

No. 662,900.

Patented Nov. 27, 1900.

A. F. KUMMEL & C. L. GOODRICH.
CHUCK OPERATING DEVICE.

(Application filed Feb. 5, 1900.)

(No Model.)

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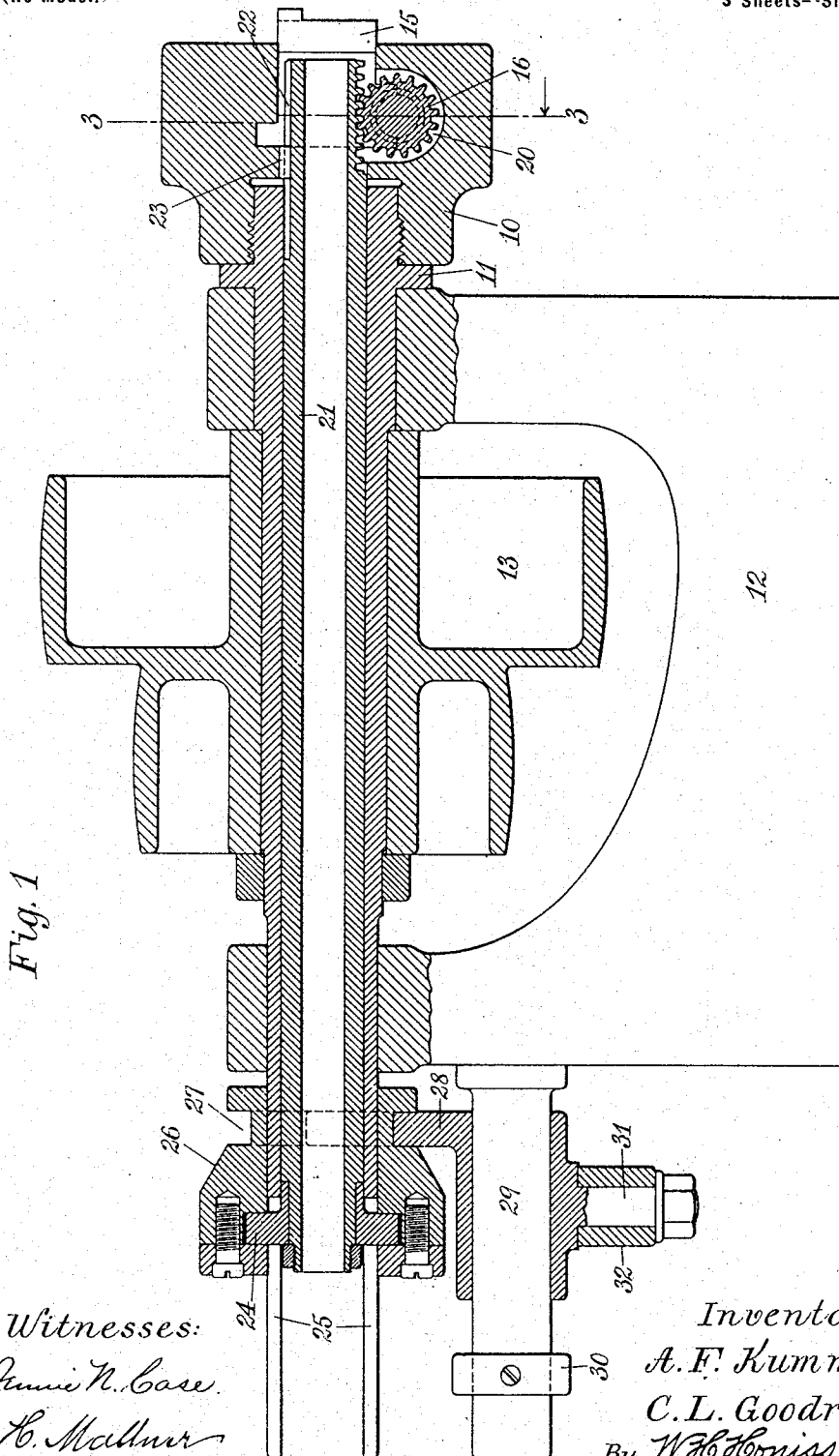


