L. F. HART.

SCREW CUTTING DEVICE.

APPLICATION FILED NOV. 25, 1907.

925,181.

Patented June 15, 1909.

4 SHEETS—SHEET 1.

Fig. 1

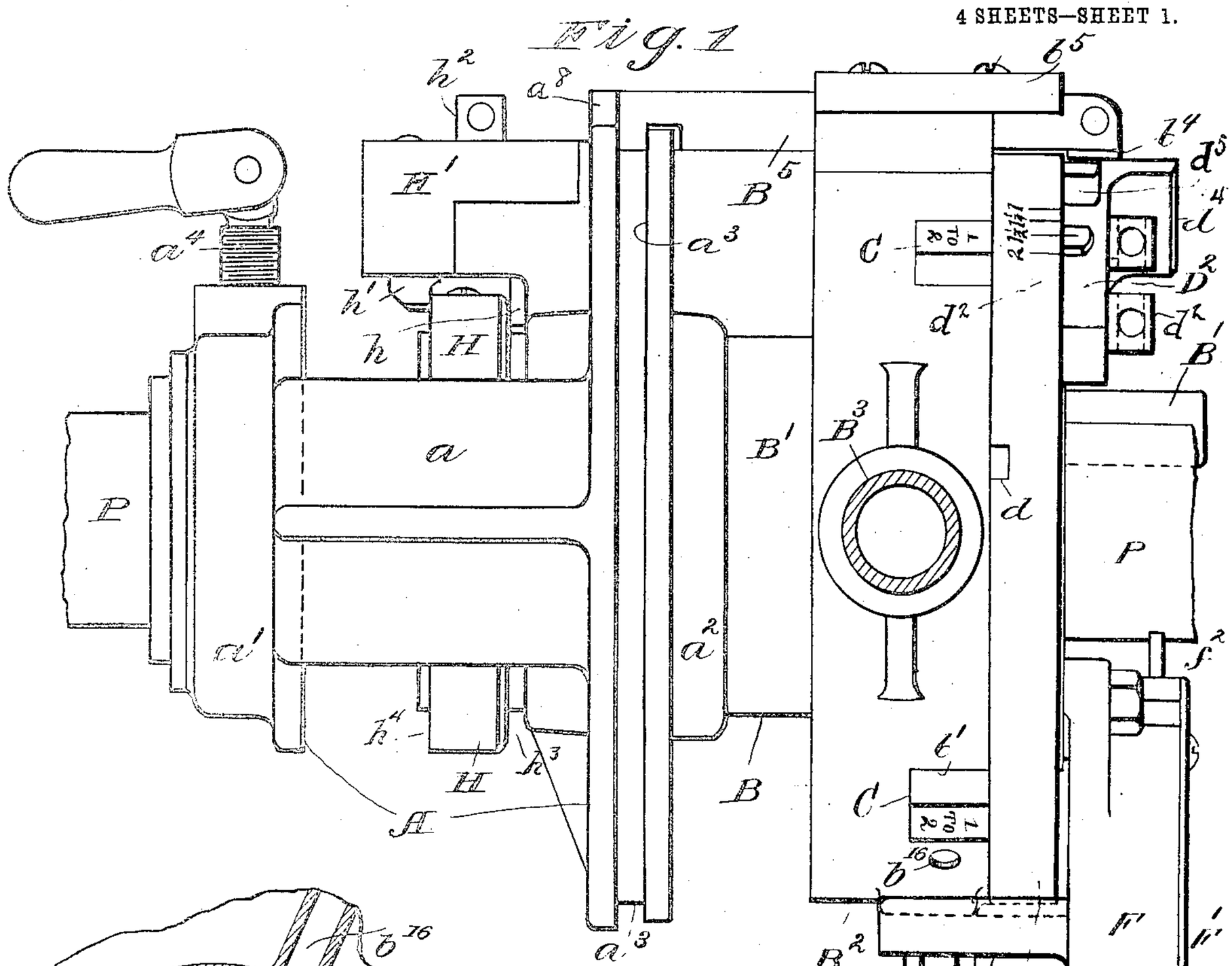


Fig. 11.

