W. L. PROCUNIER.

YIELDING BIT AND TAP CHUCK.

APPLICATION FILED JUNE 10, 1907.

900,122.

Patented Oct. 6, 1908.

Fig. 1.

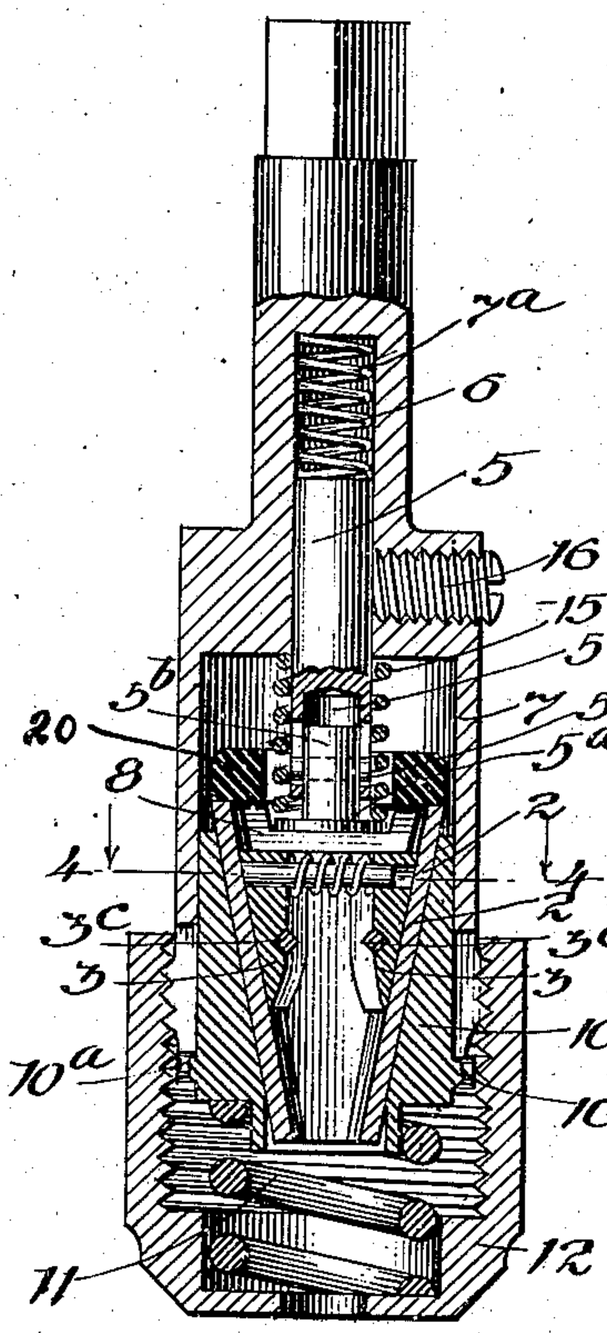


Fig. 2.