Fig. 1

Witnesses:
Jimmie N. Case.
H. Mallum

Inventors:
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Fig. 4

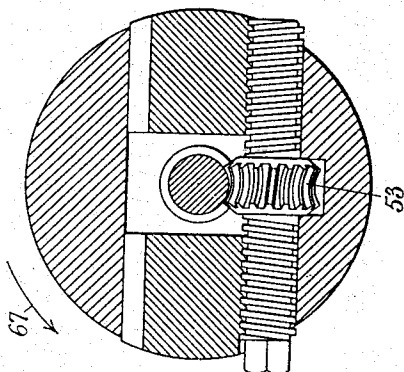


Fig. 6

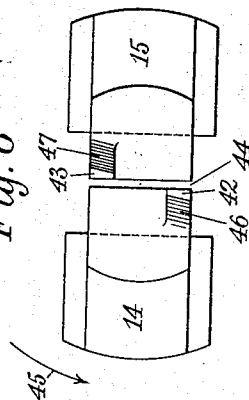


Fig. 3

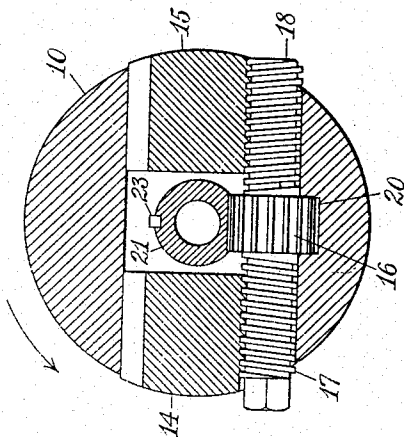


Fig. 5

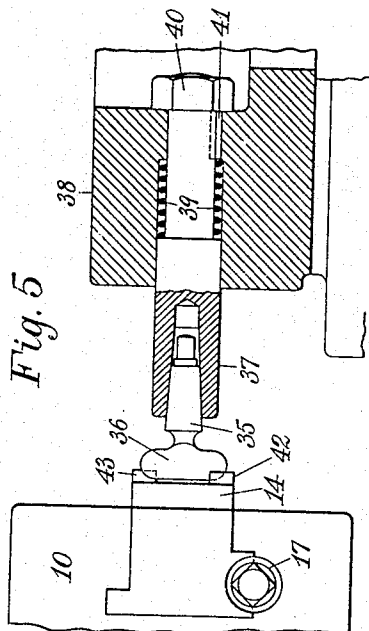
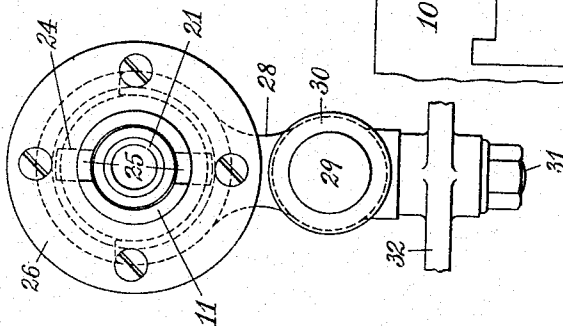