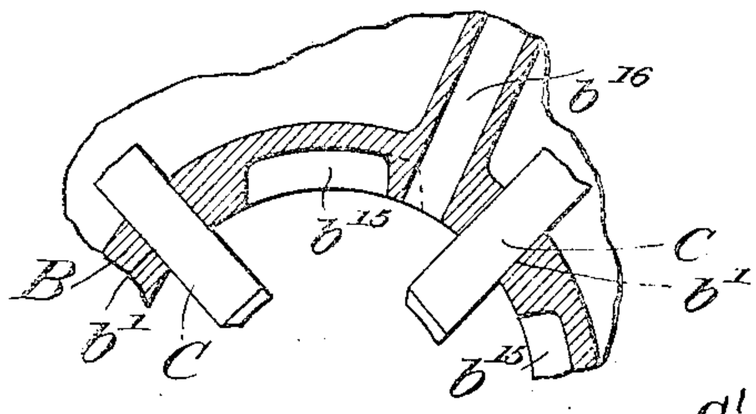
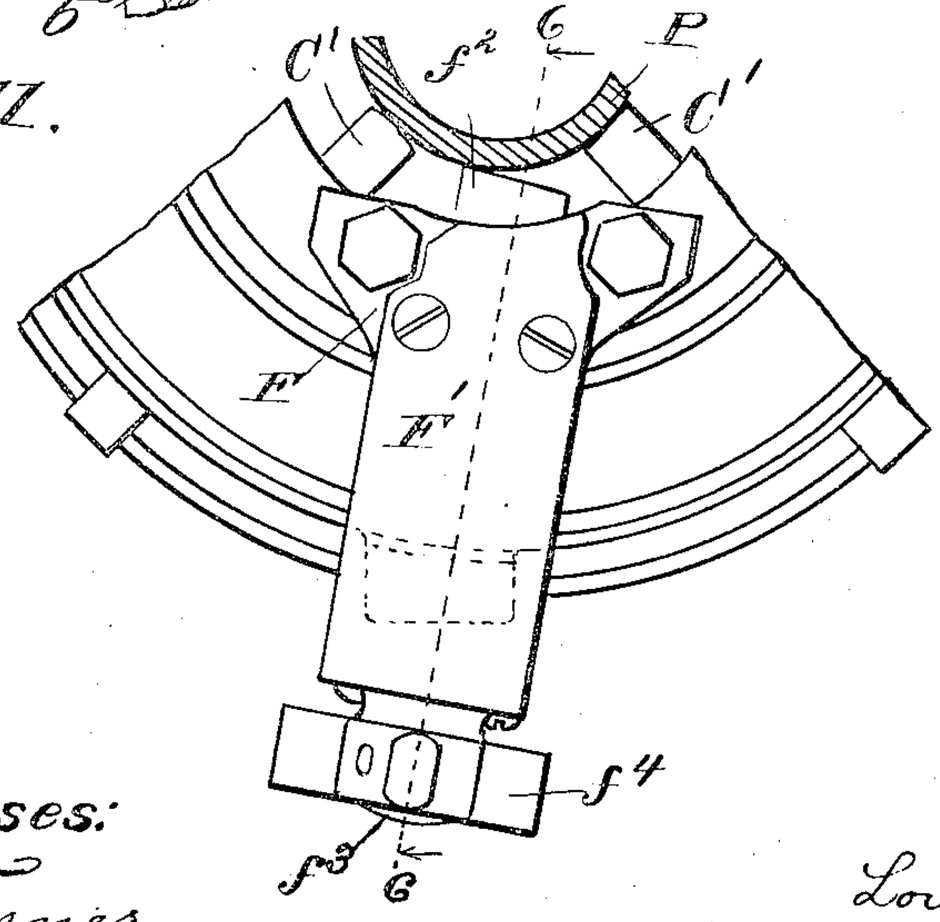


Fig. 5



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