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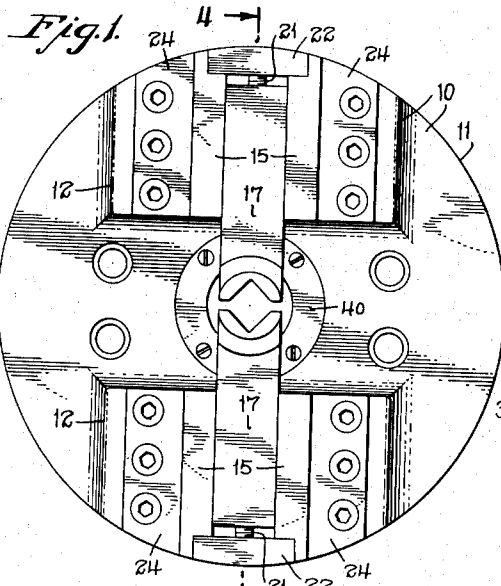
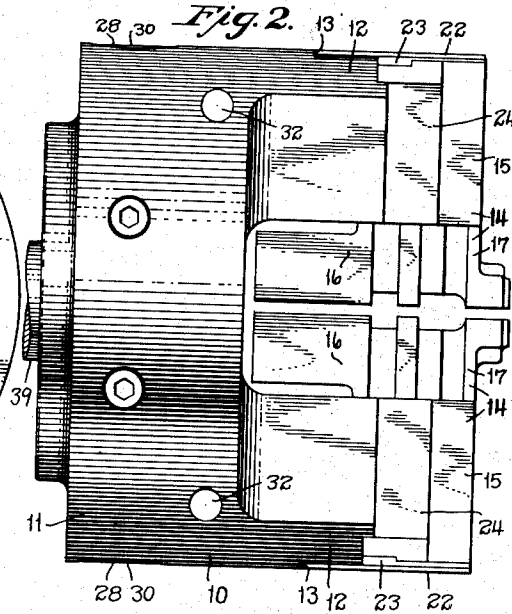
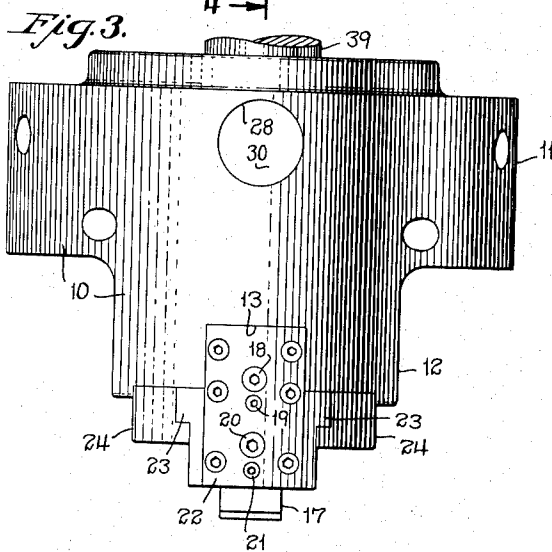
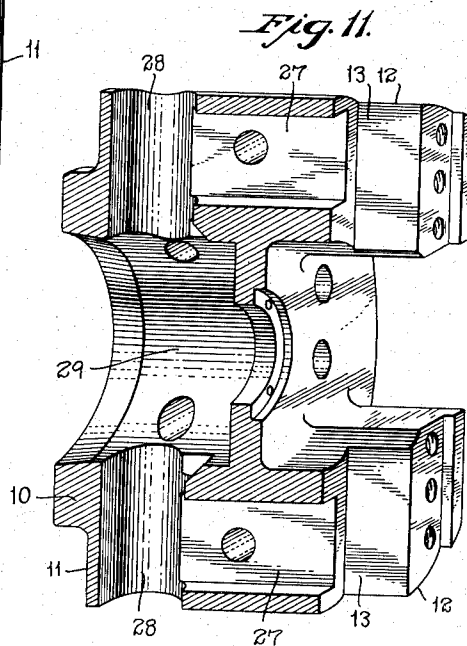
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2,657,068