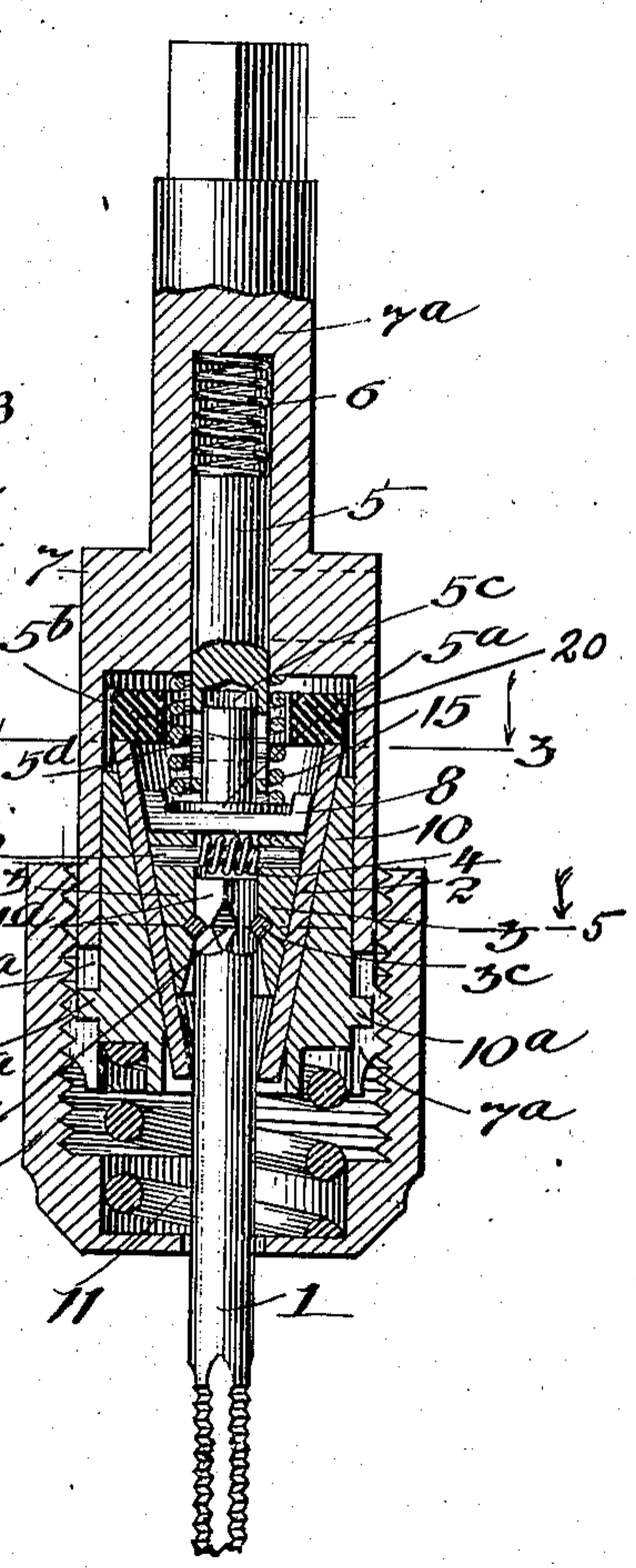


Fig. 3.

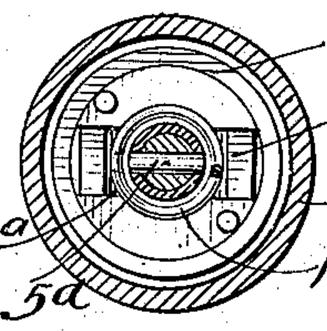


Fig. 4.

Fig. 7.

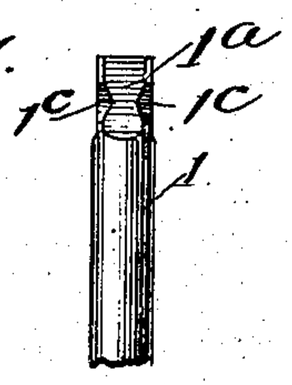


Fig. 5.

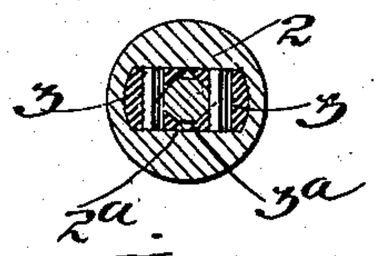
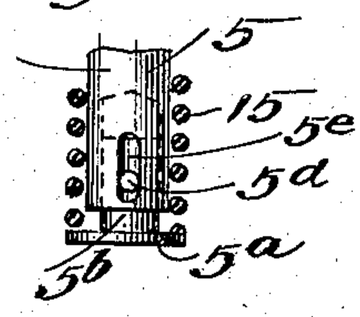


Fig. 6.



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UNITED STATES PATENT OFFICE.

WILLIAM L. PROCUNIER, OF CHICAGO, ILLINOIS.

YIELDING BIT AND TAP CHUCK.

No. 900,122. Specification of Letters Patent. Patented Oct. 6, 1908.

Application filed June 10, 1907. Serial No. 378,067.

To all whom it may concern:

Be it known that I, WILLIAM L. PROCUNIER, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented new and useful Improvements in Yielding Bits and Tap Chucks, of which the following is a specification, reference being had to the drawings forming a part thereof.

This invention is designed to provide means for holding a bit or tap releasably and securely against disengagement, but yieldingly as to the grip for rotation so as to permit the tool to slip when otherwise it would be broken.

It consists in the features of construction which are shown and described, as indicated by the claims.

In the drawings:—Figure 1 is an axial section of a chuck embodying the invention, showing it without a tool, and at most relaxed position of the spring which effects frictional driving engagement. Fig. 2 is a similar view showing the tool in place. Fig. 3 is a section at the line 3—3 on Fig. 2. Fig. 4 is a section at the line 4—4 on Fig. 1. Fig. 5 is a section at the line 5—5 on Fig. 2. Fig. 6 is a detail elevation of the end portion of the jaw-closing plunger and a spiral spring thereon in axial section. Fig. 7 is a side elevation of the shank portion of a tool adapted to be used with the device.

