No. 814,648. PATENTED MAR. 6, 1906.

B. M. W. HANSON.

CHUCK FOR METAL WORKING MACHINES.

APPLICATION FILED JUNE 6, 1903.

3 SHEETS—SHEET 1.

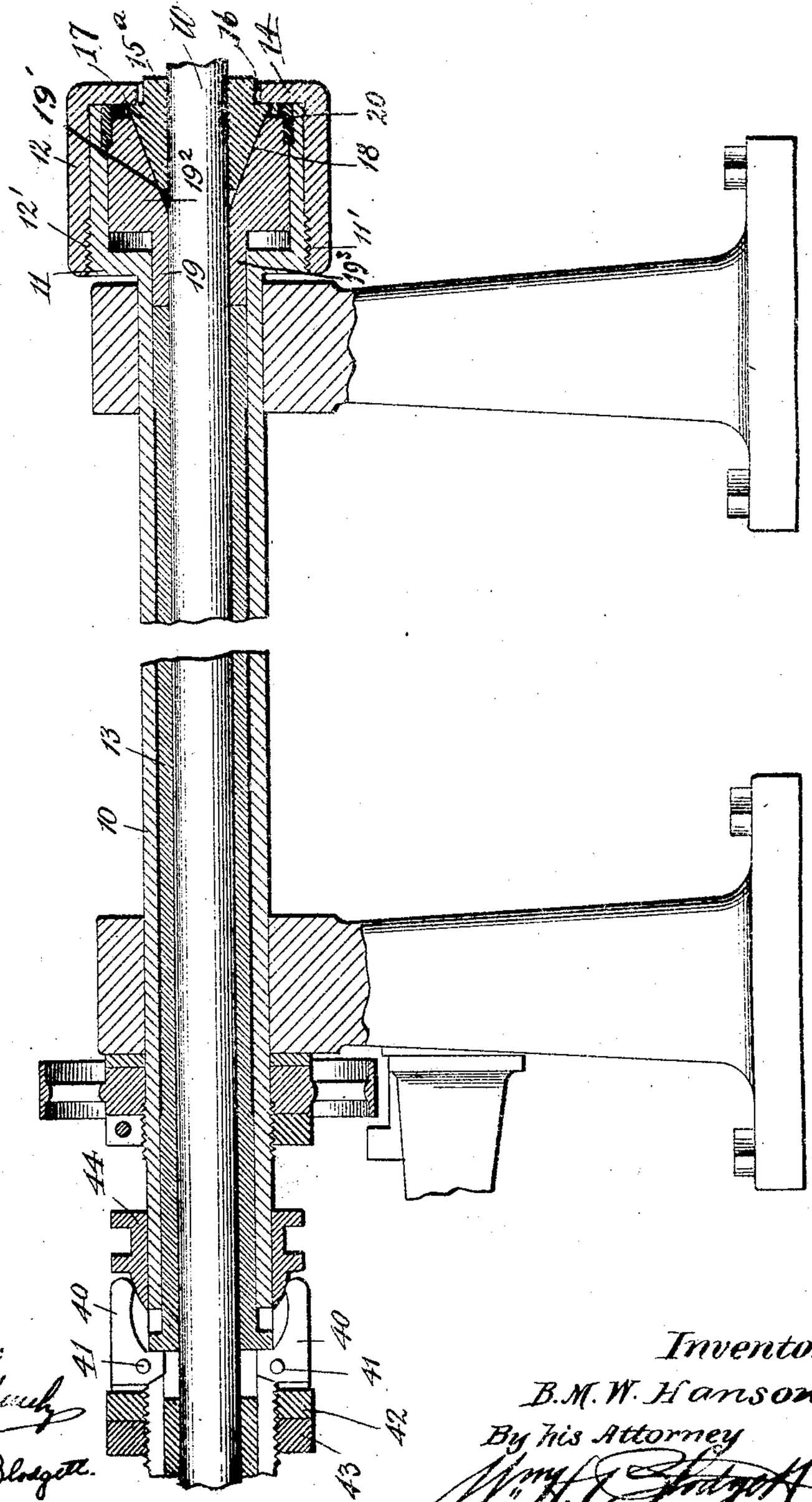


Fig. 1.

Witnesses:
Chas. P. Edwards
Frances E. Blodgett.

Inventor:
B. M. W. Hanson,
By his Attorney
Wm. H. Blodgett

No. 814,648. PATENTED MAR. 6, 1906.

B. M. W. HANSON.

CHUCK FOR METAL WORKING MACHINES.

APPLICATION FILED JUNE 6, 1903.

3 SHEETS—SHEET 2.

Fig. 2.