4 SHEETS—SHEET 2.

Fig. 2

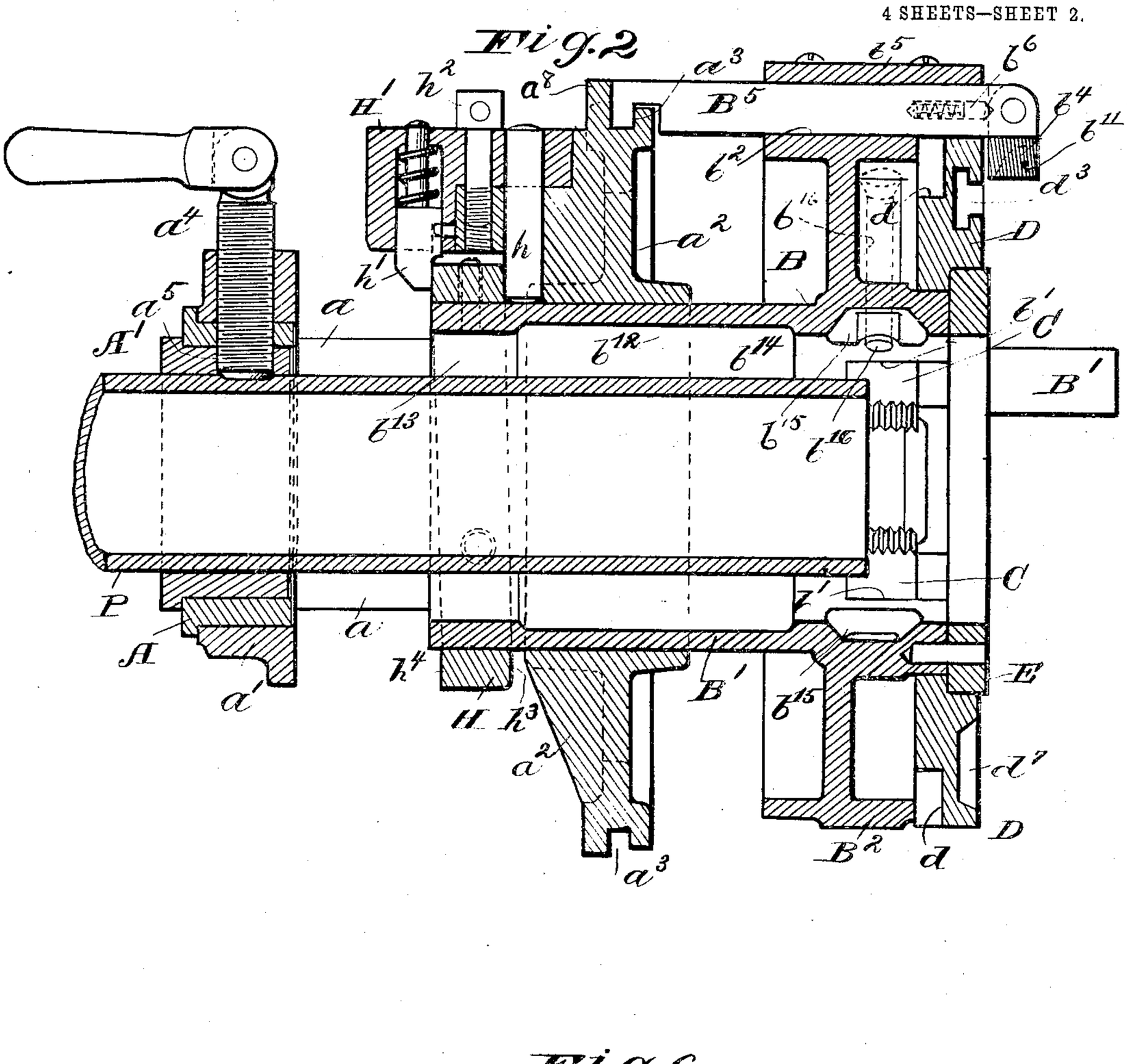
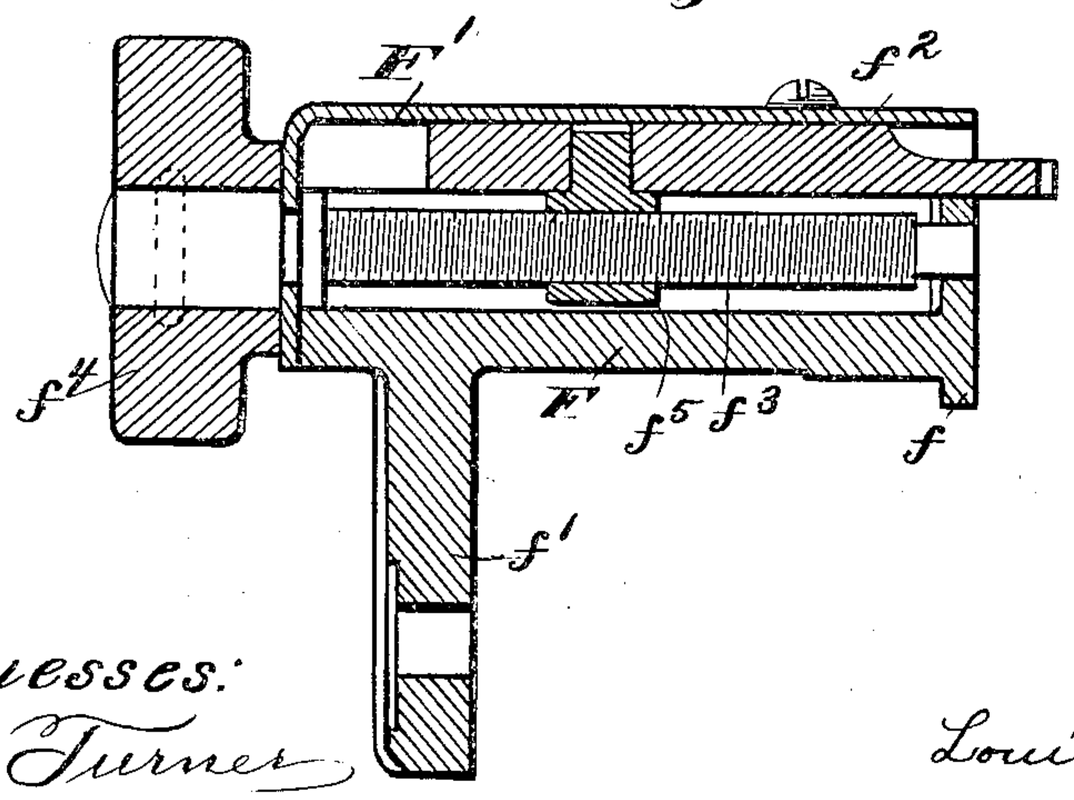