The stem or shank, 1, of the tool to be held extends axially through a conical holder, 2, and between the two jaw pieces, 3, 3, which are lodged in the upper part of said conical holder, 2, which is lodged in an interiorly conical sleeve, 10, which is in turn telescoped in the cylindrical cavity of the outer shell, 7, of the chuck, being free to move longitudinally therein to a limited extent, but prevented from rotation relative thereto by the projections or lugs, 10^a, of the sleeve which engage in the slots or end notches, 7^a, of the shell. The cap, 12, is screwed on to the shell, 7, housing a spring, 11, lodged in the cap and stopped between the lower end of the sleeve, 10, and the end of the cavity of the cap, the latter having a central opening through which the tool protrudes. The cap, it will be understood, is to be screwed up onto the shell for tensioning the spring, 11, to cause it to press the sleeve, 10, on to the conical holder, 2, to cause sufficient frictional engagement between the two elements for rotating the tool.

The holder, 2, has a cavity oblong in cross section at the upper end and tapering substantially to correspond with the taper of the conical holder, 2, from the upper to the lower end just back of which the said tapering oblong cavity becomes reduced in width by its taper to substantially the diameter of the aperture in the lower end of the tapering holder through which the tool is inserted. The two jaw pieces are themselves tapered, their outer sides or edges being fitted to the opposite surfaces of the oblong tapering cavity, 2^a, and having their facing surfaces each provided with a longitudinal V-shaped groove, 3^a, for receiving the upper squared end, 1^a, of the tool to grip the latter for rotation.

The two jaw pieces, 3, 3, are connected by a pin, 3^b, projecting from one of them and taking loosely into the other for the purpose of retaining them in directly opposed relation so that they will keep together in sliding up and down in the tapering oblong cavity, 2^a, of the holder, 2. A spring, 4, coiled about the pin, 3^b, reacts between the two jaw pieces tending to hold them apart with their outer edges seated against the opposite converging sides of the cavity, 2^a. The angular convergence of these opposite sides of the cavity is such that the operation of the spring, 4, tending to force apart the two jaw pieces causes them to normally assume a position in the height of the cavity at which they will be accommodated at the full spread which the spring, 4, tends to cause, and, if depressed in the cavity, to recover that position by the action of the spring when released from the depressing force. At the position which the jaw pieces thus normally assume and to which they tend to return when forced away therefrom they are spread apart so widely as to readily admit the squared upper end or head, 1^a, of the tool, and when forced downward in said oblong cavity they are closed together by the convergence of the opposite walls gripping said squared head. Each of the angular corners of the head, 1^a, is undercut a little back of the end, forming a notch or recess, 1^c. Each of the jaw pieces, 3, 3, is provided with a slight projection, 3^c, which protrudes into the V-shaped recess of the inner face of the jaw piece for engaging a notch, 1^c, of the tool head when the latter is passed up between the jaw pieces to be gripped thereby. When the jaw pieces are closed together by being

forced downward in the oblong cavity of the holder the tool being gripped between them is also retained by the engagement of said projections, 3^c, in the notches, 1^c, so that if the grip should be relaxed slightly the tool will not fall out. Moreover the tool would be liable, in the absence of such retaining devices, to be pulled out of the jaws by any force tending to give it a strong longitudinal pull, as when the chuck is suddenly backed up from the work while the tool is engaged therewith. Such undesirable disengagement of the tool from the jaws by longitudinal pull is prevented by the presence of the notches in the tool head and the projections for engaging therewith in the jaws, because that engagement transmits such pull directly to the jaw pieces crowding them down into the sleeve even more tightly than they are held by the pressure of the spring, 15.

For holding the jaw pieces pressed down in the tapering cavity, 2^a, of the holder, 2, so as to engage and grasp for driving the square end of the tool and to permit the jaws to yield back to admit tools of different sizes up to the limit of spread of the jaws which the size of the cavity, 2^a, will permit, there is provided a plunger, 5, exposed to the action of a spring, 6, which is lodged in the bore, 7^x, made in the stem of the shell to accommodate the plunger on whose upper end the spring reacts, the lower end or head of the plunger being arranged to rest upon the bridge piece, 8, which extends across the upper ends of the jaw pieces for bearing upon them both to transmit to them both alike the thrust movement of the plunger.