CHUCK

Filed June 28, 1949

5 Sheets-Sheet 1



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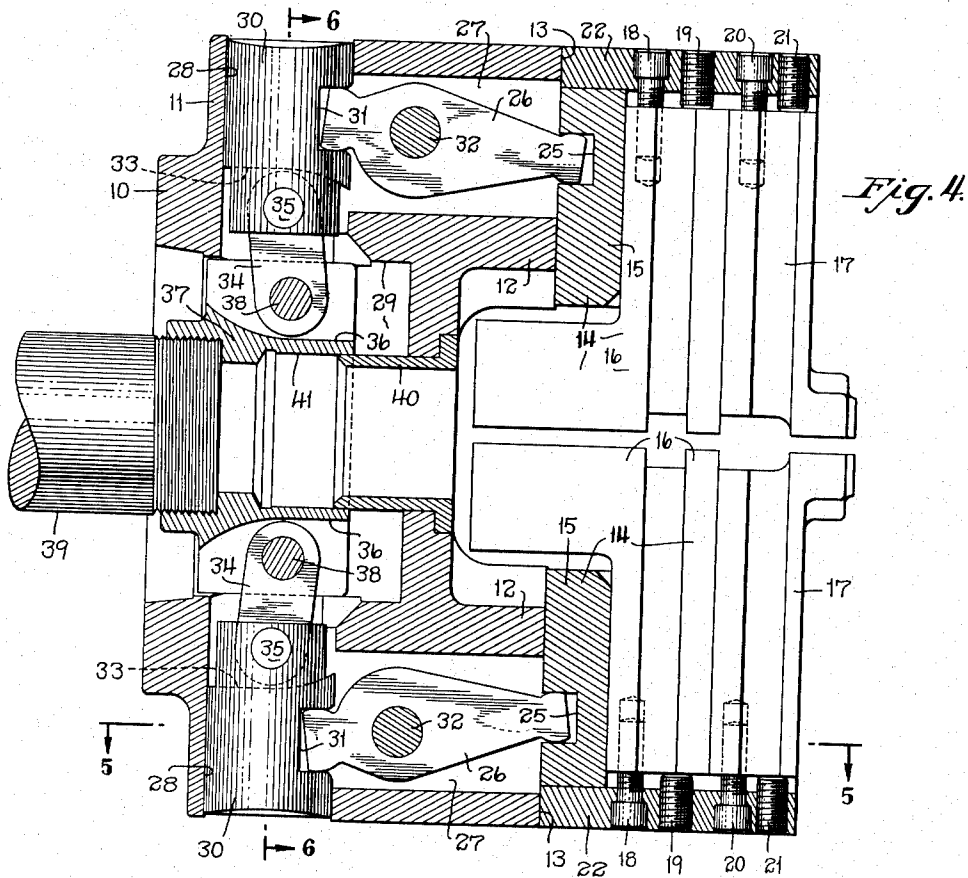
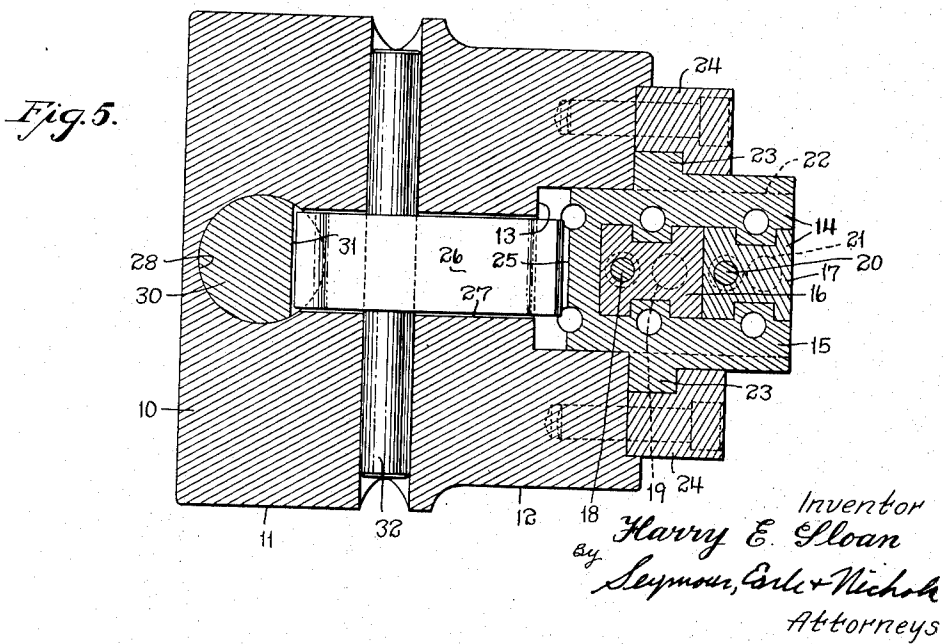
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*Fig. 6.*