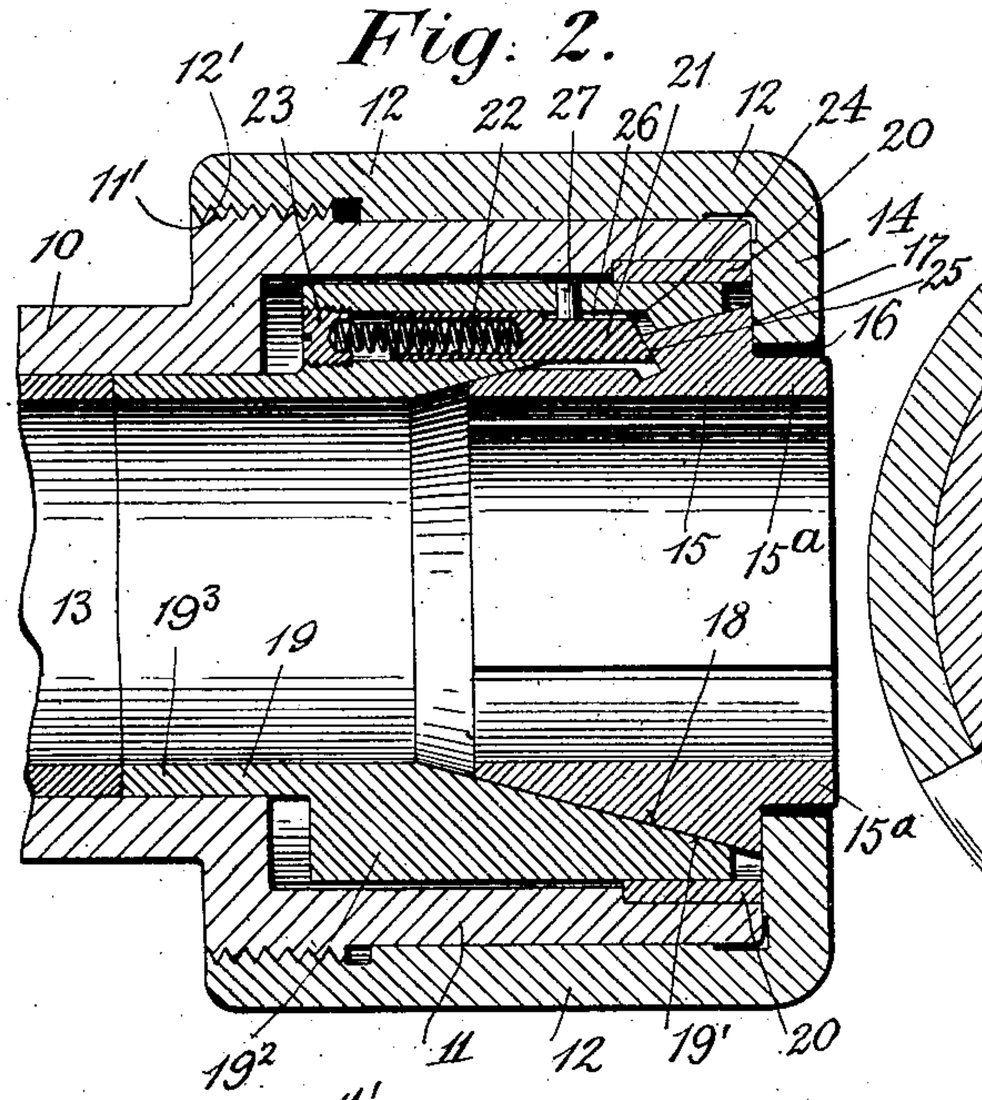


Fig. 3.

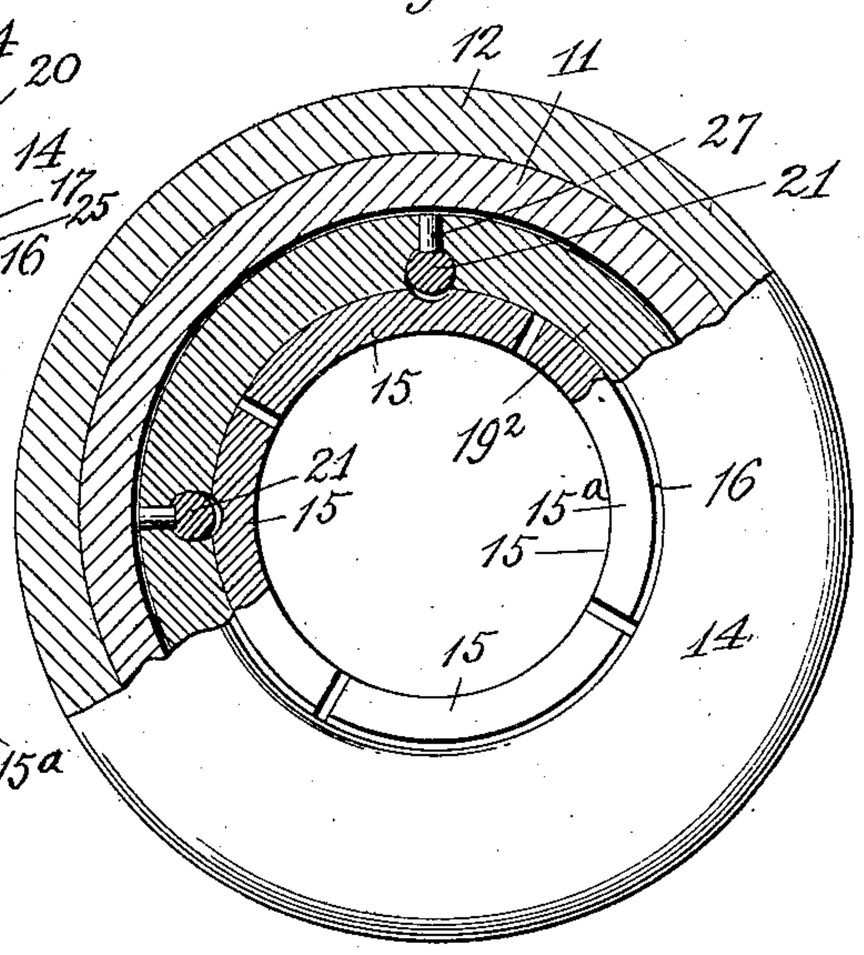


Fig. 4.