Fig. 2



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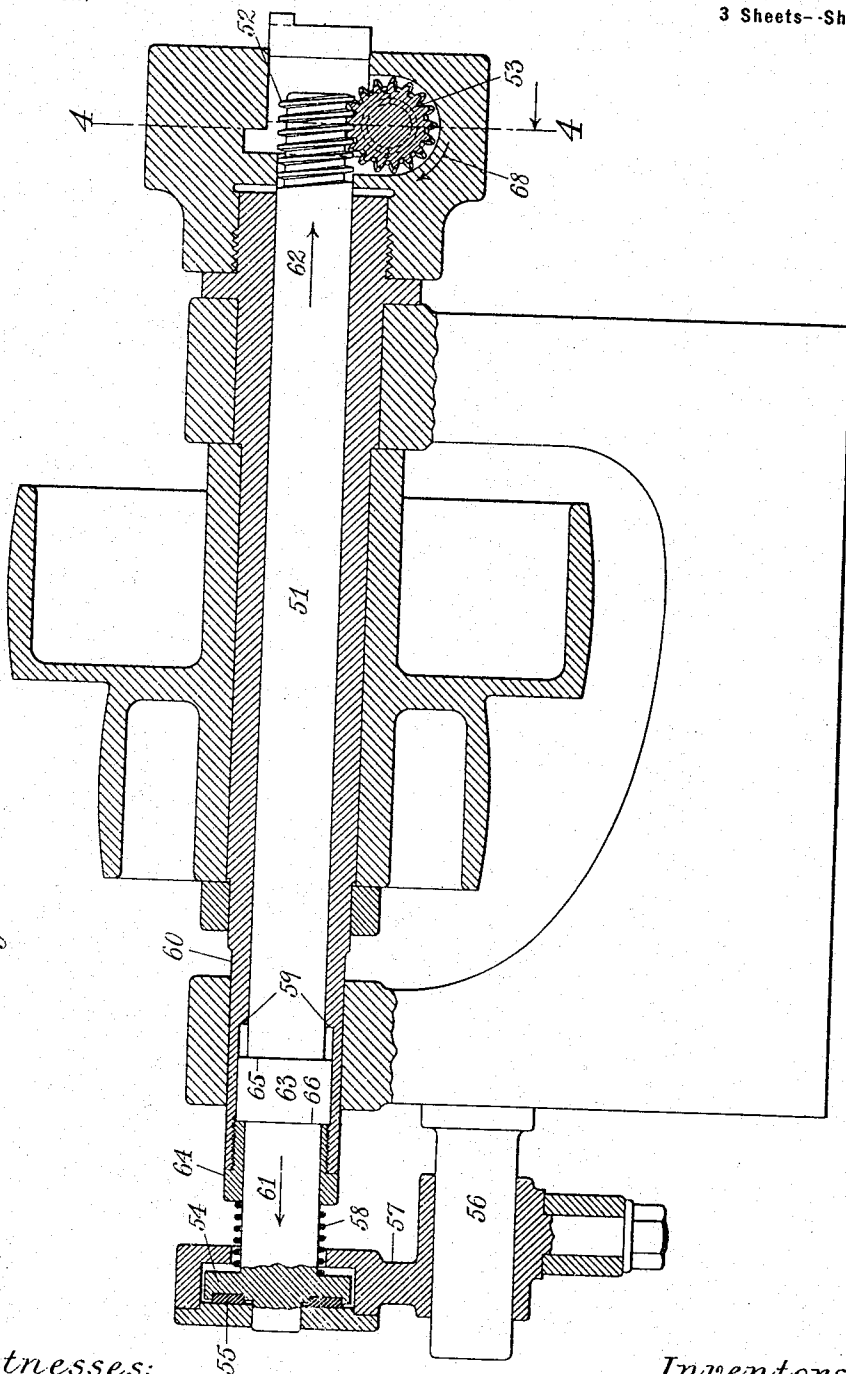
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3 Sheets--Sheet 3.

Fig. 7



Witnesses:
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H. C. Mallum

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By W. H. Bonuss Atty.

UNITED STATES PATENT OFFICE.

AUGUSTUS F. KUMMEL AND CLARENCE L. GOODRICH, OF HARTFORD,
CONNECTICUT, ASSIGNORS TO THE PRATT & WHITNEY COMPANY;
OF SAME PLACE.

CHUCK-OPERATING DEVICE.

SPECIFICATION forming part of Letters Patent No. 662,900, dated November 27, 1900.

Application filed February 5, 1900. Serial No. 4,115. (No model.)

To all whom it may concern:

Be it known that we, AUGUSTUS F. KUMMEL and CLARENCE L. GOODRICH, citizens of the United States of America, and residents of Hartford, in the county of Hartford and State of Connecticut, have invented certain new and useful Improvements in Chuck-Operating Devices, of which the following is a specification.

This invention relates to improved means for operating the jaws of a rotating work-carrier of the class which in workshop phraseology is commonly termed a "chuck" for delivering or feeding thereto the work or the objects to be carried and for gripping and releasing the said work at the desired times, whether the work-carrier is stationary or rotating in either direction.

Figure 1 of the drawings is a side view of one of the simplest forms of the work-carrier in section taken through the longitudinal center thereof. Fig. 2 is an end view projected from the left-hand end of Fig. 1. Fig. 3 is an end view in cross-section taken substantially along the line 3 3 of Fig. 1. Fig. 4 is an end view in cross-section taken along the line 4 4 of Fig. 7. Fig. 5 is a side view of the front end of one of these work-carriers and its cooperating work delivering or feeding device adapted to deliver an ordinary valve-plug, the feeding device being shown in cross-section taken substantially along its longitudinal center. In this figure the head of the plug is shown in the position of entering the jaws. Fig. 6 is a front view of the jaws of one of these work-carriers. Fig. 7 is a side view of an amplified arrangement of the work-carrier-operating devices in section, taken through the longitudinal center thereof.