As thus far described the chuck will operate for receiving tools of different sizes and holding the tool thus received positively between the jaw pieces and for rotating it without yielding until the limit of frictional driving engagement between the conical holder, 2, and the conical sleeve, 10, held pressed in frictional engagement by the spring, 11, is exceeded by the resistance of the work. As soon as the resistance of the work exceeds the driving capacity of this frictional engagement the holder will slip in the sleeve, so saving the tool from overstrain which would break or injure it. The tool may be released by unscrewing the cap, 12, thereby relaxing the pressure of the spring, 11; and this action at the same time relaxes the pressure of the spring, 6, on the plunger, 5, permitting the jaw pieces, 3, 3, to take their normal position under the expanding action of their spreading spring, 4,—that is, to withdraw upward a little in the oblong slot, 2^a, of the holder,—causing them to separate far enough to disengage the projections, 3^c, from the notches, 1^c, of the tool head so that the tool is not only free from the grasp of the V-shaped notches of the jaws, but also from the retaining engagement of the projections, 3^c, and is entirely free, therefore, for removal. Without some further provision, which will be hereinafter described, the upward or inward pressure against the tool for performing its work before reaching the limit of its strength for which the frictional grasp of the conical driving surfaces under the tension of the spring, 11, is adapted, would tend to force upward the jaw pieces, 3, 3, compressing the spring, 6. In this action the jaws would lose their grasp upon, and driving engagement with, the tool. To prevent this effect there is provided a set screw, 16, set in through the side of the shell or shank thereof in position to impinge against the stem of the plunger entered in the bore, 7^a, to clamp the stem for securing it at any position to which it may be forced upward in entering a tool of such size as to require the jaws to be forced upward in the oblong cavity of the shell in order to admit them. When the plunger is thus provided against yielding upward in a manner which would loosen the grip of the jaws, the wear which will occur between the upper end of the jaws and whatever is provided for taking the wear,—in the construction shown, the bridge-piece, 8,—and the lower end of the plunger, 5, when slipping occurs from overwork on the tool, will soon cause a little play between the wearing parts, and the jaws yielding in this play will relax their grasp on the tool. To prevent this result the plunger, 5, has a head, 5^a, which rests upon the bridge, 8, movable longitudinally with respect to the plunger for a short distance. In order to have this action, the head has a spindle or stem, 5^b, for which an axial bore, 5^c, is provided in the end of the plunger, and the head being slightly greater in diameter than the plunger so as to constitute a flange thereof receives the pressure of the spring, 15, about the plunger and is stopped at its upper end against the upper end of the cavity of the shell, 7. A cross pin, 5^d, in the spindle, 5^b, of the head being engaged in lateral slots, 5^e, in the plunger to retain the head and check and limit its movement outward with respect to the plunger under the stress of the spring, 15. The requirement for the purpose for which the plunger is provided with a yielding head as described is obviously that the head shall yield relatively to the plunger, but it is also necessary that the spring, 15, shall be compressed so as to be under tension when the plunger is secured by the set screw; and if said spring, 15, reacted directly against the plunger it would have to be weaker than the spring, 6, in order to be thus compressed in the process by which the plunger is forced up against the latter spring. The small space available for the spring, 6, makes it difficult to provide at that

point a spring which shall be stronger than the spring, 15, is required to be in order to properly perform its function described. I therefore prefer to stop the spring, 15, against the top of the cavity of the shell as shown, and make the two springs, 15 and 6, of such length that they shall both be compressed during all the upward movement of the plunger in inserting the tool and tensioning the spring, 11, to the proper degree for frictional drive. By this means the spring, 15, is compressed during the setting of the tool to a sufficient tension to hold the jaws almost with the same effect as if they were positively stopped, and at the same time with capacity for reaction to compensate for wear which would not be afforded by the positive stop.