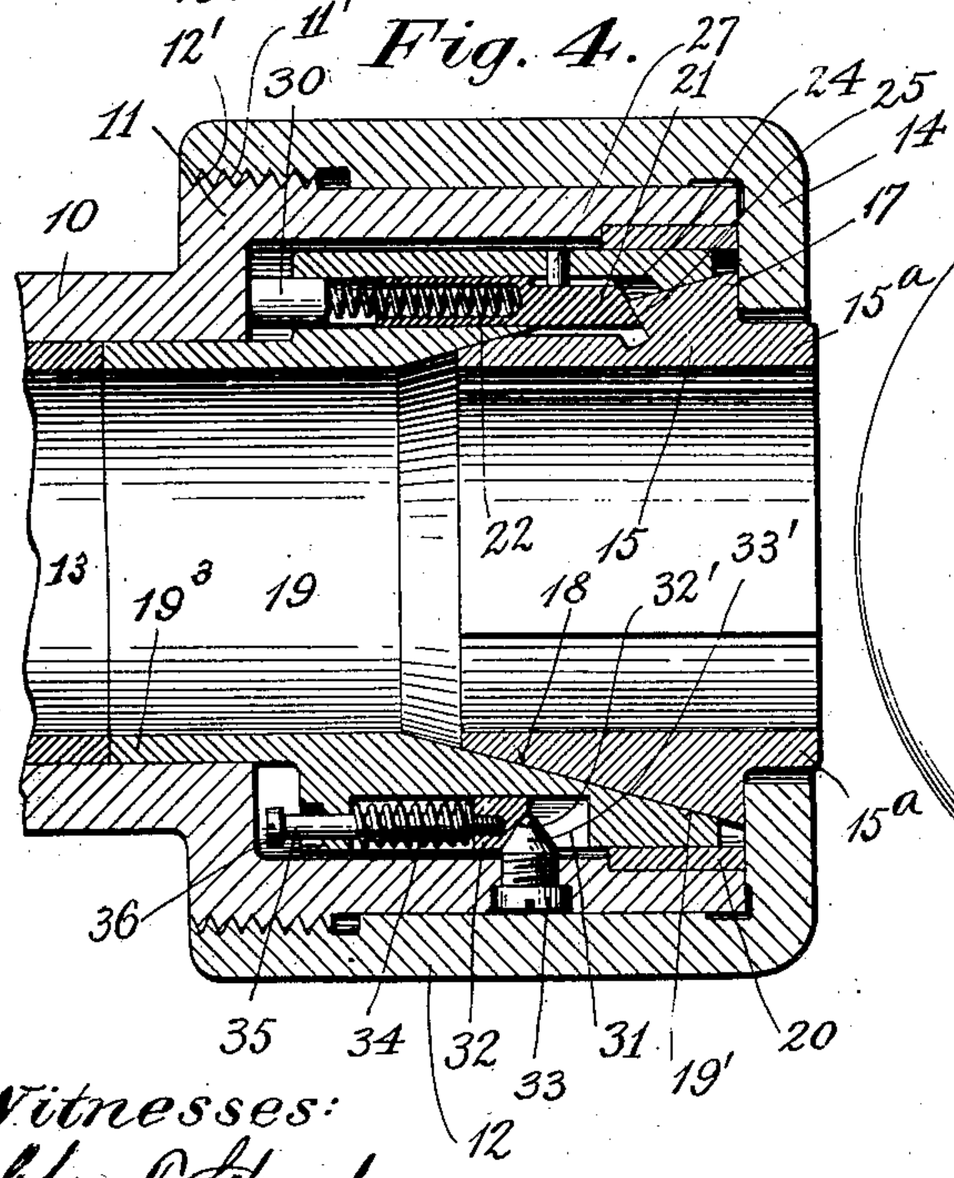
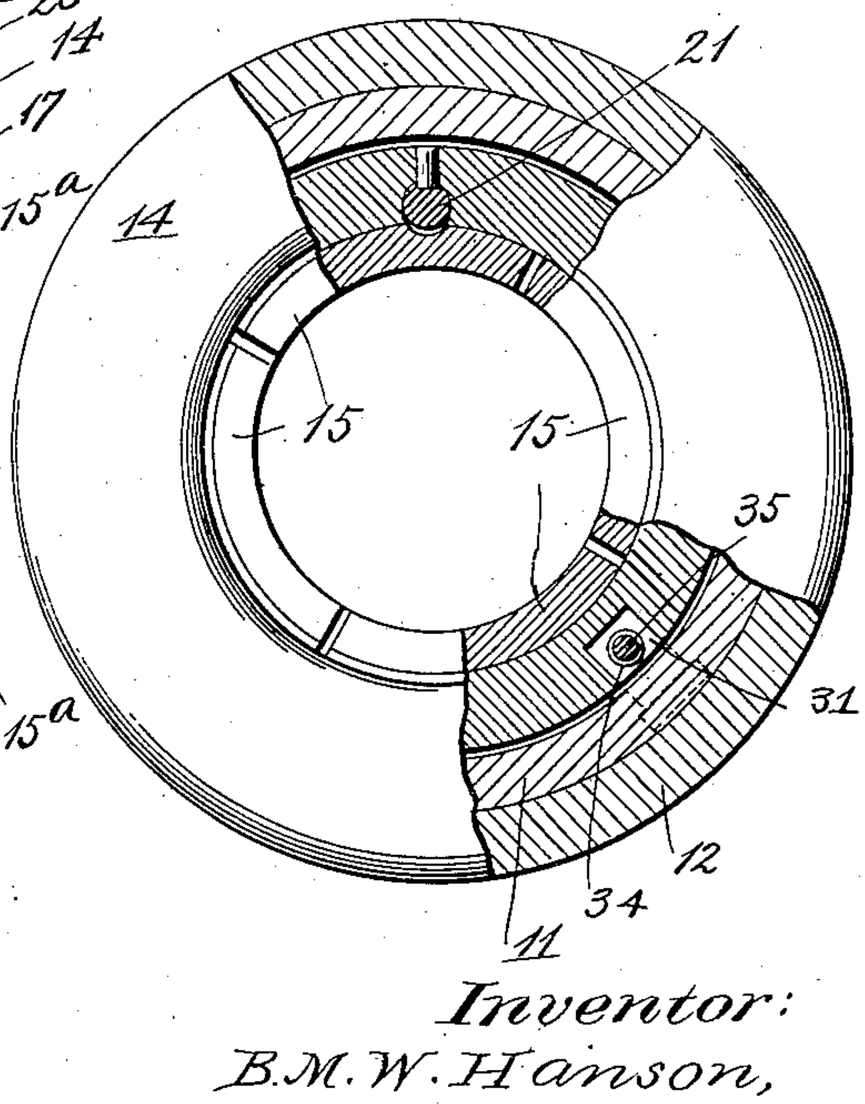


Fig. 5.



Witnesses:
Chas. F. Schmelz
Frances E. Blodgett.

Inventor:
B. M. W. Hanson,
By his Attorney
Wm. H. C. Blodgett

No. 814,648. PATENTED MAR. 6, 1906.

B. M. W. HANSON.

CHUCK FOR METAL WORKING MACHINES.

APPLICATION FILED JUNE 6, 1903.

3 SHEETS—SHEET 3.

Fig. 6.