In the embodiment of the invention shown in Fig. 1 the body or chuck 10 of the work-carrier is fitted upon the end of the spindle 11, which is journaled in the head 12, and has keyed upon it the belt-pulley 13, by means of which suitable rotative movement may be imparted to the spindle from any convenient driving-shaft. The chuck-body is provided with the oppositely-disposed jaws 14 and 15, which are fitted to slide transversely in suitable ways in the chuck. The pinion 16 is

journaled in the chuck with its axis parallel with the direction of movement of the jaws, the extended ends 17 and 18 being provided with left and right hand screw-threads which engage with the jaws 14 and 15, respectively. The enlarged toothed portion of the pinion is shouldered at its opposite sides against the corresponding sides of the recess 20 of the chuck to prevent end movement of the pinion, so that when the latter is rotated in one direction it will move the jaws 14 and 15 together, and will move them apart when rotated in the opposite direction.

As a means for rotating the pinion to operate the jaws during the rotation of the work-carrier it is provided with a plunger 21, which is fitted to slide freely in the central bore of the spindle 11. The plunger is preferably tubular throughout, as shown, in order to allow of the insertion or passage of rods or similar material to be operated upon. The forward end of this plunger is provided with gear-teeth meshing with teeth upon the periphery of the pinion 16, so that the plunger 21 serves as a rack to operate the jaws 14 and 15 when moved longitudinally with relation to the spindle, and this form of plunger is preferably provided with a spline 22, which is engaged by the spline 23 of the chuck-body 10 and rotates positively therewith. As a means for moving this plunger longitudinally to operate the jaws the plunger has fixed upon its rearward or left-hand end the dog 24, the arms of which extend outwardly through slots 25 in the spindle 11 and are clamped in the clutch-sleeve 26. The latter is provided with an annular groove 27 for receiving the fork of the clutch 28, which is fitted to slide longitudinally upon the stud 29. The latter projects rearwardly from the head 12 and is provided with an adjustable collar 30 for limiting the rearward longitudinal movement of the clutch 28. The lower side of the clutch is provided with a stud 31 for receiving the hand-lever 32, by means of which the plunger 21 is moved longitudinally by the hand of the operator in a manner well known in machinery of this class and which need not therefore be more specifically described herein.

The jaws 14 and 15 may be operated equally well whether the carrier is standing still or rotating rapidly in either direction. When standing still, the work may be delivered to the jaws by the hand of the operator in the customary way; but this invention finds its chief utility in connection with machinery, such as turret-head lathes, screw-machines, and chucking-machines in their operation upon work which is of such a nature that it could hitherto be delivered to its carrier only by stopping the rotation of the latter, thereby, and for this reason alone, sacrificing a considerable amount of time for each piece of work. In Fig. 5 is shown a device for co-operating with this work-carrier to deliver automatically thereto the work to be carried, which in the case illustrated is an ordinary valve-plug 35. This is held in proper relation for presentation to the jaws of the chuck by means of the collet 37, which may be carried upon the foot-block spindle of the lathe or, as herein illustrated, in the tool-turret 38 of a turret-head screw-machine or chucking-machine. The collet 37 is mounted to slide longitudinally in a seat in the turret, being pressed outwardly by means of the spring 39, the nut 40 serving as a stop to limit its outward motion. The front end of the collet is provided with a recessed seat for the plug, which, as here shown and in the case of all symmetrical work, may serve as a bearing for the rotation of the work. The carrier is provided with one or more projecting guides, as 42 and 43, which are herein shown to be located upon the jaws 14 and 15, respectively, for engaging with the advancing end of the work and rotating it synchronously with the carrier, the portion to be gripped being located in the plane of the opening 44 between the jaws, so as to guide that portion into the opening as it is moved forward by the collet. The operation of this device upon a piece of work like the valve-plug 35 is as follows: The plug is inserted in the collet 37 and is moved forward thereby in line with the center of rotation of the rotating work-carrier until the forward end or head 36 of the plug is engaged by the leading faces of the projecting guides 42 and 43 of the chuck-jaws 14 and 15, which thus locate the head 36 in the plane of the opening 44 between the jaws and rotate the plug in that relation to that opening while the head of the plug is pushed forward to the desired gripping position. The clutch-lever 32 is then operated to push forward the plunger 21, thus turning the pinion 16 and closing the jaws upon the work, after which the collet 38 is drawn back and the required tools are presented, so as to perform in their proper sequence the required operations upon the plug. The latter is then released from the jaws by pushing back the hand-lever 32 and its connected plunger 21, the succeeding pieces being thus presented, gripped, operated upon, and released in like