With this construction the set screw, 16, being relaxed so as not to engage the plunger stem, the spring, 6, holds the plunger downward relatively to the shell, 7, and the spring, 15, holds the flange of the plunger downward thereon to the limit, so that the plunger device operates with yielding pressure upon the upper ends of the jaw pieces, as already described, and with the effect of holding the jaws down in the oblong cavity of the holder, 3, ready for receiving and engaging the squared head of the tool when it is inserted. Upon pushing the tool up into place, entering its head between the jaw pieces with whose projections, 3^c, the notches, 1^c, of the head become engaged, the cap, 12, will be screwed up for forcing the sleeve, 10, up onto the holder, 2, until the requisite pressure for frictional engagement for driving the tool, according to its strength, is obtained. The larger the tool and its squared head, the farther up in the tapering cavity of the holder, 2, will the jaws, 3, be pushed in order to admit the head into their V-shaped notches; and the extra length of the holder, 2, above the top of the jaws at the lowest position to which the latter can descend in the tapering cavity of the holder is designed for accommodating tools within certain range as to size. Such upward and resultant spreading movement of the jaws carries upward the entire plunger, 5, against the resistance of the spring, 6, the springs, 15 and 6, being both compressed at the same time, as above explained, so that both are under proper tension by the time the tool is in place and engaged by the jaws. The set screw, 16, will now be tightened on to the spindle, 5^b, holding the latter in definite position and preventing any compression of or reaction by the spring, 6, in the further use of the chuck, the spring, 15, however, continuing to react upon the flange, 5^a, as described, thereby causing them to take up any lost motion as described.

In order to prevent heating and excessive wear of the parts when the tool is stopped by resistance of the work beyond the limit to which it is adjusted, it is preferred to interpose a fiber wearing washer, 20, between the top of the holder, 4, and the upper end of the cavity in the shell.

I claim:—

1. A tool-holding chuck comprising, in combination with a driven holder, a pair of jaw pieces lodged in the holder and engaged therewith for rotation, having V-shaped recesses for engaging a tool-head to rotate it positively, and having projections extending into the recesses transversely thereof for engagement with a tool head to prevent its longitudinal withdrawal.

2. A tool-holding chuck comprising a holder for the tool provided with a longitudinally tapering cavity; tool-gripping jaws lodged in said cavity, said jaws having coöperating features for engaging a tool against relative longitudinal movement when the jaws are closed upon the tool head, and a spring for pressing the jaws into the tapering cavity to close them together onto the tool.

3. A tool-holding chuck comprising a tool holder and a coöperating element for rotating the same by frictional engagement therewith, said holder and coöperating element being correspondingly tapered for seating one upon the other for said frictional engagement; a spring for yieldingly pressing them into engagement, the holder having a longitudinally tapering cavity; a pair of tool-gripping jaws lodged in said cavity and adapted to be closed together for gripping the jaws by movement in the cavity toward the smaller end; a stop which resists the movement of the jaws in the opposite direction, the reaction of said spring being opposed to the resistance of such stop.

4. A tool-holding chuck comprising a holder having a longitudinally tapering cavity; a pair of tool-gripping jaws lodged in the cavity and adapted to be closed together by movement therein toward the smaller end thereof, said jaws having features for engaging a tool to resist longitudinal withdrawing movement of the tool from the jaws; a spring reacting between the jaws to spread them for releasing the tool; a stop which opposes the movement of the jaws withdrawing from the holder, and means for yieldingly pressing the holder toward such stop.

5. A tool-holding chuck comprising an outer shell; a holder for the tool within the shell, and a driving element for the holder having positive engagement with the shell and frictional engagement with the holder; a spring for pressing the two parts into engagement, and means for adjusting the tension of the spring; jaws for gripping the tool lodged in the holder, said jaws and holder being relatively shaped to cause the

jaws to be closed together by a longitudinal movement relative to the holder in one direction; means carried by the shell for stopping the jaws against movement for withdrawing from the holder, the reaction of said spring being in the direction opposed to said stop.

6. A tool-holding chuck comprising a shell; a holder within the shell; coöperating jaws within the holder engaged therewith for rotation and adapted to be closed together by longitudinal movement in one direction in the holder; a spring which tends to spread them; a stop which resists longitudinal movement in the direction required for such spreading; an element engaged positively with the shell and frictionally with the holder for rotation of the latter, and means for yieldingly pressing said element toward said stop for such frictional engagement.

7. A tool-holding chuck comprising a holder having a longitudinal tapering cavity; tool-gripping jaws lodged in said cavity adapted to be closed together for gripping the tool by movement toward the smaller end of the cavity; said jaws having features for engagement with a tool to prevent longitudinal withdrawal of the tool while the jaws are closed upon it; a spring tending to spread the jaws for disengaging said features; a yielding stop which yieldingly opposes the longitudinal movement of said jaws in the holder necessary for such spreading.

8. A tool-holding chuck comprising a holder for the tool provided with a longitudinally tapering cavity; tool-gripping jaws lodged in said cavity, a spring-pressed stop which resists the movement of the jaws outward from the cavity; means for positively securing said stop, the stop having a yielding head which directly opposes the outward movement of the jaws, and a spring which operates on said yielding head to hold it toward the jaws.