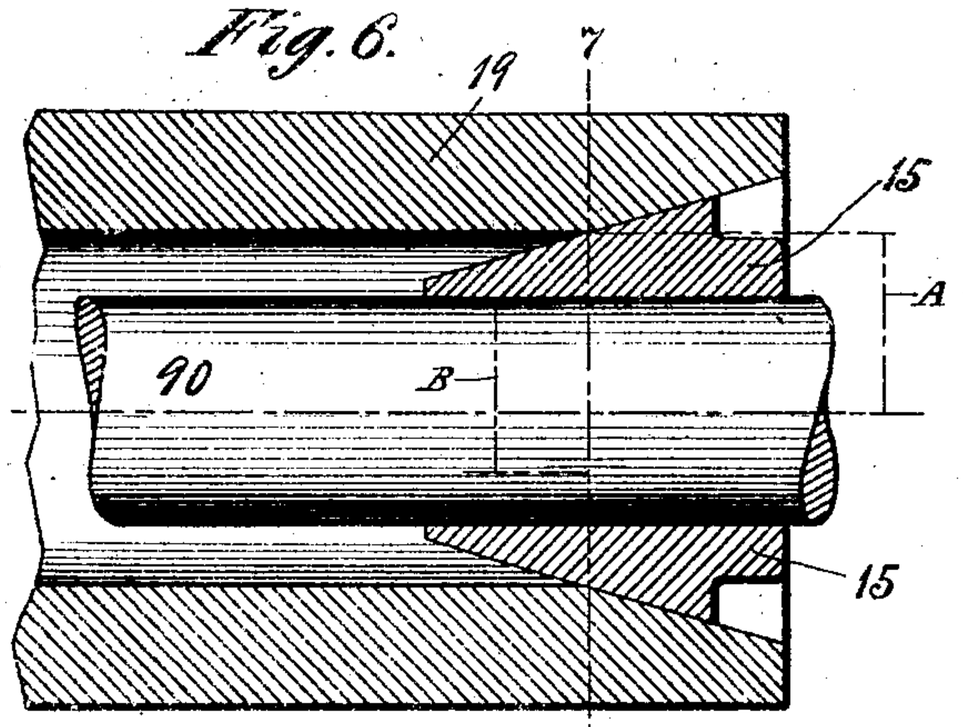


Fig. 7.

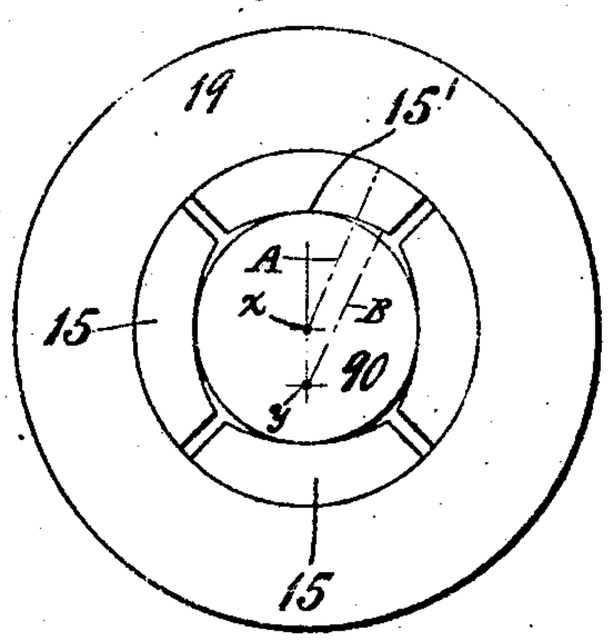


Fig. 8.

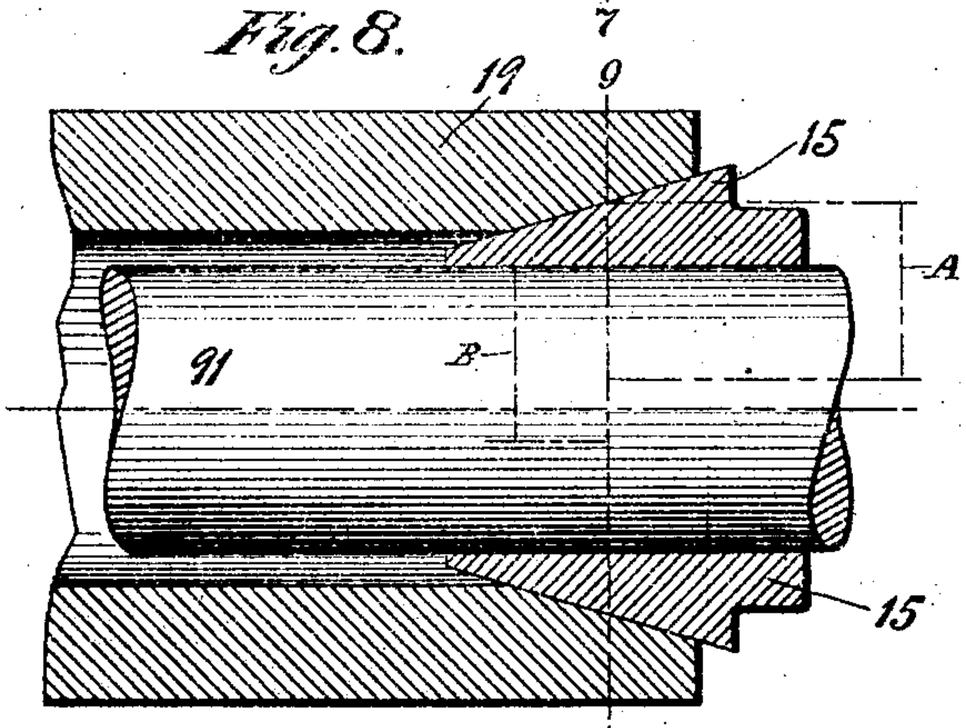


Fig. 9.

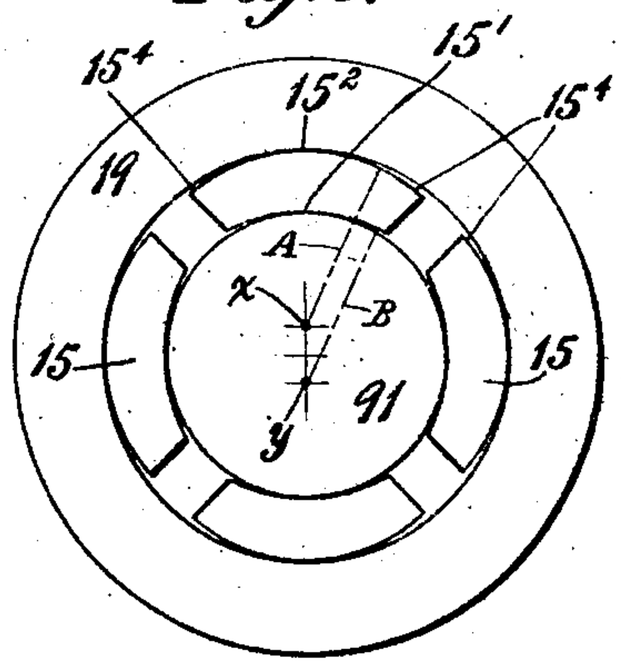


Fig. 10.