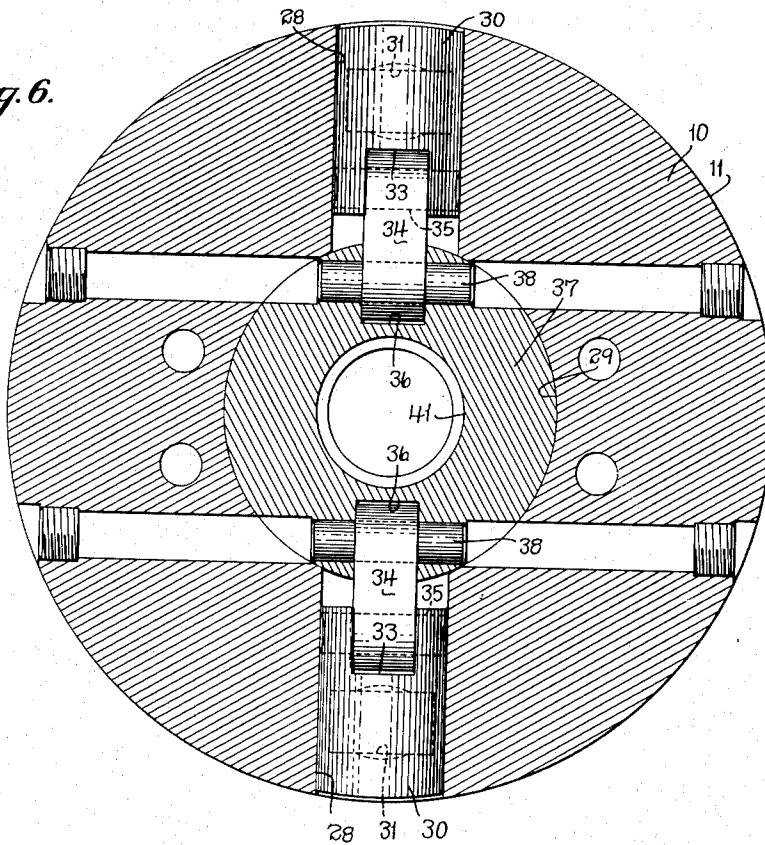


*Fig. 8.*

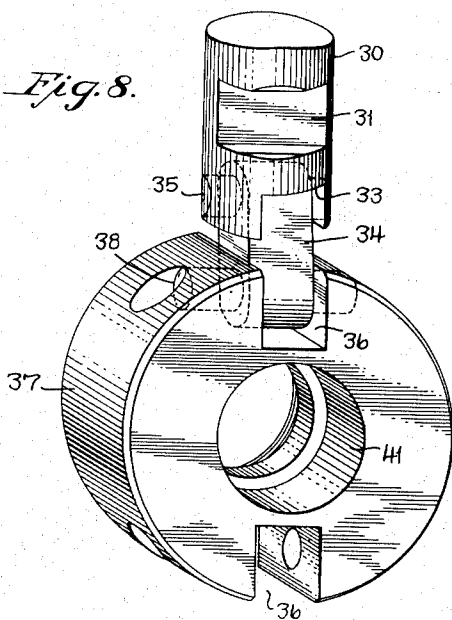
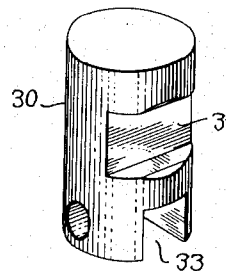


*Fig. 9.*



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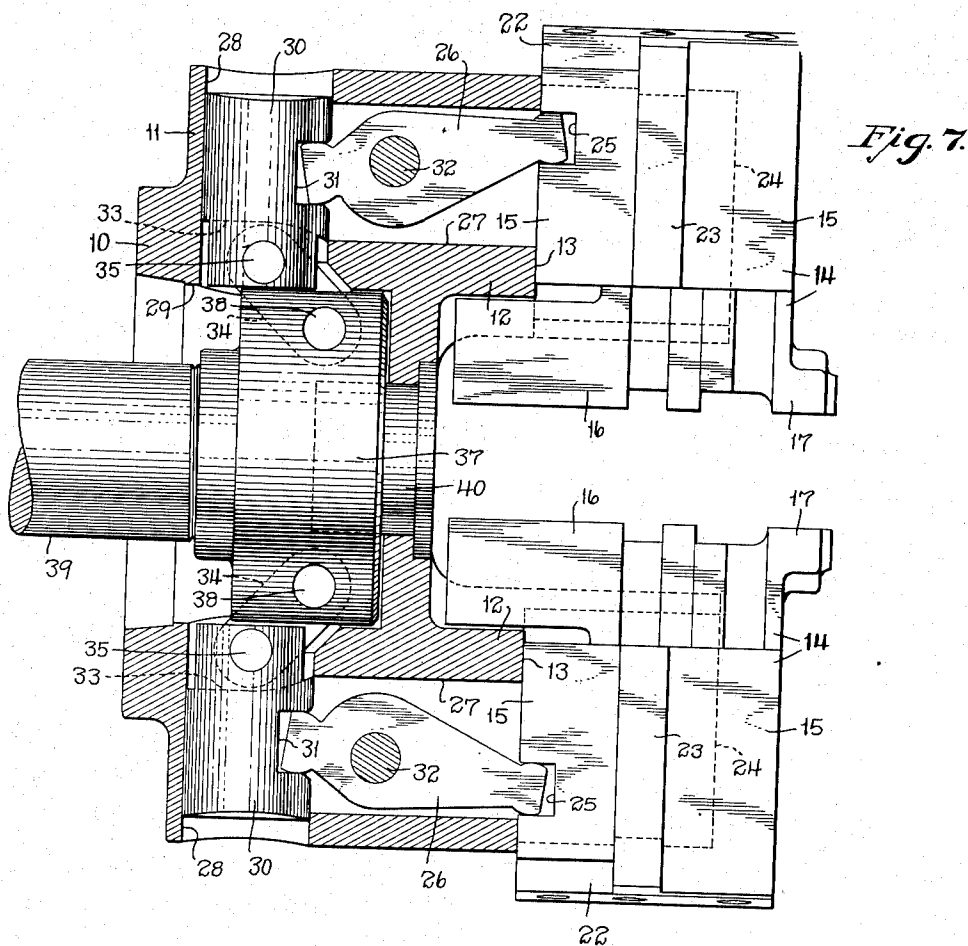
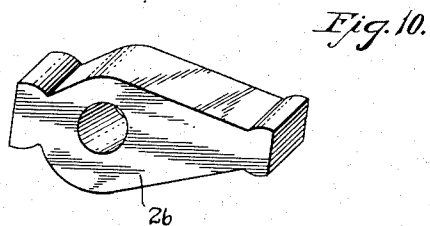
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Fig. 12.