Fig. 6



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4 SHEETS—SHEET 3.

Fig. 3

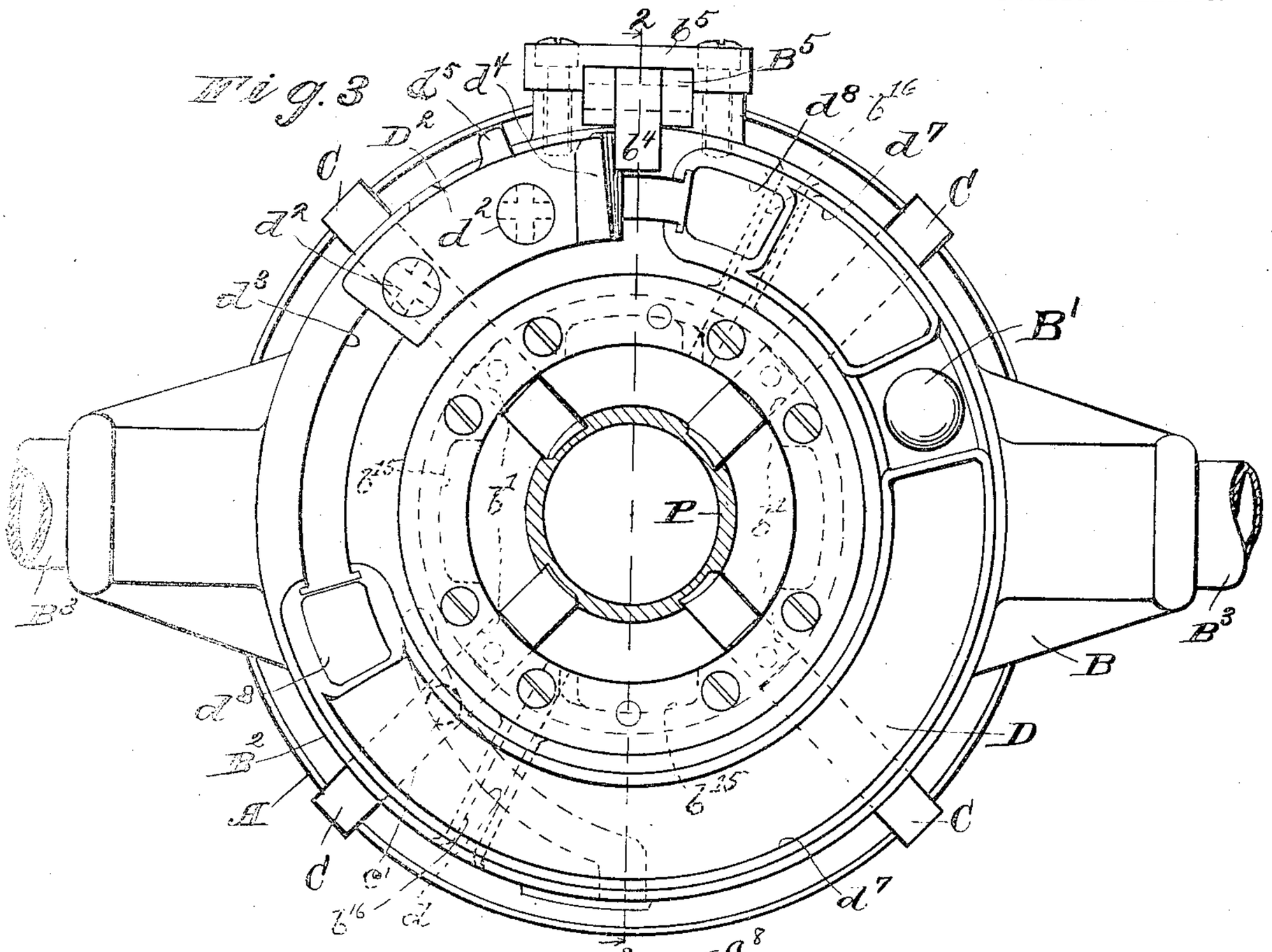

Fig. 4

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4 SHEETS—SHEET 4.

Fig. 9

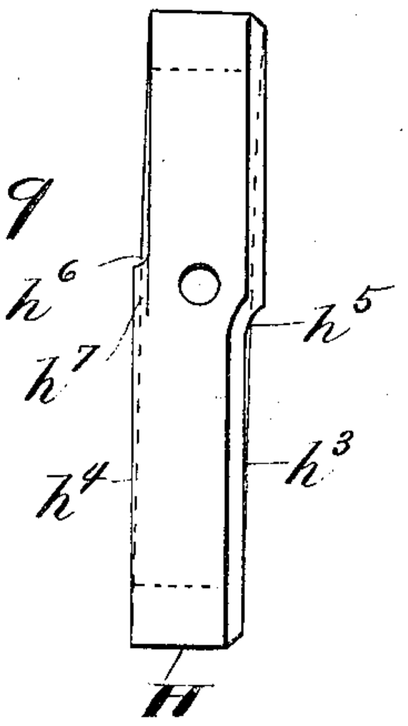


Fig. 7

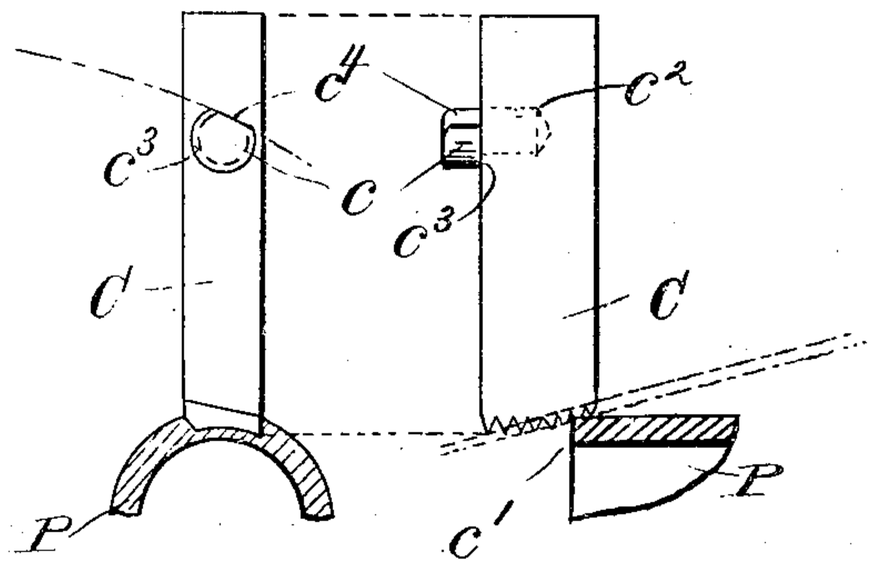


Fig. 10

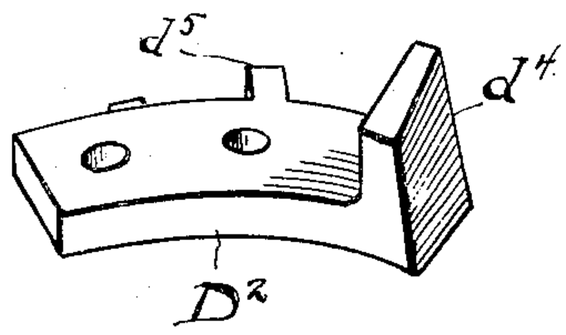
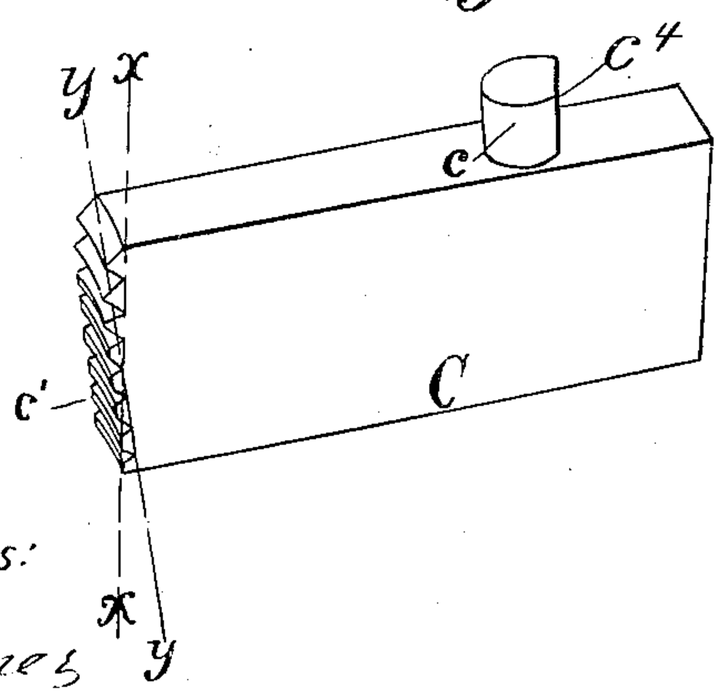


Fig. 8



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UNITED STATES PATENT OFFICE.