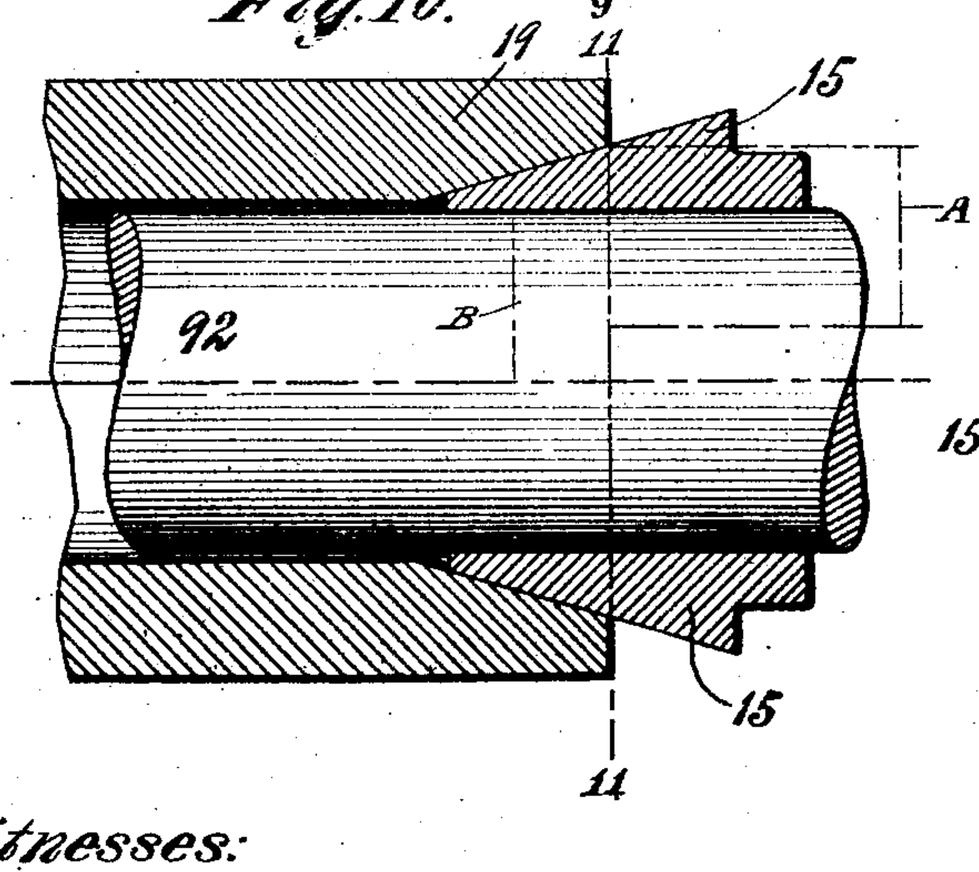
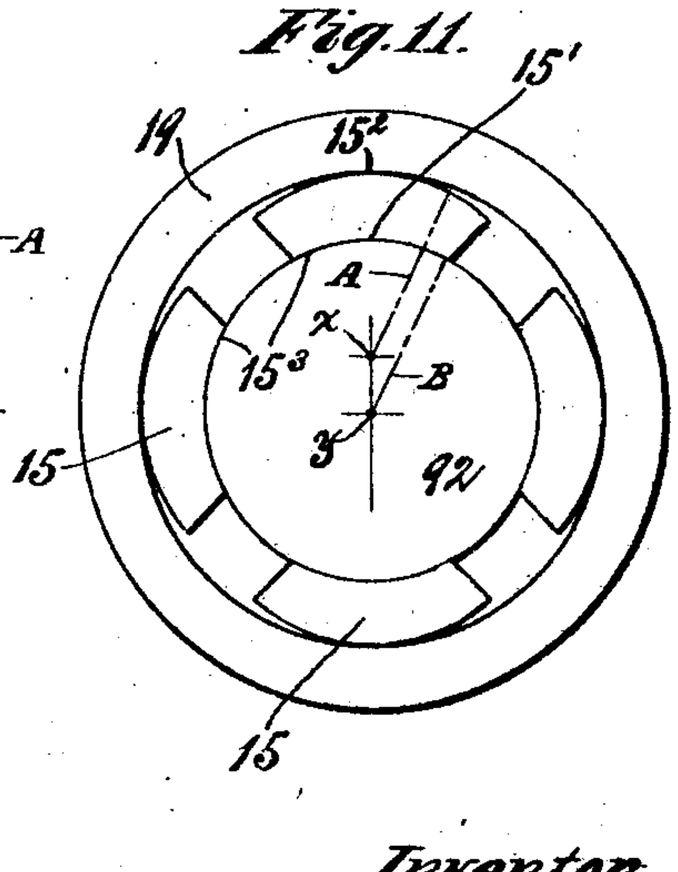


Fig. 11.



Witnesses:

F. E. Anderson.

L. L. Grotta.

Inventor.

B. M. W. Hanson,

By his Attorney,

Wm. H. Blodgett

UNITED STATES PATENT OFFICE.

BENGT M. W. HANSON, OF HARTFORD, CONNECTICUT, ASSIGNOR TO PRATT & WHITNEY COMPANY, OF HARTFORD, CONNECTICUT. A CORPORATION OF NEW JERSEY.

CHUCK FOR METAL-WORKING MACHINES.

No. 814,648. Specification of Letters Patent. Patented March 6, 1906.

Application filed June 6, 1903. Serial No. 160,356.

To all whom it may concern:

Be it known that I, BENGT M. W. HANSON, a citizen of Sweden, residing at Hartford, in the county of Hartford and State of Connecticut, have invented certain new and useful Improvements in Chucks for Metal-Working Machines, of which the following is a specification.