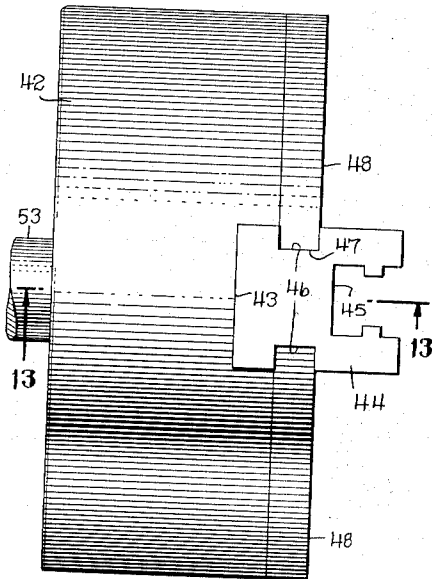


Fig. 14.

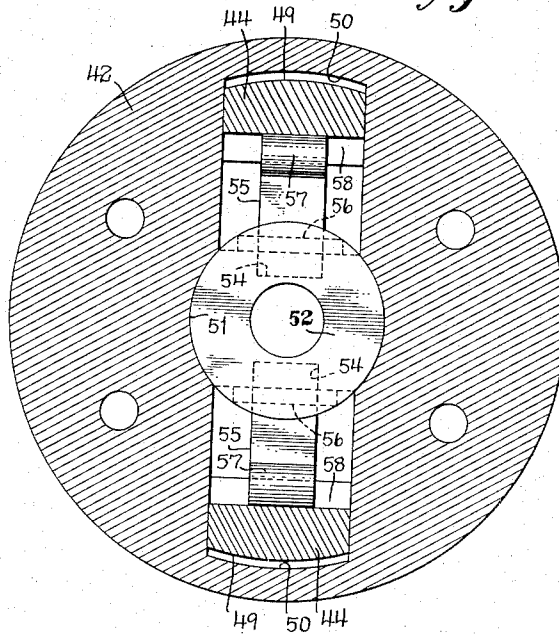


Fig. 15.

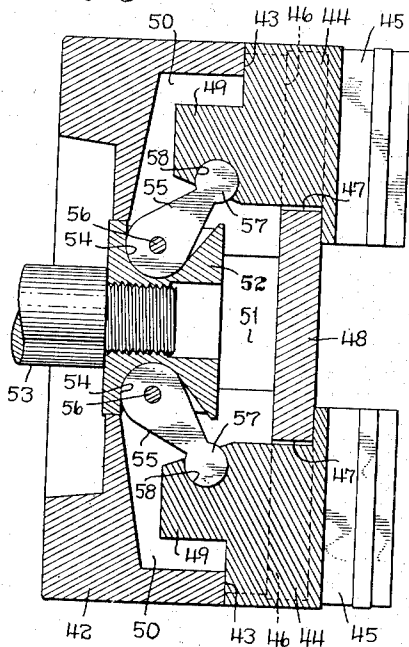
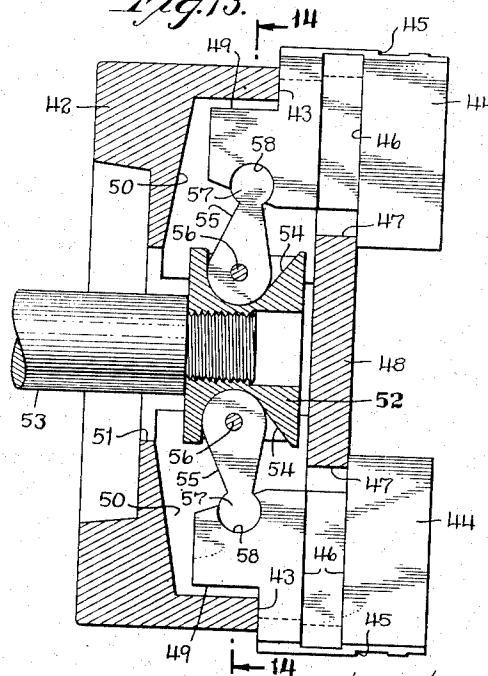


Fig. 13.



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## UNITED STATES PATENT OFFICE

2,657,068

CHUCK

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Application June 28, 1949, Serial No. 101,806

7 Claims. (Cl. 279-118)

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The present invention relates to improvements in chucks having movable jaws for holding work-pieces to be machined or for holding tools for performing operations upon such work-pieces.

One of the main objects of the present invention is to provide a superior chuck of the character referred to and having relatively-large jaw-movements in order to allow for the reception of work-pieces having bosses, bulges or other projections.

A further object of the present invention is to provide a superior chuck having movable jaws and combining large jaw-movement with a very powerful gripping action when the gripping-jaws are in their closed or gripping positions.

Another object of the present invention is to provide a superior chuck of the character referred to and having the operating-means for its gripping-jaws so constructed and arranged as not only to firmly grip a work-piece or the like but to effectively resist the jaw-opening tendencies of centrifugal forces when the chuck is being rotated at high speeds.

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.