manner. The direction and speed of rotation of the spindle are immaterial in the operation of the jaws of this work-carrier, since the plunger 21 is at all times in direct and positive engagement with the jaws. The operation of the work-delivering device of Fig. 5 is also independent of the direction of rotation excepting that the guides 42 and 43 are here shown to be located so as to receive the work from the collet while the work-carrier is rotating in the direction indicated by the arrow 45 in Fig. 6. It is, however, only necessary to suitably locate the guides in order to enable the carrier to receive its work when rotated in the opposite direction. For many kinds of work a single guide will answer all practical requirements; but the use of two is considered more positive and accurate.

On account of the fact that it is frequently necessary to rotate the same piece of work first in one direction and then in the other in order to perform the several required operations thereon the guides 42 and 43 are preferably beveled back at 46 and 47 to the level of the face of the chuck-jaws. For the same reason the collet is resiliently mounted to move longitudinally against the pressure of the spring 39, so that if the work should inadvertently be presented to the carrier while the latter is rotating in the wrong direction these beveled backs of the guides will force the collet backwardly against its spring, thus avoiding damage to the apparatus and the work. This beveling of the guides also facilitates the entrance of the work when the carrier is rotating in the right direction by increasing the angle of the arc through which the work may find its way between the guides and into the opening 44. This is a feature of considerable importance in connection with high rotative speeds of the carrier.

As herein shown, the collet is prevented from rotating with the work by means of the spline 41. With some classes of work, and especially when used with a slowly-rotating carrier, the spring 39 may be dispensed with and the collet may be clamped fast in its turret or holder, or both the spring 39 and the spline 41 may be omitted and the collet allowed to rotate with the work. The latter arrangement is preferable when the work to be operated upon is not of a symmetrical form, so that it can be rotated in the collet. In such a case the seat in the collet should be made to receive the work and to present the gripping portion thereof in a suitable relation to the jaws of the carrier, the collet itself rotating with the work and with the jaws until the work is gripped and the collet withdrawn. The jaws of the carrier should also be shaped and adapted to the nature and form of the work to be gripped. They may, if required, be reversed or faced outwardly, and thus adapted to hold some kinds of work by its bore or by an interior rim or flange, the jaws

being in that case moved outwardly to grip the work by drawing the plunger back or to the left, as viewed in Fig. 1.

It is not an essential feature of this invention that the plunger 21 should be tubular or even that it be journaled concentrically with the spindle 11, since the connection between the dog 24 and the rack portion of the plunger may be considerably modified to meet the conditions of the work to be done or the construction of the machine or spindle to which it is applied. It is, however, preferable to employ a tubular plunger, and to locate it concentrically with the spindle in order to permit of the passage of rods of materials, drills, counterbores, and similar tools.

Either or both of the jaws 14 and 15 may be adjusted radially to or from each other to adapt them to different sizes of work by loosening the collar 30 and drawing the clutch 28 and its attached plunger backwardly until it is clear of the pinion 16, after which the latter may be turned with a wrench to adjust the jaws to the desired position, the end of the pinion being squared, as shown in Fig. 3, to receive the wrench for this purpose. The plunger is then pushed forward again into mesh with the pinion and the collar 30 is replaced, the function of this collar being to serve as a stop for the rearward movement of the plunger.