This invention relates to chucks, and more especially to that class thereof employed in what are known as "automatic metal-working machines;" and it has for one of its objects the provision of a device of this character in which the collet or work-holder is composed of a plurality of independent sections adapted for coöperative clamping action on the stock.

A further object of the invention is the provision, in connection with each of the independent collet-sections, of a device whereby said section may be not only maintained in its forward position against the cap of the chuck when the sections or jaws are not in clamping action, but whereby all liability of its movement toward the axis of the spindle during the feed movement of the stock will be avoided. In this connection my invention therefore comprises as one of its features a jaw-returning device the engaging face of which acts normally to lock the jaws against inward movement unless it is forced inward by an actuator provided for the purpose.

My invention has, furthermore, for its object the provision of a thrust device tending normally to move the jaw-actuator rearward to permit the several jaws to open, so that when said actuator is forced forward the jaws will be advanced toward the axis of the spindle without displacement longitudinally of said spindle.

My invention has, furthermore, for its object work-clamping jaws of peculiar form whereby all tendency of said jaws to spring will be avoided, so that the contact or, in other words, the thrust on the work by each jaw will be in a direct line with the contact-point between the jaw and the jaw-actuator.

In the accompanying drawings, in which similar characters denote similar parts throughout the several views, Figure 1 is a longitudinal vertical section of mechanism in which my invention is embodied. Fig. 2 is a central longitudinal section of the improved chuck. Fig. 3 represents an end view of said chuck in section and partly broken away to disclose the construction. Figs. 4 and 5 are views similar to Figs. 2 and 3, illustrating a modification. Fig. 6 is a longitudinal vertical section of the chuck-jaws and actuator, illustrating diagrammatically the position of the cone when the jaws are in engagement with the smallest size of standard stock within the capacity of the chuck. Fig. 7 is a diagram on line 7 7 of Fig. 6, the sectional line being removed to produce a better effect in illustrating the action of the chuck-jaws upon work of small diameter. Fig. 8 is a view similar to Fig. 6, showing the position of the chuck-jaws and conical surfaces of the actuator when said jaws are in engagement with standard stock. Fig. 9 is a diagram taken on line 9 9 of Fig. 8. Fig. 10 is a section similar to Figs. 6 and 8, illustrating the position of the chuck-jaws and conical actuator when said jaws are in engagement with the largest size of standard stock within the capacity of the chuck; and Fig. 11 is a diagram taken on line 11 11 of Fig. 10.

As above stated, my improved chuck comprises a plurality of individual jaws, which may be contracted to clamp the work—as, for instance, by a jaw-actuator, shown as a sleeve or similar device mounted for longitudinal movement relatively to the jaws and which may be operated in any conventional manner.

In the drawings the numeral 10 designates a tubular main spindle having at its forward end an enlarged head 11, which is externally threaded at 11′ to engage the internal thread 12′ of a cap 12, and mounted for sliding movement in said spindle is a sleeve 13, through which the stock is fed.

Inasmuch as stock varies in size and difficulty would be experienced in substituting a sleeve of different diameter for the one in use, the bore of said sleeve is made sufficiently large to accommodate material of the greatest diameter within the capacity of the machine, and the jaws of the chuck proper are made in sections independent of the sleeve, and the jaw-actuator is also independent of, although actuated by, said sleeve.

Referring to Fig. 2, it will be seen that the forward end of cap 12 is provided with an an-

nular flange 14, which serves as a stop or abutment against which the jaws will be constantly held, so that no longitudinal movement of said jaws can take place, while, on the other hand, they may be forced toward and retreat from the axis of the spindle. In the present case the collet or chuck proper consists of four independent jaws 15, and the forward end of each jaw is reduced in diameter at 15^a to project through a central opening 16 in the flange 14 of cap 12 and also has a stop, shown as a shoulder 17, engaging with the inner side of said flange. Each jaw 15 has a conical surface 18, and these surfaces engage with an inclined inner wall 19′ in the head 19^2 of a jaw-actuator 19, which is mounted for longitudinal movement within the head 11 of spindle 10, is supported at its forward end within a hardened ring 20 of said head, said ring serving as a wear-resisting backing, and has a shank 19^3 fitting in spindle 10 and against the end of sleeve 13. Means are provided for retaining the several jaws 15 of the chuck in their open positions and for also simultaneously keeping the shoulders 17 in contact with the inner surface of the flange 14, and said means consist, in the exemplification given, of plungers 21, mounted in recesses of the jaw-actuator, and each plunger being chambered for the reception of a spring 22, which bears at one end against the bottom of the chamber and at its other extremity is received in a seat in the end of a plug 23, held in said jaw-actuator 19.

From the foregoing description it will be seen that the springs 22 serve to shift the jaw-actuator and the chuck-jaws relatively to each other longitudinally, and hence it will be understood that inasmuch as the shoulders 17 of the jaws are in contact with the inner face of the flange 14 said springs will act to force the jaw-actuator 19 rearward, which will result in withdrawing the conical inner surface of said actuator from the tapered outer portions of the jaws, thus enabling them to move away from the axis of the spindle.

To force and hold the jaws open and also to prevent them from rattling within the cap and jaw-actuator, I preferably form the forward end of each plunger with a beveled surface 24 to engage a similarly beveled and undercut face or shoulder 25 on the jaw 15, so that when the jaws are in their open positions it will be necessary to shift the plungers 21 bodily, thereby compressing springs 22 before said jaws can be closed upon the stock. Hence the plungers described serve as stops to prevent movement of the jaws toward the axis of the spindle unless they are positively closed by the jaw-actuator 19.

In order to keep the beveled ends of the plungers 21 and the beveled faces 25 of the jaws in true positions, I provide in the outer surface of each plunger a groove 26, adapted to engage a pin 27, held within the body of the jaw-actuator 19, said pins serving to prevent the plungers from axial rotation. From the above description it will be seen that the springs 22 serve not only to hold the several jaws forward and against the inner surface of the flange 14 of cap 12, but also act to force the jaw-actuator 19 rearward, this construction being clearly illustrated in Figs. 2 and 3 of the drawings.

In Figs. 4 and 5 a modification is illustrated in which the plungers 21 serve only to force the jaws forward, thus holding their shoulders 17 against the flange 14. In this instance each spring 22 bears at its rear end against a plug 30, which is in contact with the end wall of the chamber in the head of spindle 10, and hence independent means are provided for imparting to the jaw-actuator a rearward movement with relation to the jaws 15.