9. A tool-holding chuck comprising, in combination with a frictionally driven holder having a longitudinally tapering cavity, tool-gripping jaws lodged in said cavity and adapted to be closed together by movement toward the narrower end thereof; an adjustable stop which resists the movement of the jaws outward from said cavity for releasing the tool; means for positively securing said stop, the stop having a yielding head which directly opposes the outward movement of the jaws, and a spring which operates on said head to hold it toward the jaws.

10. A tool-holding chuck comprising, in combination with a holder, a pair of jaw pieces lodged in the holder, engaged therewith for rotation, and adapted for receiving and engaging a tool head for positive rotation of the latter, said jaw pieces having also devices for engaging a tool head against longitudinal withdrawal.

11. A tool-holding chuck comprising a driven holder having a longitudinally tapering cavity; jaw pieces lodged in the cavity and thereby engaged with the holder for rotation; means for yieldingly pressing the jaw pieces toward the narrower end of the cavity for closing them together, said jaw pieces having devices for transverse engagement with the tool-head lodged between them to prevent withdrawal of said tool head.

12. A tool-holding chuck comprising a holder for a tool provided with a longitudinally tapering cavity; tool-gripping jaws lodged in such cavity having means for engaging a tool against longitudinal withdrawal, and a spring for pressing the jaws into the tapering cavity to close them together for such engagement.

13. A tool-holding chuck comprising a holder having a longitudinally tapering cavity; a pair of tool-gripping jaws lodged in the cavity and adapted to be closed together by movement therein toward the smaller end thereof, said jaws having means for engaging a tool against longitudinal withdrawal thereof; a spring reacting against the jaws to spread them for releasing the tool; a stop which opposes the jaws' withdrawal from the holder, and means for yieldingly pressing the holder towards such stop.

14. A tool-holding chuck comprising a frictionally driven holder; an element cooperating with such holder for frictionally communicating the driving movement, the holder having a tapering cavity; tool-gripping jaws lodged in such cavity for rotation by the holder and adapted to be closed together for gripping the tool between them by movement of the jaws in the cavity toward the smaller end; a spring tending to spread the jaws to release the tool; a stop device which opposes the movement of the jaws withdrawing from the holder, and means operating upon the holder-driving element for yieldingly pressing it into frictional engagement with the holder, such pressure being in the direction opposed to the resistance of the stop.

15. A tool-holding chuck in combination with a holder having a tapering cavity; tool-gripping jaws lodged in the cavity adapted to be closed together for gripping the tool by movement toward the smaller end of the cavity, said jaws having features for engaging a tool which may be between the jaws to prevent the longitudinal withdrawal of the tool; a spring which tends to spread the jaws to release the tool; a stop for resisting the longitudinal movement of the jaws in the holder necessary for such spreading; a spring which yieldingly presses the stop toward the jaws; means for positively securing the stop

against yielding movement, said stop having a head by which it opposes said longitudinal movement of the jaws, said head being lodged on the stop for movement longitudinally thereof, and a spring which yieldingly protrudes the head toward the jaws.

16. A tool-holding chuck comprising a tool-holder and a coöperating element for rotating the same by frictional engagement therewith, said holder and coöperating element being correspondingly tapered for seating, one upon the other, for such frictional engagement; a spring for yieldingly pressing them into frictional engagement, the holder having a longitudinally tapered cavity; a pair of tool-gripping jaws lodged in said cavity and adapted to be closed together for gripping the tool by movement in the cavity toward the smaller end; a spring-pressed stop device which yieldingly resists the movement of the jaws in the opposite direction, and means for positively securing said yielding stop.

17. A tool-holding chuck comprising a tool-holder and a coöperating element for rotating the same by frictional engagement therewith, said holder and coöperating element being correspondingly tapered for seating one upon the other for such frictional engagement; a spring for yieldingly pressing them into engagement and means for varying the tension of the spring, the holder having a longitudinally tapering cavity; a pair of tool-gripping jaws lodged in said cavity and adapted to be closed together for gripping a tool between them by movement in the cavity toward the smaller end; a stop which resists the movement of the jaws in the opposite direction; a spring which yieldingly presses the stop to afford such resistance, and means for positively securing the stop against yielding, the last-mentioned spring being lighter than the spring which affords the pressure for frictional driving engagement.

In testimony whereof, I have hereunto set my hand at Chicago, Illinois, this 7th day of June, 1907.

WILLIAM L. PROCUNIER.

Witnesses:

J. S. Abbott,

M. Gertrude Ady.