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

Fig. 1 is a face view of one form of chuck embodying the present invention;

Fig. 2 is a view thereof in side elevation;

Fig. 3 is a top or plan view thereof;

Fig. 4 is a view mainly in central-longitudinal section on the line 4-4 of Fig. 1 but on a larger scale and with some of the parts left in elevation and with the gripping-jaws shown in their closed position;

Fig. 5 is a detailed sectional view taken on the line 5-5 of Fig. 4;

Fig. 6 is a transverse sectional view taken on the line 6-6 of Fig. 4;

Fig. 7 is a central-longitudinal sectional view similar to Fig. 4 but showing the gripping-jaws in their retired position;

Fig. 8 is a perspective view of a group of elements comprising the operating-head, a toggle-link and a jaw-operating plunger;

Fig. 9 is a perspective view of one of the jaw-operating plungers, detached;

Fig. 10 is a similar view of one of the jaw-operating levers, detached;

Fig. 11 is a sectional perspective view of the body;

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Fig. 12 is a top or plan view of another form of chuck constructed in accordance with the present invention with the jaws in their closed position;

Fig. 13 is a central-longitudinal sectional view taken on the line 13-13 of Fig. 12;

Fig. 14 is a transverse sectional view taken on the line 14-14 of Fig. 13; and

Fig. 15 is a view similar to Fig. 13 but showing the jaws in their outermost position.

#### THE STRUCTURE OF FIGS. 1 TO 11 INCLUSIVE

The particular chuck chosen for illustration in Figs. 1 to 11 of the accompanying drawings for purposes of making clear a preferred form of the present invention, includes a body generally designated by the reference character 10 and comprising, in the main, a rear disk-like portion 11 from which forwardly projects two integral arms 12-12 arranged diametrically opposite each other and having their outer peripheries flush with the outer periphery of the said disk-like portion 11.

In its forward face, each of the arms 12-12 of the body 10 is formed with a substantially-radial guideway 13 opening forwardly through the arm in which it is formed and intersecting both the outer periphery and the inner surface thereof, as is especially well shown in Fig. 11.

Mounted in each of the guideways 13-13 is one of two similar gripping-jaw units each generally designated by the reference character 14. Each of the said units comprises a jaw-carrier 15 and, in the present instance, two independently-adjustable gripping-jaws 16 and 17. The particular nature of the gripping-jaws 16 and 17 and the jaw-carrier 15 is not essential to the present invention and with respect thereto it is believed sufficient to state that as organized in the jaw-carrier 15, the gripping-jaws 16 and 17 may be respectively independently adjusted in a direction substantially radially of the body 10 by means of oppositely-acting adjusting-screws 18-19 and 20-21 indicated in Figs. 3 and 4. The said adjusting-screws 18-19 and 20-21 extend inwardly through a cap-plate 22 rigidly secured to the outer end of the adjacent jaw-carrier 15.

Each jaw-carrier 15 is formed on each of its respective opposite sides with one of two longitudinal guide-ribs 23-23 (Fig. 5) respectively engaged by retaining-plates 24-24 firmly secured to the forward face of the adjacent arm 12 of the body 10 on each of the respective opposite sides of the jaw-carrier 15.

As before noted, the particular character of

the gripping-jaw units 14 forms no essential feature of the present invention, since under some circumstances each thereof may be of one-piece structure, but which in the present instance are shown as having two independently-movable gripping-jaws to adapt it for a special task and to enable the gripping-jaws to be replaced when desired.

Each jaw-carrier 15 is formed in its rear face about midway of its length with a transverse rearwardly-opening coupling-notch 25 receiving the cylindrically-contoured forward terminal of one of two similar jaw-operating levers 26—26. Each jaw-operating lever 26 is accommodated in one of two similar clearance-passages 27—27 respectively formed at diametrically-opposite points in the body 10. At its forward end, each clearance-passage 27 intersects the adjacent guideway 13 and at its rear end intersects the adjacent one of two similar guide-bores 28—28. The guide-bores 28—28 are respectively located diametrically opposite each other and extend in a radial direction in the disk-like portion 11 of the body respectively to the rear of the gripping-jaw units 14, as is especially well shown in Figs. 4, 5 and 7.

Preferably, the guide-bores 28 above referred to are of cylindrical form in cross section and at their outer ends intersect the outer periphery of the body 10 and at their inner ends intersect a recess 29 formed in and opening rearwardly through the rear portion of the body 10. Preferably and as shown, the recess 29 has the major portion of its length cylindrically contoured and is arranged coaxially with respect to the body 10 in which it is formed.

Respectively mounted for reciprocation in the guide-bores 28—28 and in a direction radially with respect to the body 10, are two jaw-operating plungers 30—30. Each jaw-operating plunger 30 is formed with a forwardly-opening transverse coupling-notch 31 receiving the cylindrically-contoured rear terminal of the adjacent jaw-operating lever 26, as is especially well shown in Figs. 4 and 7. Each of the said jaw-operating levers 26, as before noted, is located in one of the clearance-passages 27—27 in the body 10 and is mounted intermediate its front and rear ends for pivotal movement therein upon one of two similar transverse pivot-pins 32—32.

In addition to its coupling-notch 31, each jaw-operating plunger 30 is formed in its inner end with an inwardly-opening diametrical notch 33 receiving the outer end of the adjacent one of two similar toggle-links 34—34. The outer end of each toggle-link 34 just referred to is pivotally connected to its complemental plunger 30 by means of a pivot-pin 35 extending diametrically through the notched inner end of the said plunger and through the toggle-link 34.