Figs. 4 and 7 represent an arrangement of the work-carrier, whereby its scope is greatly amplified and extended, and this arrangement differs from that already described chiefly in the respect that the plunger is adapted to rotate as well as move longitudinally, the utility of which resides in the fact that the jaws may thereby be given a greater range of automatic movement, that range being limited in the apparatus shown in the previous figures to the permissible longitudinal movement of the plunger 21. To extend this range of movement and also when desired to increase the force of the gripping action the plunger 51 is provided at its forward or right-hand end with a worm-thread 52 instead of the spur-gear teeth of Figs. 1 and 3, and the pinion 53 is made in the form of a worm-wheel, having upon its periphery teeth for suitably engaging with the worm-thread 52. With this arrangement it is evident that the worm-wheel 53 may be operated to open and close the jaws by either the rotary or the longitudinal movement of the plunger 51 with relation to the spindle 60, or by both of these movements either simultaneously or in sequence. As a means for imparting the desired movements to this plunger 51 it is provided at its opposite or left-hand end with a friction-disk 54, preferably faced with a ring 55, of leather or similar material, for engaging with the side of the clutch 57, which, like the clutch 28 of Fig. 1, slides on the stud 56. This plunger is provided with the shoulders 65 and 66, forming a thrust-collar 63, which being confined

between the shoulder 59 and the collar 64 of the spindle serves to limit the longitudinal movement of the plunger with relation to the spindle and to take the thrust of the worm-thread. The collar 64 should be removably fixed to the spindle in any convenient way, herein shown to be by means of a screw-thread, which under the conditions here shown should be left-handed in order that it may not be unscrewed from the spindle by the frictional action of the collar 63 under the pressure due to closing the jaws. A spring 58 is preferably employed between the disk 54 and the outside of the collar 64, the function of this spring being to resiliently press the spindle longitudinally of the direction of the arrow 61 against the collar 64 and to cushion the action of the clutch 57 against the friction-disk 54. In the arrangement here shown the jaws may be closed by moving the plunger 51 in the direction of the arrow 62 or by holding the plunger against rotative movement while the work-carrier is rotated in the direction of the arrow 67 of Fig. 4, although it is obvious that the device may be adapted to close the jaws by reversing either or both of these movements by suitably altering the direction of lead of the screw-threads on the worm-wheel 53 or of the worm-thread 52. In the operation of this apparatus of Figs. 4 and 7 the jaws are gripped upon the work by moving the clutch-slide 57 by means of the customary hand-lever 32 against the rearward face of the friction-disk 54, which serves either to move the plunger forward or to hold it from rotating according to the pressure of the spring 58. In the absence of that or a similar spring the collar 63 of the plunger would be carried forward against the shoulder 59 or until the resistance of the jaws became sufficient to prevent further forward movement, whereupon the continued rotation of the work-carrier and the revolution of the worm-gear 53 around the now stationary plunger operates to rotate that worm-gear in the direction of the arrow 68 until the jaws of the carrier close tightly upon the work. Whatever may be the preliminary movements the resistance of the jaws to the closing movement ultimately reacts through the worm-gear as a nut to thrust the plunger toward the left, jamming its collar 63 tightly against the collar 64, which therefore then takes the pressure of holding the work; but since both the collar 64 and the plunger 51 rotate with the spindle 60 when the work is gripped and while it is being operated upon there is then no loss of power through friction with external or stationary parts, the clutch 57 being moved slightly to the left after the work is gripped to free it from the rotating friction-disk 54. When it is desired to release the work, the direction of rotation of the spindle is reversed, and the clutch is again brought against the friction-disk 54 to stop the rotation of the plunger. The worm-gear 53, re-

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 revolving around the non-rotating plunger, operates thereon as a nut to draw the plunger to the right or in the direction of the arrow 62, away from the collar 64 and against the shoulder 59, whereupon the stationary plunger serves to rotate the worm-wheel in a direction opposite to that indicated by the arrow 68, thereby separating the jaws and releasing the work therefrom.

10 With some forms of work it is necessary to recess the jaws or it may be sometimes necessary that the jaws shall extend over and across the larger diameter of a piece of work and grip a smaller diameter beyond it. Hence
 15 arises the utility of the increased traverse of the jaws of the chuck made possible by this arrangement of my invention, since the jaws can be traversed to any desired extent by merely extending the time of contact between
 20 the clutch 57 and the friction-disk 54.