LOUIS F. HART, OF CLEVELAND, OHIO, ASSIGNOR TO THE HART MANUFACTURING COMPANY, OF CLEVELAND, OHIO, A CORPORATION OF OHIO.

SCREW-CUTTING DEVICE.

No. 925,181. Specification of Letters Patent. Patented June 15, 1909.

Application filed November 25, 1907. Serial No. 403,712.

To all whom it may concern:

Be it known that I, LOUIS F. HART, a citizen of the United States, resident of Cleveland, county of Cuyahoga, and State of Ohio, have invented a new and useful Improvement in Screw-Cutting Devices, of which the following is a specification, the principle of the invention being herein explained and the best mode in which I have contemplated applying that principle, so as to distinguish it from other inventions.

The present application relates to devices for cutting screw threads, particularly for cutting screw threads on pipes and the like where it is generally desirable to make such thread with a taper in order to insure a tight fitting joint. Such invention belongs to that type of screw cutting device which forms the subject matter of a co-pending application, Serial No. 307,598, filed March 23, 1906, wherein means are provided for automatically producing a tapered thread of the character described, such means being operated by the outward pressure of the dies in a cam plate with which they engage and by which their position is adjusted.

The present invention relates more particularly, then, to certain details of improvement in the general form of device above described and to other details involved in changing such general form so as to adapt the same for use in a die-stock structure as distinguished from the machine type of tool previously shown and described by way of illustration of the general invention. A description of the latter is of course necessarily involved in a description of the specific features constituting such present invention and recourse will have to be had to the claims at the end of this specification for a more exact designation and description of these specific features.

The annexed drawings and the following description set forth in detail certain mechanism embodying the invention, such disclosed means constituting but one of various mechanical forms in which the principle of the invention may be used.

In said annexed drawings: Figure 1 represents a side elevation of a die stock embodying the several improved features of construction of my invention; Fig. 2 is a central longitudinal cross-section of such die stock; Figs. 3 and 4 are respectively front and rear elevations of the same; Fig. 5 is a broken front elevation of the device showing a removable cutting-off tool attached thereon; Fig. 6 is a section taken on the line 6—6, Fig. 5, of such cutting-off tool; Fig. 7 shows a front elevation, and a side elevation, of an improved form of chaser die designed for use in connection with my die stock; Fig. 8, is a perspective view of such chaser die; Fig. 9 is a side elevation of a leader ring constituting a feature of the invention; Fig. 10 is a perspective view of a stop plate constituting yet another feature thereof; and Fig. 11 is a broken transverse sectional view taken in line with the dies and showing a detail of the oil pockets operating in connection therewith.

As indicated above the specific form of device here chosen for illustrative purposes is a die stock. It will, of course, be understood that not merely is such die stock exemplary of the general features of construction before alluded to and forming the subject matter of my co-pending application, but also that certain of the improved details of construction here disclosed are equally adaptable for use in conjunction with the other larger machine, as also in other types of threading devices entirely.

Having reference to the several figures, the tool there shown will be seen to be made up of two main elements, a stock-holding frame A and a die-holding member, or head, B, revolubly mounted in said frame. Member A, although integral in actual construction, may be regarded as being made of two concentric, but axially separated, annular portions a' a^2 joined together by longitudinally disposed connecting portions a. Annular portion a' of the frame is designed to serve as the work-holding device and to this end is provided with one or more telescoping bushings or guide-sleeves A′ held in place by means of a handled screw a^4 that projects through an aperture a^5 in said sleeve to engage with the pipe P or other work on which the screw threads are to be cut. To adapt the work-holding device to receive different sizes of pipe these telescoping bushings are removed or inserted as the case demands, the largest having an internal diameter corresponding to that of the largest size of pipe upon which the die-stock is adapted to operate. By removing this largest sleeve a nipple holder for the corresponding size of pipe may be inserted should it become neces-

sary in the threading of a nipple. In the type of tool illustrated it is of course intended that the pipe shall be held against rotation in a suitable vise or the like, the purpose of the work-holding member just described being merely to hold the tool frame from rotation on the pipe.

Annular portion a^2 of frame A has its inner face finished to form a bearing for the die-holding member B. Such die-holding member comprises the sleeve portion B′, adapted to be thus journaled within portion a^2 of the frame, and a flanged portion B^2 in which the dies C are designed to be supported. To rotate member B in frame A the former is provided with two radially extending arms or handles B^3 of the usual type.

For the reception of the dies C a plurality of preferably radially disposed slots b', four in number in the tool shown, are cut in the face of flange portion B^2 of member B. It will be understood that, as shown in the drawings, such flange need not be constructed solidly but may be suitably hollowed out to decrease the weight of the tool to within reasonable limits. With the same object in view the sleeve portion B′ of member B is interiorly hollowed out, or rather cast with an annular recess at b^{12}. This has the further advantage of decreasing the machine work upon the piece since the bore of the sleeve accordingly requires to be finished at the ends b^{13} b^{14} only. The forward end b^{14} being amply reinforced by the surrounding flange portion B^2 is also recessed intermediately between the slots b' that receive the dies C so as to form a plurality of disconnected but alined pockets b^{15}. These pockets subserve a distinct function apart from the result already noted, namely that of gathering the oil, for the admission of which holes b^{16} are provided, and pouring it over the dies in succession as the head B is revolved. In order that the oil may not escape by the holes b^{16} through which it is thus fed to the work, such holes open interiorly in the finished face of the sleeve and not in the pockets under consideration. It will accordingly be seen that by the expedient of these pockets I am enabled not only to conserve the oil and so lessen the amount required, but also to apply the lubricant exactly where most needed. Such dies, of which the details of construction will be later more particularly noted, are adjustably positioned in the slots thus provided, by means of a cam plate D rotatably mounted on the face of the flange B^2, being secured thereto by means of a retaining ring E. The face of cam-plate D is desirably hollowed out, as at d^7 d^7, after the fashion of flange B^2, in order to decrease weight. Engagement of plate D with the respective dies C is had by means of a series of cam grooves d, Fig. 3, where, however, only one is shown in order to avoid confusion. Such grooves correspond in number and disposition with the dies C, which latter are formed with projections or pins c, Figs. 3, 7 and 8, adapted to register in the grooves. Rotation of the cam plate obviously serves either to advance or retract the dies in the slots, depending on the direction of rotation, and in one position, in view of the conformation of the grooves, such rotation is adapted to permit release of the dies therefrom entirely. Manual rotation of the cam plate is facilitated by provision of a handle D′ on its outer face.