The respective inner ends of the toggle-links 34—34 are entered into one of two notches 36—36 respectively formed at diametrically-opposite locations in the outer periphery of an operating-head 37 mounted for reciprocation axially within the recess 29 in the body 10. The said operating-head has a cylindrical periphery and has a smooth sliding fit in the cylindrical portion of the recess 29 above referred to, while the notches 36 therein extend from front to rear through the said operating-head in a direction parallel with the central-longitudinal axis of the device. The inner end of each of the toggle-links 34 is pivotally connected to the operating-head 37 by one of two similar pivot-pins 38—38 mounted in the

operating-head 37 and respectively extending across the notches 36—36 and through the inner end of the complemental toggle-link 34, as is especially well indicated in Fig. 6.

Threaded into the rear portion of the operating-head 37 or otherwise coupled thereto, is a reciprocative actuating-rod 39 indicated in Figs. 4 and 7.

Rigidly mounted in the portion of the body 10 lying immediately forwardly of the recess 29 therein, is an axially-arranged guard-sleeve 40 projecting rearwardly into the axial bore 41 in the operating-head 37 with a smooth sliding fit. The said guard-sleeve 40 serves to prevent chips or other foreign matter from having access to the recess 29 in which the operating-head 37 reciprocates.

#### *Operation of the structure of Figs. 1 to 11 inclusive*

In the particular instance shown, the gripping-jaw units 14 are adapted to be moved inwardly to substantially the extreme indicated in Fig. 4, to firmly grip any desired work-piece or the like, and further to be retired outwardly into substantially the positions shown in Fig. 7, to disengage from the work-piece and to receive another work-piece or the like, even though such work-piece may have bosses, bulges, or other projections which might interfere with their insertion between the said jaw-units, were the degree of movement of the latter not as extensive as is here provided.

When the gripping-jaw units 14 are in their gripping positions as indicated in Figs. 1, 2 and 4, the toggle-links 34 stand substantially on "dead-center" (Fig. 4), thereby applying the maximum outward thrust upon the jaw-operating plungers 30. The said plungers, in turn, have their movements multiplied by the very rigid jaw-operating levers 26 so that the gripping-jaw units 14 not only move to a relatively-greater extent than do the plungers 30, but the said units are firmly held in their closed positions.

When the operating-head 37 is moved forwardly relative to the body 10 by means of the actuating-rod 39 or its equivalent, the toggle-links 34 will, so to speak, "collapse" into substantially the positions in which they are shown in Fig. 7, thereby drawing the jaw-operating plungers 30—30 inwardly. The inward movement of the jaw-operating plungers 30—30 will, in turn, cause the forward ends of the jaw-operating levers 26—26 to move outwardly, with the result that the gripping-jaw units will be moved outwardly to a greater degree than the jaw-operating plungers have moved inwardly—all as will be fully apparent by a comparison of the showings of Figs. 4 and 7.

When a work-piece to be operated upon is inserted between the now widely-open gripping-jaw units 14, rearward draft may be applied to the actuating-rod 39, to thereby shift the operating-head 37 rearwardly within the body 10 and along with it the inner ends of the complemental toggle-links 34—34. As the inner ends of the toggle-links 34—34 are moved rearwardly, the rate of outward movement of the jaw-operating plungers 30 will progressively diminish, while the effective force applied to the plungers 30—30 will progressively increase until the said toggle-links 34—34 have assumed substantially the dead-center position in which they are indicated in Fig. 4 and in which they are substantially self-lock-

ing.

Thus, by means of the linkages employed, the gripping-jaw units 14 or their equivalent have their most rapid movement as they are initially moved inwardly with a progressively-decreasing rate of movement until they seat against the work, whereupon the effective gripping force applied thereto is strongest when the parts have reached substantially the positions in which they are shown in Fig. 4.

In many uses, chuck structures are required to revolve at very high speed in order to rotate a work-piece with respect to relatively-stationary tools, and consequently there is a very considerable tendency for jaw-members to move radially outwardly, due to the effects of centrifugal force.

By means of the construction and arrangement of parts exemplified by the chuck illustrated in the accompanying drawings, the effects of centrifugal force as above referred to, are firmly resisted, so that despite relatively-high speeds at which the entire chuck structure may be rotated, the grip of the gripping-jaw units 14 or their equivalent upon the work-piece is not appreciably relaxed.

#### THE STRUCTURE OF FIGS. 12 TO 15 INCLUSIVE

In the previously-described chuck structure, the toggle-links 34 were under lengthwise compressive strain when the gripping-jaw units were moved inwardly to clamp a work-piece or the like. In the chuck structure now to be described, the toggle-links, equivalent to the previously-described toggle-links 34, are under compressive strain when the jaw-carriers and such gripping-jaws as may be carried thereby are moved outwardly to engage interior surfaces within a work-piece or the like.

In the structure of Figs. 12 to 15 inclusive, there is employed a body 42 having in its forward face two oppositely-disposed guideways 43—43 extending in a radial direction and each receiving with a smooth sliding fit one of two similar jaw-carriers 44—44 which may form parts of any suitable gripping-jaw units or which may, themselves, be directly engaged with a work-piece or the like to thus function as gripping-jaws. In the instance shown, each jaw-carrier 44 is formed with a ribbed channel or guideway 45 in which may be mounted a relatively-adjustable gripping-jaw (not shown) of any suitable character.

