disengaged from the

thrust-shoulder 39 to thereby permit the said collet to be rotated to bring the coupling-lugs thereof into registration with the notches 41-41 in the actuating-ring 40 to thereby permit the collet 20 to be axially withdrawn from the passage 18 in the head 17. To insert a new collet of different size, the procedure just set forth is reversed, that is, the shank of the collet is placed in the passage 18 and the coupling-lugs 37-37 thereof passed through the notches 41-41 in the actuating-ring 40, the said collet being then rotated to bring the said coupling-lugs into their proper position beneath the ribs 42-42 to be locked in coupled relation to the actuating-ring 40 by the coupling-member 52.

To facilitate the removal of the collet 20 the head 17 is suitably marked as at 17a, (Fig. 1) which mark when brought to the front face of the fixture indicates that the coupling-member 52 is in a position accessible to the operator. To assure the correct assembly of the head and associated parts with respect to the actuating-ring 40 and coupling-member 52 the pin 44a is employed.

As will be apparent from the foregoing, the provision of releasable collet-coupling means, such as the coupling-member 52, permits the ready removal and replacement of a collet of varying size, with consequent increase in efficiency and range of application to which the fixture may be employed.

It will thus be seen that a work-holding fixture is provided for firmly holding a large variety of articles, including screws, bolts, studs, etc., for having operations performed thereon by any suitable tool upon the completion of which, the article may be either automatically or manually released and ejected, leaving the jaws of the collet open for the insertion of a fresh article.

The invention may be carried out in other specific ways than those herein set forth without departing from the spirit and essential characteristics of the invention, and the present embodiments are, therefore, to be considered in all respects as illustrative and not restrictive, and all changes coming within the meaning and equivalency range of the appended claims are intended to be embraced therein.

I claim:

1. A device of the class described, including: a head, a collet seated therein, an actuating-ring with which the collet is detachably connected, means for holding the collet in engagement with the said actuating-ring, an index-ring connected to the head, an operating-ring, a pawl carried by said operating-ring to engage with said index-ring, and means for turning said operating-ring.

2. A device of the class described, including: a head, a collet seated therein and formed at its lower end with lugs, an actuating-ring formed with a central opening having inwardly-projecting segments with which the collet is detachably connected, an index-ring connected to the head, an operating-ring, a pawl carried by said operating-ring to engage with said index-ring, and means for turning said operating-ring.

3. A device of the class described, including: a head, a collet seated therein and formed at its lower end with segmental coupling-lugs and clearance notches, an actuating-ring formed with coupling ribs, said ribs being less in thickness than the thickness of said actuating-ring, whereby shoulders are formed having a diameter substantially equal to the diameter of the clearance-notches and the external diameter of the coupling-lugs.

4. A device of the class described, including: a head, a collet seated therein, an actuating-ring with which the collet is detachably connected, lifting arms on which the actuating-ring may rest, horizontal shafts having eccentric studs on which the lifting arms are supported, whereby said actuating-ring may be raised, springs tending to push the actuating-ring downward to hold the collet in gripping position, means for turning said shafts to raise the said actuating-ring, an index-ring connected to the head, an operating-ring, a pawl carried by said operating-ring to engage with said index-ring, and means for turning said operating-ring.

5. A device of the class described, including: a head, a collet seated therein, an actuating-ring with which the collet is detachably connected, lifting arms on which the actuating-ring may rest, horizontal shafts having eccentric studs on which the lifting arms are supported, whereby said actuating-ring may be raised, springs tending to push the actuating-ring downward to hold the collet in gripping position, and means for turning said shafts to raise the said actuating-ring, whereby the collet is moved to an open or closed position.

6. A device of the class described, including: a head, a collet seated therein, an actuating-ring with which the collet is detachably connected, lifting arms on which the actuating-ring may rest, horizontal shafts having eccentric studs on which the lifting arms are supported, whereby the said actuating-ring may be raised, pins mounted on said bottom-plate, springs mounted in the casing with which said pins coact to hold the collet in gripping position, means for turning said shafts to raise the said actuating-ring, an index-ring connected to the head, an operating-ring, a pawl carried by said operating-ring to engage with said index-ring, and means for turning said operating-ring.

7. A device of the class described, including: a head, a collet seated therein, an actuating-ring with which the collet is detachably connected, a gauge-rod in said collet, an ejector upon which said gauge-rod rests, means for moving the ejector to raise said rod, an index-ring connected to the head, an operating-ring, a pawl carried by said operating-ring to engage with said index-ring, and means for turning said operating-ring.

8. A device of the class described, including: a head, a collet seated therein, an actuating-ring with which the collet is detachably connected, a gauge-rod in said collet, an ejector upon which said gauge-rod rests, means for moving the ejector to raise said rod, said ejector extending through a cage comprising a plate above and parallel with the actuating-ring and connected therewith by pins, an index-ring connected to the head, an operating-ring, a pawl carried by said operating-ring to engage with said index-ring, and means for turning said operating-ring.

9. A device of the class described, including: a head, a collet seated therein, an actuating-ring with which the collet is detachably connected, lifting arms adapted to engage with the actuating-ring, horizontal shafts having eccentric studs on which the hangers are supported, whereby said actuating-ring may be raised, springs tending to push the actuating-ring downward to hold the collet in gripping position, means for turning said shafts to raise the said actuating-ring, a bar, links connecting said bar with said horizontal

shafts, an anchor for said bar, a handle on said bar, a kicker, a stop on said bar adapted to engage said kicker, an index-ring connected to the head, an operating-ring, a pawl carried by said
5 operating-ring to engage with said index-ring, and means for turning said operating-ring.

10 10. A device of the class described, including: a head, a collet seated therein, an actuating-ring with which the collet is detachably connected, lifting arms adapted to engage with the actuating-ring, horizontal shafts having eccentric studs on which the lifting arms are supported, whereby said actuating-ring may be raised,

springs tending to push the actuating-ring downward to hold the collet in gripping position, means for turning said shafts to raise the said bottom-plate, a bar, links connecting said bar with said horizontal shafts, an anchor for said bar, a handle on said bar, means for locking the bar to hold the collet in open position, a kicker, a stop on said bar adapted to engage said kicker, an index-ring connected to the head, an operating-ring, a pawl carried by said operating-ring
5 10 to engage with said index-ring, and means for turning said operating-ring.

J. W. DEARBORN.