In Fig. 4 the jaw-actuator 19 is shown longitudinally recessed or grooved at 31 to receive and guide a thrust block or plunger 32, having an inclined surface 32′ at its forward end, which is in constant engagement with an abutment—such, for instance, as a screw 33, having a conical point 33′—while its rear end receives the thrust of a spring 34. This spring is shown coiled around a screw-bolt 35, threaded into or otherwise attached to the block 32, and the stem of said bolt passes through a part of the jaw-actuator 19, movement of which as caused by the spring 34 is limited by a head 36, provided on said screw 35, said head fitting in a recess in the rear face of the actuator 19. Normally the inclined surface 32′ of block 32 will be in engagement with the conical point 33′ of the screw 33, and the jaw-actuator is so confined in movement that it can never be shifted far enough to nullify the action of the spring 34 in causing said actuator to release the jaws.

From what has been stated it will be seen that in both constructions illustrated the shoulders of the jaws are kept snugly against the inner surface of the flange 14 of cap 12 and that there will be no longitudinal movement of either the jaws or the stock and no inward movement of said jaws while they are in an open position.

In chuck-jaws of ordinary construction great difficulty exists in so clamping the work that it will be held firmly without danger of slippage, and these ordinary jaws are liable to distortion when forced to engage work either of less size or of over size than standard or to engage standard work having an uneven surface.

In the present case one of the principal objects of the invention resides in such a construction of the chuck-jaws that they will hold the work in a better manner, and their grasping-surfaces will always engage said work on direct radial lines, whether the stock

be of standard diameter or over or less than standard diameter.

Referring to Figs. 6 to 11, inclusive, for illustration of the manner in which the jaws operate upon different diameters of stock, it will be seen that the grasping-surface of each jaw 15 is formed on an arc the diameter of which is equal to and not less than the diameter of the largest variation of standard stock within the capacity of the chuck. In other words, assuming the diameter of the largest stock within the capacity of the chuck to be one and one-half inches, as illustrated in Figs. 10 and 11, the arc of the curved grasping-surface of each jaw will be concentric to the axis of said stock and the periphery of the work will completely fill the arc or curve of the jaws Having thus formed the grasping-surfaces of the jaws concentric with the axis of the largest size of standard work within the capacity of the chuck, I now turn the conical peripheral surfaces of the jaws, while the grasping-surfaces are in firm contact with the smallest size of standard stock within the capacity of the chuck.

Referring to Figs. 6 and 7, it will be seen that when the grasping-surfaces of the jaws are in contact with the smallest size of standard work—for instance, work of one inch in diameter—the peripheral surfaces of the jaws when turned in the manner described will be concentric to the axis of the conical interior portion of the cone or jaw actuator. In these figures the dotted line A, leading from the axis of the stock, illustrates the manner in which the conical peripheries of the jaws are formed, and it will be seen that while the periphery of each jaw is concentric with the curve of the cone on the actuator with which it coöperates the bearing-point 15′ of each jaw will be on a direct radial line to the axis of the work, thereby preventing the jaws from being deflected at their ends or crushed downward upon the stock. From these figures it will be seen that the axis of the arc from which the curved periphery of each jaw is struck is above the axis of the arc on which the curved grasping-surface of each is formed, and this condition holds true throughout the various figures, as illustrated by the lines A and B.

In Figs. 8 and 9 the jaws 15 are shown as in engagement with work of standard size—for instance, work having a diameter of one and one-quarter inches—and it will be seen that the conical interior portion of the jaw-actuator 19 has not moved up as far on the conical peripheries of the jaws as it has in Fig. 6, and consequently radial contact of the actuator on each jaw will be at the points 15^2, while radial contact of each jaw upon the work 91 will be at the points 15′. In Figs. 10 and 11, where work of one and one-half inches in diameter is shown engaged by the jaws, full contact of said jaws on direct radial lines, as at 15^2, is the result, while the actuator 19 has not moved as far upon the surfaces of the jaws as in Fig. 8, and therefore radial contact at the points 15^2 is the result, as in Figs. 8 and 9.

In Fig. 7 the work of smallest diameter is designated by the numeral 90, in Fig. 9 that of standard size by 91, and in Fig. 11 that of larger size than standard by 92. From all of these views it will be seen, as before stated and as indicated by the line A radiating from the center x, that said center is above the center y from which line B radiates, and that therefore the peripheries of the jaws are formed on an arc the axis of which is above the axis of the curved grasping-surfaces of the jaws.

Referring to Figs. 6 and 7, it will be seen that the diameter of the work 90 is one-fourth of an inch less than the diameter of the standard stock 91, (illustrated in Fig. 9,) and that in this instance the peripheral surface of each jaw is concentric with the axis of the stock, while the conical surface of the jaw-actuator 19 at the point in the cone where it engages the jaws is concentric with the peripheral surface of said jaws.

In Figs. 8 and 9 the stock 91 is of standard diameter and the jaws are in contact with the work at points 15′, while their peripheral surfaces are engaged at points 15^2 by the conical surface of the jaw-actuator 19.

In Figs. 10 and 11 the diameter of the stock 92 is one-quarter-inch greater than that of standard stock, and the inner surfaces of the jaws 15 are, as before stated, on a circle equal in diameter to the diameter of this stock, so that the radius of the curved grasping-surfaces of the jaws will be equal to that of the diameter of the largest variation in standard stock within the capacity of the chuck, while the peripheries of said jaws are formed on an arc the radius of which has its center disposed above the center of the inner surfaces of the jaws, so that said jaws will be slightly thicker in the middle than at their ends, with the following results:

In Figs. 6 and 7 the stock 90 is smaller than standard, and the jaws will therefore be in contact with the work at points 15′, while their outer surfaces are in full contact with the actuator 19.

In Figs. 8 and 9 standard stock is shown at 91 and the jaws are in contact with the work at points 15′, while their peripheral surfaces are engaged at points 15^2 by the actuator 19.

In Figs. 10 and 11 the stock 92 is of larger diameter than standard, and here the jaws 15 are in full contact with the work throughout their grasping-surfaces, while the peripheral surfaces of said jaws are engaged by the actuator 19 at points 15^2. It will thus be seen that the periphery and the curved grasping-surface of each jaw are turned on arcs eccentric to each other, the result being that the

pressure of the actuator 19 is always applied to the jaws in direct radial lines, so that a firm clamping contact upon work without deflection of the jaws is assured.