Each jaw-carrier 44 is formed in each of its respective opposite sides with one of two corresponding guide-grooves 46—46 (Fig. 12) which receive with a smooth sliding fit the respective opposite edge-portions of a clearance-notch 47 formed in a retaining-plate 48 rigidly secured in any suitable manner to the front face of the body 42. The respective clearance-notches 47 for the jaw-carriers 44—44 are located diametrically opposite each other respectively in registration with the guideways 43—43 in the body 42.

Each jaw-carrier 44 is formed with a rearwardly-projecting lug 49 which is freely accommodated in one of two similar recesses 50—50 formed in the body 42 respectively to the rear of the guideways 43—43. The inner end of each recess 50 intersects a cylindrically-contoured recess 51 formed in the body 42 and extending axially therein.

Mounted in the axial recess 51 in the body 42 for reciprocation therein in an axial direction,

is a ring-like operating-head 52. Preferably and as shown, the said operating-head 52 has threaded thereinto the forward end of an actuating-rod 53, by means of which the said operating-head may be reciprocated in an axial direction.

Respectively at diametrically-opposite points therein, the operating-head 52 is formed with one of two similar recesses 54—54 each receiving the cylindrically-contoured inner end of one of two similar toggle-links 55—55 adapted to pivot therein. For the purpose of retaining the inner ends of the toggle-links 55 in their respective recesses 54, there are provided two similar pivot-pins 56—56, one of which extends through the inner end of each of said toggle-links and is supported at its respective opposite ends in the wall-portions of the adjacent recess 54.

Each toggle-link 55 is formed at its outer end with a cylindrically-contoured terminal 57 of considerably more than a half-circle in extent and snugly fitting into a cylindrically-contoured groove 58, one of which is formed in the inner portion of each of the lugs 49 respectively forming integral parts of the jaw-carriers 44—44, as is especially well shown in Figs. 13 and 15.

Each groove 58 is of greater extent than a half-circle in a transverse direction so that when one of the cylindrically-contoured terminals 57 is installed therein by edgewise insertion, the adjacent toggle-link 55 will be coupled to the adjacent jaw-carrier 44 so as to, when needed, exert an inward draft thereon, in a manner as will hereinafter appear. The respective cylindrically-contoured terminals 57—57 and their complementary cylindrically-contoured grooves 58—58 provide the means for connecting the respective toggle-links 55—55 to the complementary jaw-carriers 44—44 or their equivalent.

#### Operation of the structure of Figs. 12 to 15 inclusive

As previously indicated, the chuck structure of Figs. 12 to 15 inclusive is primarily designed for use in gripping interior surfaces of work-pieces by moving its jaw-carriers outwardly away from each other, though available for other uses.

If the parts are considered as being in their retired positions as shown in Fig. 15, a forward thrust applied to the actuating-rod 53 will move the operating-head 52 forwardly. The described forward movement of the operating-head 52 will similarly move the respective inner ends of the toggle-links 55—55, which latter will pivot about their respective pivot-pins 56—56 and upon the curved bottoms of their respective recesses 54—54. Through the intermediary of the respective terminals 57—57 and grooves 58—58, the said toggle-links will exert a powerful outward force upon the jaw-carriers 44—44 until ultimately the parts reach substantially the positions in which they are shown in Fig. 13.

As the inner ends of the toggle-links 55—55 are moved forwardly as above described, the rate of outward movement of the jaw-carriers 44—44 will progressively diminish, while the effective force applied to the said jaw-carriers will correspondingly progressively increase until the toggle-links 55—55 have assumed substantially their dead-center positions in which they are indicated in Fig. 13, and in which position they are substantially self-locking.

When it is desired to retire the jaw-carriers 44—44 inwardly to release the grip upon the

interior surfaces of a work-piece, the actuating-rod 53 may be moved rearwardly from the position in which it is indicated in Fig. 13 into the position in which it is indicated in Fig. 15, thereby inwardly collapsing the said jaw-carriers 44-44 and such gripping-jaws (if any) as may be carried thereby.

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 chuck of the character described and including in combination: a body; a plurality of gripping-jaws carried by and movable with respect to the said body toward and away from each other; and operating-means concurrently moving the said gripping-jaws as described, the said operating-means including an operating-head reciprocally connected to the said body and movable with respect thereto in substantial parallelism with the central-longitudinal axis thereof, a plurality of reciprocative jaw-operating plungers also reciprocally connected to the said body for movement substantially perpendicularly with respect to the direction of movement of the said operating-head, a plurality of toggle-links each having its outer end pivotally connected to one of the said jaw-operating plungers and each having its inner end pivotally connected to the said operating-head, and a plurality of jaw-operating levers pivotally connected intermediate their respective opposite ends to the said body and each having one end pivotally connected to one of the said jaw-operating plungers and each having its opposite end pivotally connected to one of the said gripping-jaws.

2. A chuck of the character described and including in combination: a body having an axial recess; a plurality of gripping-jaws carried by and movable with respect to the said body toward and away from each other; and operating-means concurrently moving the said gripping-jaws as described, the said operating-means including an operating-head reciprocally mounted in the recess in the said body and movable with respect thereto in substantial parallelism with the central-longitudinal axis of the said body, a plurality of reciprocative jaw-operating plungers also reciprocally connected to the said body for movement substantially perpendicularly with respect to the direction of movement of the said operating-head, a plurality of toggle-links each having its outer end pivotally connected to one of the said jaw-operating plungers and each having its inner end pivotally connected to the said operating-head within the said body, and a plurality of jaw-operating levers pivotally connected intermediate their respective opposite ends to the said body and each having one end pivotally connected to one of the said jaw-operating plungers and each having its opposite end pivotally connected to one of the said gripping-jaws.