I have discovered that by giving cam grooves d the proper degree of inclination not only may movement of the dies be positively effected by rotation of the plate by the instrumentality of the handle or like means, but that the outward pressure of the dies themselves when in engagement with the work will be effective to rotate such cam plate. Such rotation will obviously be in a predetermined direction depending upon the direction of inclination of the grooves, irrespective of whether the die-holding member, or head B, be rotated to the right or the left for the cutting of correspondingly directed threads. The tendency of the cam plate thus to rotate when the device is in operation, I control by the following means: At a convenient point in the periphery of the flange B^2 of the die-holding member B is formed a longitudinal slot b^2 and slidably mounted therein is a rider bar B^5 retained against dislodgment from the slot by means of a cover plate b^5 secured to the flange and projecting a short distance in front of the same so as to afford ample support to the forwardly extending end of the rider bar. The rearwardly extending end of such bar engages a slot or recess a^3 encircling annular portion a^2 of frame A, whereby said bar is retained against longitudinal movement relatively to said frame while still being allowed to rotate freely along with member B. As has been indicated the outer end of bar in the initial operative position of the device shown in Figs. 1 and 2 projects a trifle beyond the front face of the cam plate D. In such front end of the bar is cut a longitudinal slot in which is pivotally mounted, on a transverse axis, a dog b^4 that is normally held in a radially alined, inwardly extending, direction by means of a spring-pressed plunger b^6 engaging with a recess in its rear face, Fig. 2. Such plunger is likewise adapted to frictionally retain said dog in a raised position when desired. The one face of dog b^4 is provided with a recess or gash b^{11} adapted to form a finger grip.

Cam plate D is provided on its face with a recess, or T-slot d^3 of circular conformation having the axis of the device as its center, such slot being adapted to receive bolts d^2

which serve in turn to secure a stop-plate D^2 in any desired axial position on the cam plate. To facilitate the milling of slot d^3, recesses d^7 in the face of the plate are terminally depressed, as at d^8 d^8 thus permitting the direct insertion of the milling cutter. Stop plate D^2 is provided with two stop members, one d^4, extending forwardly and adapted laterally to engage the dog b^4 depending as just described from rider bar B^5, and one, d^5, extending radially outward and adapted to engage the bar itself. The engaging face of the stop d^4 is beveled, as shown in Figs. 3 and 10, to incline in the same direction as that in which the cam grooves d recede from the center. This beveled surface may hence be styled right helicoidal being in effect shaped so as to present to the complementary face of the dog d^4 a surface every element of which in planes at right angles to the direction of the dog's travel with respect to such stop, is radial with the axis of the device. From the foregoing construction it will be apparent that the rotative tendency imparted to the cam plate will be negatively checked and controlled by engagement of such stop d^4 with the dog aforesaid. The cam plate, however, is not held entirely against movement since, as the die-holding member B is moved longitudinally within frame A, the rider bar B^5, and with it dog b^4, projects farther and farther in front of the cam-plate; or, in other words, the latter moves outwardly along the face of stop d^4 the retreating character of which permits to the cam plate a limited rotative movement with respect to the die-holding member. Upon the end of the stop d^4 being reached the dog escapes from the latter entirely and such cam-plate is thereupon free to rotate under the impulsion of the outward pressure of the dies until the secondary stop d^5 engages with the bar B^5, the object of this engagement being to prevent the entire release of the dies from the retaining grooves of the cam-plate. Such release can only be had by loosening set screws d^2 and shifting the plate D^2.

The construction of the cutting faces of the dies, forming no part of the present invention, need not here be other than briefly dwelt upon. This construction as fully explained in my co-pending application above referred to consists in forming the main or cutting threads of such face on one taper indicated by the construction lines x—x Fig. 8, whereas the starting threads are cut on a more abrupt taper indicated by the lines y—y. By properly correlating the rate of expansion of the dies, automatically secured as above described, to the length of the more abruptly tapered portion of the thread on the dies, such portion may be relieved from cutting, once it has served its proper function of initially gripping the screw, and the burden of the cutting operation be thrown on the main threads of the die. Another detail in the construction of the die, to which it is desired to call attention, is the manner of inserting therein the pin c whereby engagement is had by said die with the cam grooves d of plate D. Such pin is made with a shoulder c^3 somewhat larger than the hole c^2 in the side of the die in which the shank of the pin is designed to be press-fitted until the shoulder rests solidly against the surface of the die. This shoulder is made of a diameter greater than that of the cam groove in which it is desired subsequently to fit. Its rear side is accordingly cut off subsequently to the insertion of the pin in the die to present a surface c^4 complementary to that of the cam groove and properly angularly disposed to fit exactly against the same. The amount thus cut off is regulated to leave the transverse width of the projecting portion of the pin substantially equal to the width of the cam groove. It will accordingly be seen that the contacting face of the pin which bears the thrust when the die is mounted in the die-stock presents a sufficient bearing surface to greatly reduce the wearing effect due to the movement of the die with respect to the cam plate. The opposite or inner side of the pin will on the contrary have merely a line bearing on the corresponding face of the groove. Any tendency to bind or cramp in the groove, such as would be apt to occur were both sides of the pin formed to fit against the sides of the groove, is thus prevented. At the same time the projecting shoulder on the inner side of the pin serves to brace the latter against the strain impressed upon its opposite flattened face.