It is not essential to the operation of the apparatus of Figs. 4 and 7 that provision be made for longitudinal movement of the plunger, but that provision is for most purposes
 25 deemed preferable, especially for the operation of loosening the jaws of the carrier, since with this provision the force required to release the collar 63 from contact with the collar 64 is not exerted simultaneously with
 30 that required for releasing the chuck-jaws themselves. This provision permits the work-carrier to gather momentum after its collar is released from the collar 63 of the plunger and brings the latter against the shoulder
 35 59 with more or less of a blow which reacts upon the worm-gear 53 to start the jaws more readily from their grip upon the work, which usually jams the jaws and the plunger somewhat tightly in their gripped positions.

40 This invention permits of the ready removal of the chuck from the spindle for the substitution of others of different sizes or adapted to different purposes, all operable by the same plunger devices; but during the
 45 performance of its functions as a work-carrier the chuck and the spindle may be considered as being integral to all intents and purposes. These chucks being of simple and inexpensive construction may be multiplied
 50 to any desired extent to suit the various requirements of the different kinds of work coming within the scope of this apparatus.

The range of movement and the force applied to the gripping of the jaws upon the
 55 work may be modified by changing the length of the hand-lever or the position of its fulcrum by changing the diameter of the pinion or the pitch of its screw-threads. In the arrangement shown in Figs. 4 and 7 either the
 60 range of movement or its force, or both, may be increased by thus altering the worm-wheel 53 and extending the time during which the rotation of the plunger is arrested.

We claim as our invention—

65 1. A rotatable work-carrier provided with laterally-movable jaws, a pinion provided

with right and left hand threads for moving two or more of the jaws, and means for operating the pinion while the carrier is rotating.

2. A rotatable work-carrier, provided with laterally-movable jaws, a pinion having right and left hand threads for moving two or more of the jaws simultaneously, and a plunger mounted in a substantially concentric relation to the carrier for engaging with and rotating the pinion.

3. In combination with a rotatable carrier, provided with a pair of oppositely-disposed laterally-movable jaws, a pinion provided with right and left hand screw-threads for moving the jaws to and from each other, and a plunger operable from the rearward end of the carrier provided with teeth for engaging with those of the pinion and serving as a rack therefor.

4. In combination with a rotatable spindle, a chuck removably attached to the spindle and provided with laterally-movable jaws, a pinion provided with right and left hand screw-threads for opening and closing the jaws, and a plunger mounted in the spindle and provided with teeth for engaging with those of the pinion, whereby different chucks may be employed with the same spindle and plunger.

5. A rotatable work-carrier, provided with work-gripping jaws, a worm-wheel operatively connected with the jaws to open and close them upon the work, a plunger provided with a worm-thread for engaging with the worm-wheel, and means for arresting the rotation of the plunger with relation to that of the carrier, for operating the jaws.

6. A rotatable work-carrier provided with work-gripping jaws, a worm-wheel provided with right and left hand screw-threads engaging with the respective jaws for moving them simultaneously toward or from the center of rotation, a plunger provided with a worm-thread for engaging with the worm-wheel, and means for arresting the rotation of the plunger with relation to the rotating carrier, whereby the jaws of the work-carrier may be operated while rotating.

7. A rotatable work-carrier, provided with work-gripping jaws, a worm-wheel operatively connected with a plurality of the jaws to open and close them upon the work, a plunger journaled concentrically with the carrier, and provided with a worm-thread for engaging with the worm-wheel, the plunger being provided with a friction-disk, and means for applying friction thereto to arrest its rotation with relation to that of the carrier.

8. A rotatable work-carrier, provided with work-gripping jaws, a worm-gear for operating the jaws, a plunger having a worm-thread for operating the gear, mounted concentrically with the carrier, and arranged for longitudinal and rotary movement relative thereto, with means for imposing frictional resistance to the rotation of the plunger for the purpose specified.

9. A rotatable work-carrier, provided with work-gripping jaws, a worm-gear for operating the jaws, and a plunger provided with a worm-thread for operating the gear, and with
5 a shoulder for receiving the thrust of the worm-thread.

10. A rotatable work-carrier, provided with work-gripping jaws, a worm-gear for operating the jaws, and a plunger provided with a
10 worm-thread for operating the gear and with

a thrust-collar supported for longitudinal movement between the shoulders of the carrier.

Signed at Hartford, Connecticut, this 2d day of February, 1900.

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Witnesses:

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