In further illustration of the action of the conical actuator upon the conical peripheries of the jaws it will be seen by Fig. 6 that said actuator has moved forward to such a point that the arcs of the surfaces on which the actuator and jaw peripheries are formed are concentric to each other and the periphery of each jaw is in full contact with the inner surface of the actuator. In other words, the actuator has moved forward to its limit, while in Fig. 8 it has not advanced as far as in Fig. 6, and consequently the conical surface of the jaws recedes from the like surface of the actuator at the points 15^4.

In Figs. 10 and 11, the work being of larger size than standard, the jaws are forced away therefrom, so that the actuator cannot be advanced as far as in Fig. 8, and therefore it bears in direct radial lines at the points 15^2 against the peripheries of the jaws, while points on the peripheries adjacent to the ends of the jaws have receded from the actuator, as in Fig. 9. In this manner chuck-jaws universally applicable to stock of the kinds mentioned within the capacity of the chuck are made to grasp said stock with direct pressure on radial lines and are therefore firmly clamped to the same without danger of slippage and without the liability of fracture due to the distortion or spring of the jaws liable to occur when they are constructed in the usual manner.

If two cones are telescoped, there will be a point in which the enveloping cone will fit or coincide with the surface of the inner cone, (see Figs. 6 and 7,) and when the enveloping cone is withdrawn this full contact will be disestablished, as shown in Figs. 8 to 11, and consequently with chuck-jaws constructed as described pressure must always be applied by the actuator on direct radial lines to the chuck-jaws, they will grasp the work on points directly opposite the points of engagement of the actuator, and there will be no danger of springing the jaws.

Any suitable mechanism may be employed for shifting the sleeve 13 above mentioned, the mechanism shown in Fig. 1 of the drawings comprising levers 40, pivoted at 41 to a collar 42, which is in screw-threaded engagement with the spindle 10 and may be held against rotation by a check-nut 43. Levers 40 are operated in the present instance by a conically-ended sleeve 44, mounted for sliding movement on the spindle 10 and serving to rock said levers 40 around their pivots 41 to impart a longitudinal movement to the sleeve 13, as will be readily understood.

My invention is not limited to the devices shown and described for holding the chuck-sections against an abutment and for preventing inward movement of said sections when the chuck is open; nor is it limited to any particular jaw-actuator nor to special means for operating said actuator. Changes may also be made in the form and proportions of the parts without departure from the invention.

Having thus described my invention, what I claim is—

1. The combination, with a head having an abutment, of a chuck composed of independent jaws; a jaw-actuator; plungers carried by said jaw-actuator, and serving to hold the jaws against said abutment; and springs between said plungers and a part of the jaw-actuator.

2. The combination, with a chambered head, of independent chuck-jaws mounted in said head and each having a stop; a cap having a perforated flange against which the stops of the jaws are held; a jaw-actuator; means for operating said actuator to close the jaws; spring-actuated plungers carried by the jaw-actuator, and serving to hold the chuck-jaws against the flange of the cap; and means for retracting the jaw-actuator to cause it to release the jaws.

3. The combination, with a chambered head having a perforated flange at its forward end, of independent chuck-jaws, each having a shoulder on its outer surface; a jaw-actuator; plungers carried by said jaw-actuator, and bearing against the inner surfaces of said shoulders; and springs for actuating said plungers.

4. The combination, with a chambered head, of independent chuck-jaws mounted in said head and having conical exterior surfaces; a jaw-actuator shaped to engage said surfaces; a cap rigid with the head, and having a perforated abutment at its forward end; plungers fitted in longitudinal recesses of the jaw-actuator; and springs for causing said plungers to hold the chuck-jaws against said abutment.

5. The combination, with a chambered head, of a perforated abutment overlapping the forward end of said head; chuck-jaws having conical and undercut surfaces; a recessed jaw-actuator having a conical interior; and spring-actuated plungers located in the recesses of the actuator and having inclined ends for fitting the undercut surfaces of said chuck-jaws.

6. The combination, with a chuck composed of jaws each of which is provided with a recess having an undercut wall, of a head in which said chuck is mounted; a cap having a flange at its forward end, said cap being rigid with the head; a series of plungers having inclined ends adapted to engage the undercut walls of the recesses; a support for said plungers; and means for forcing said plungers forward to thereby hold the chuck-sections

against the flange, and to prevent them from inward movement when the chuck is open.

7. The combination, with a chambered head, of conical jaw-segments mounted in said head, and having notches with undercut walls; a recessed jaw-actuator having an inclined inner surface; plungers seated in the recesses of the actuator and having inclined forward ends received within the notches of the jaws; and springs for impelling said plungers against the undercut walls of said notches, and thereby preventing inward movement of the jaws when they are in their open positions.

8. The combination, with a chambered head, of a cap removably secured to the head and having a perforated flange; a series of conical jaw-segments, each having a shoulder and a recess with an undercut wall; a conical jaw-actuator having recesses; plungers with inclined forward ends fitted in the recesses of the jaw-actuator, springs bearing against the plungers and impelling them forward; and means for operating said jaw-actuator.

9. The combination, with a conical actuator, of chuck-jaws having grasping-surfaces formed on an arc struck from an axis concording with the axis of the chuck when the latter is in engagement with the largest size of stock within the capacity of the chuck, and conical peripheral surfaces formed on arcs struck from an axis conforming to the axis of the smallest size of standard stock which the jaws are adapted to engage.

10. A chuck composed of jaws each having a curved grasping-surface and a conical peripheral surface eccentric to said grasping-surface, the peripheral surfaces being formed on arcs struck from an axis nearer the grasping-surface than the axis of the curve on which the grasping-surface is formed.

11. A chuck-jaw having a curved grasping-surface, and an outer conical surface, said outer conical surface being formed on arcs struck from an axis nearer the grasping-surface than the axis of the curve on which the said grasping-surface is formed.

In testimony whereof I affix my signature in presence of two witnesses.

BENGT M. W. HANSON.

Witnesses:
HARRIE E. BAILEY,
NEHEMIAH S. BATES.