From the construction of the cutting faces of the dies above described, taken in conjunction with the manner in which they are mounted in the head B, it will be seen that they are not only self-centering but self-gripping. To assist them, however, in securing an initial grip, I have found it desirable to provide a ring H mounted upon the rear end of sleeve B′ which projects beyond annular portion a^3 of frame A. The respective faces h^3 h^4 of this ring are made of parallel cam formation, Fig. 9, and are designed to be engaged by a pin h and spring-pressed plunger h' mounted in a block H′ detachably secured by means of a capstan-headed screw h^2 to the rear side of such annular portion a^2, Figs. 1 and 2. The pin h, it will be understood, is press-fitted into block H′, so as to be practically an integral part thereof, but has a working fit in the portion of the frame to which the block is attached. The latter is thus in effect U-shape and very solidly secured when in place. When in the starting position the pin h should rest at the off-set or lowest point h^5 of the inner cam-face h^3 of said leader ring, and in this position plunger h'

will of course rest adjacent to the offset point h^6, or at the highest point on the rear face h^4. In this manner the parts of the device are loosely held in such position, the correctness of which is determined by the engagement of the pin with the offset h^5 aforesaid. To further facilitate the adjustment of member B in frame A, a boss a^8 is provided on the top of annular portion a^2, with which the rear end of the rider bar B^5 can be brought into register preparatory to beginning work. To permit the plunger to rise onto the ring, H, upon the subsequent rotation and longitudinal movement of the latter along with member B upon which it is mounted, an incline h^7 is provided, leading up from the point of offset on such rear face. Similarly to permit the passage of such plunger back again onto the rear side of the ring the edge of the inner face is beveled as shown, Fig. 9, as is also the rear edge of the plunger itself. It will be understood that the use of this leader mechanism is not absolutely essential. Accordingly in case there is little occasion for the cutting of left-handed threads, ring H, which is shown as right handed as being the one most frequently employed, will not require to be replaced with a left-handed ring; but, by simply detaching the block H′ with pin h and plunger h', the tool is left free to be used in the manner of the ordinary die-stock the dies being induced to grip the pipe by hand-pressure alone. Where the die-stock is required to be used generally in the cutting of left handed threads, ring H may of course be replaced by one on which the cams are oppositely disposed.

In Figs. 5 and 6 is illustrated a cutting off device adapted for use in conjunction with the die-stock above described. This tool comprises a body F adapted to be secured to the face of the die-stock, its inner end being formed with a projection f adapted to rest against the inner periphery of flange B^2, the intermediate portion spanning the cam-plate D, as will be evident. In such body portion F, retained therein by a cover plate F′, is slidably mounted the cutter proper f^2, adjustment of which is had by means of a screw f^3 adapted to be rotated by a hand wheel f^4 mounted upon the end projecting without the cover and bearing a nut f^5 which engages with said cutter, Fig. 6. Such cutting-off device it will be seen may be readily attached and detached as occasion demands, and when in place it is held or locked securely against any outward thrust such as the cutter imparts thereto when pressed against the pipe, Fig. 5, by virtue of the projecting inner end and bracket. For use with the cutter, blank dies C′ are employed, in place of the cutting dies, in order to properly aline and sustain the outer end of the pipe.

By way of conclusion, I would call attention particularly to the improved construction of the leading mechanism including leader ring H and the elements coöperative therewith whereby not only may the parts of the die stock be readily adjusted preliminarily to starting operations but also loosely there held. By the particular construction and arrangement of the rider bar and the dog borne by it, not only is additional strength secured in parts that are subject to more or less strain, but such parts are made readily accessible both for assembling the tool and subsequently cleaning the same. In the matter of the dies the feature of the pin with the shoulder disposed and constructed as described provides not merely a much simpler article in the way of manufacture, compared with the proposition of cutting the die block with such pin out of an integral blank, but also, as tests have shown, a construction that is equally strong for any use to which it may be subjected. Finally as to the cutting off tool, by mounting the same in the manner shown so as to span the annular face of the head or die holding member B, a very rigid and solid support for the cutting tool proper is secured without sacrificing the lightness essential to the convenient use of a manually operated tool of the character in hand.

Other modes of applying the principle of my invention may be employed instead of the one explained, change being made as regards the mechanism herein disclosed, provided the means stated by any one of the following claims or the equivalent of such stated means be employed.

I therefore particularly point out and distinctly claim as my invention:—

1. In a screw cutting device, the combination of work-holding means, a member longitudinally and rotatably movable therein, dies radially movable in said member, a plate rotatably secured to said member and provided with cam-elements engaging said dies, the elements of said plate being so disposed that the outward pressure of said dies is effective to rotate the latter in a predetermined direction relative to said member, a bar longitudinally movable in the periphery of said member and held against longitudinal movement with respect to said work-holding means, a dog mounted in the end of said bar on a transverse axis so as to be movable in a radial plane with respect to the axis of the device, and a stop attached to the face of said plate and adapted to engage the dog when disposed in front of said plate, said stop having a retreating contact face whereby a relative movement is permitted said plate pending the longitudinal movement of said member.

2. In a screw-cutting device, the combination of a frame comprising alined annular portions, a flanged sleeve rotatably and longitudinally movable in one of said portions,

dies movable in the flange of said sleeve, a rider-bar longitudinally movable in the periphery of the flange of said sleeve and held against longitudinal movement with respect to said frame, a cam-plate rotatably secured on the face of said flange and engaging said dies, the outward pressure of the latter when the device is in operation being effective to rotate said cam plate, a dog mounted in the end of said bar on a transverse axis so as to be movable in a radial plane with respect to the axis of the device, a spring-pressed plunger adapted to normally retain said dog inwardly disposed in front of said cam-plate, and a stop attached to the face of said cam-plate and adapted to engage said dog when thus disposed, said stop having a retreating contact face whereby a limited rotative movement is permitted said cam-plate pending the longitudinal movement of said sleeve.