3. A chuck of the character described and including in combination: a body; a plurality of gripping-jaws carried by and movable with respect to the front portion of the said body toward and away from each other; and operating-

means concurrently moving the said gripping-jaws as described, the said operating-means including an operating-head reciprocally connected to the rear portion of the said body and movable with respect thereto in substantial parallelism with the central-longitudinal axis thereof, a plurality of reciprocative jaw-operating plungers also reciprocally connected to the rear portion of the said body for movement substantially perpendicularly with respect to the direction of movement of the said operating-head, a plurality of toggle-links each having its outer end pivotally connected to one of the said jaw-operating plungers and each having its inner end pivotally connected to the said operating-head, and a plurality of jaw-operating levers extending from front to rear in the said body and pivotally connected intermediate their respective opposite ends to the said body, each of the said levers having its front end pivotally connected to one of the said jaw-operating plungers and each having its rear end pivotally connected to one of the said gripping-jaws.

4. A chuck of the character described and including in combination: a body; a plurality of gripping-jaws carried by and movable with respect to the front portion of the said body toward and away from each other; and operating-means concurrently moving the said gripping-jaws as described, the said operating-means including an operating-head reciprocally connected to the rear portion of the said body and movable with respect thereto in substantial parallelism with the central-longitudinal axis thereof, a plurality of reciprocative jaw-operating plungers also reciprocally connected to the rear portion of the said body for movement substantially perpendicularly with respect to the direction of movement of the said operating-head, a plurality of toggle-links each having its outer end pivotally connected to one of the said jaw-operating plungers and each having its inner end pivotally connected to the said operating-head, and a plurality of jaw-operating levers extending from front to rear in the said body and pivotally connected intermediate their respective opposite ends to the said body, each of the said levers having its front end pivotally connected to one of the said jaw-operating plungers and each having its rear end pivotally connected to one of the said gripping-jaws.

5. A chuck of the character described and including in combination: a body; a plurality of gripping-jaws carried by and movable with respect to the said body toward and away from each other; and operating-means concurrently moving the said gripping-jaws as described, the said operating-means including a reciprocative operating-head carried by the said body and movable with respect thereto in substantial parallelism with the central-longitudinal axis thereof, the said operating-head being provided in its outer periphery with a plurality of notches, a plurality of reciprocative jaw-operating plungers carried by the said body, a plurality of toggle-links each having its outer end pivotally connected to one of the said jaw-operating plungers and having its inner end extended into one of the notches in the said operating-head and pivotally connected thereto, and a plurality of jaw-operating levers pivotally connected intermediate their respective opposite ends to the said body and each having its rear end pivotally connected to one of the said jaw-operating plungers and each of the said jaw-operating levers having its forward end piv-

totally connected to one of the said gripping-jaws.

6. A chuck of the character described and including in combination: a body; a plurality of gripping-jaws carried by and movable with respect to the said body toward and away from each other; and operating-means concurrently moving the said gripping-jaws as described, the said operating-means including a reciprocative operating-head carried by the said body and movable with respect thereto in substantial parallelism with the central-longitudinal axis thereof, a plurality of reciprocative jaw-operating plungers carried by the said body and each having a notch in its inner end, a plurality of toggle-links each having its outer end extended into the notch of one of the said jaw-operating plungers and pivotally connected thereto, each of the said toggle-links having its inner end pivotally connected to the said operating-head, and a plurality of jaw-operating levers pivotally connected intermediate their respective opposite ends to the said body and each having its rear end pivotally connected to one of the said jaw-operating plungers and each of the said jaw-operating levers having its forward end pivotally connected to one of the said gripping-jaws.

7. A chuck of the character described and including in combination: a body; a plurality of gripping-jaws carried by and movable with respect to the said body toward and away from each other; and operating-means concurrently moving the said gripping-jaws as described, the said operating-means including a reciprocative operating-head mounted in the said body and movable with respect thereto in substantial parallelism with the central-longitudinal axis thereof, the said operating-head being provided in its

outer periphery with a plurality of notches; a plurality of reciprocative jaw-operating plungers carried by the said body in locations radially outwardly with respect to the said operating-head, the said jaw-operating plungers each having a notch in its inner end and being reciprocative in the said operating-head in substantially-radial directions and in substantial parallelism with respect to the direction of movement of one of the said gripping-jaws; a plurality of toggle-links each having its outer end extended into the notch of one of the said jaw-operating plungers and pivotally connected thereto, each of the said toggle-links having its inner end extended into one of the notches in the said operating-head and pivotally connected thereto; and a plurality of jaw-operating levers extending in substantial parallelism with the direction of movement of the said operating-head and pivotally connected intermediate their respective opposite ends to the said body, each of the said levers having its rear end pivotally connected to one of the said jaw-operating plungers and each having its forward end pivotally connected to one of the said gripping-jaws.

HARRY E. SLOAN.

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