3. In a screw-cutting device, the combination of a frame comprising alined annular portions, a flanged sleeve rotatably and longitudinally movable in one of said portions, dies movable in the flange of said sleeve, such flange having a longitudinal slot in its periphery, a rider-bar slidably mounted in said slot and having its rear end in engagement with said frame so as to be held against longitudinal movement with respect to the same, a cover-plate adapted to retain said rider-bar in such slot and projecting forwardly beyond the face of such flange, a cam-plate rotatably secured on the face of said flange and engaging said dies, the outward pressure of the latter when the device is in operation being effective to rotate said cam plate, a dog mounted in the end of said bar on a transverse axis so as to be movable in a radial plane with respect to the axis of the device, a spring-pressed plunger adapted to normally retain said dog inwardly disposed in front of said cam-plate, and a stop attached to the face of said cam-plate and adapted to engage said dog when thus disposed, said stop having a retreating contact face whereby a limited rotative movement is permitted said cam-plate pending the longitudinal movement of said sleeve.

4. In a screw-cutting device, the combination of a frame comprising alined annular portions, a flanged sleeve rotatably and longitudinally movable in one of said portions, dies movable in the flange of said sleeve, a rider-bar longitudinally movable in the periphery of the flange of said sleeve and held against longitudinal movement with respect to said frame, a cam-plate rotatably secured on the face of said flange and engaging said dies, the outward pressure of the latter when the device is in operation being effective to rotate said cam plate, a dog mounted in the end of said bar on a transverse axis so as to be movable in a radial plane with respect to the axis of the device, a spring-pressed plunger adapted to normally retain said dog inwardly disposed in front of said cam-plate, and a stop attached to the face of said cam-plate and adapted to engage said dog when thus disposed, the contacting faces of said stop and dog being substantially helicoidal in conformation whereby a limited rotative movement is permitted said cam-plate pending the longitudinal movement of said sleeve, and said dog being provided with a finger grip.

5. In a screw-cutting device, the combination with a work-holding member and a die-holding member independently longitudinally and rotatably movable therein, of a leader device comprising elements borne by said members respectively said members being adapted to engage and when in engagement to impart a limited longitudinal movement to said die-holding member upon rotation of the same, and means adapted to detachably secure the latter member in said work-holding member in proper position for starting.

6. In a screw-cutting device, the combination with a work-holding member and a die-holding member independently longitudinally and rotatably movable therein, of a leader device comprising elements borne by said members respectively and adapted when in engagement to impart a limited longitudinal movement to said die-holding member upon rotation of the same, and means provided in connection with said leader device adapted to engage and, when thus engaging to detachably secure said die-holding member in said work-holding member in proper position for starting.

7. In a screw-cutting device, the combination with a work-holding member and a die-holding member independently longitudinally and rotatably movable therein, of a leader ring borne by one of said members, an element borne by the other thereof adapted to engage with said ring to impart a limited longitudinal movement to the latter of said members upon rotation of the same, and means borne by said members adapted to engage with each other to detachably secure the latter member in the former in proper position for starting.

8. In a screw-cutting device, the combination with a work-holding member and a die-holding member independently longitudinally and rotatably movable therein, of a leader ring borne by the latter of said members, a pin borne by the former thereof and adapted to engage with the forward face of said ring, such face being of cam formation so as to impart longitudinal movement to said latter member upon rotation thereof, and resilient means adapted to engage the other face of said ring to secure said latter member in proper place for starting.

9. In a screw-cutting device, the combi-

nation with a work-holding member and a die-holding member independently longitudinally and rotatably movable therein, of a leader ring borne by the latter of said members, and a pin and plunger borne by the former and respectively adapted to engage the forward and rear faces of said ring, such faces being of parallel cam formation and the outer face being furthermore provided with an incline whereby said plunger may rise onto the ring upon rotation and longitudinal movement of said die-holding member.

10. In a screw-cutting device, the combination with a work-holding member and a die-holding member independently longitudinally and rotatably movable therein, of a leader ring borne by the latter of said members, and a pin and spring pressed plunger borne by the former and respectively adapted to engage the forward and rear faces of said ring, such faces being of parallel cam formation, the outer face being furthermore provided with an incline whereby said plunger may rise onto the ring upon rotation and longitudinal movement of said die-holding member, and the inner face being beveled whereby said plunger may be restored to its initial position.

11. In a screw-cutting device, the combination with a work-holding member and a die-holding member independently longitudinally and rotatably movable therein, of a leader ring borne by the latter of said members, a block detachably secured to the former thereof, and a pin and spring-pressed plunger mounted in said block and respectively adapted to engage the forward and rear faces of said ring, such faces being of parallel cam formation, the outer face being furthermore provided with an incline whereby said plunger may rise onto the ring upon rotation and longitudinal movement of said die-holding member, and the inner face being beveled whereby said plunger may be restored to its initial position.

12. A chaser die for use in a screw-cutting device of the cam-actuated type, comprising a die block and a pin inserted in the side thereof for engaging the grooves of the cam-plate, such pin having a shoulder resting solidly on the face of the block and cut away on its outer side so as substantially to conform with the corresponding face of such grooves.

13. In a screw-cutting device including a die-holding member, having an annular face, a cutting-off tool comprising a body adapted to span such face and formed with projections for engaging the inner and outer edges of the same, means for detachably securing said body to said face, and a cutter adjustably mounted in said body.

14. In a screw-cutting device including a die-holding member having an annular face and a cam-plate rotatably secured to such face for positioning the dies, a cutting-off tool comprising a body adapted to span such face and cam plate, said body being formed with projections for engaging the inner and outer edges of the face, means for detachably securing said body to said face, and a cutter adjustably mounted in said body.

15. In a screw-cutting device, a die-holding member comprising an annular head provided with slots for the reception of the dies, and with recesses in its inner face intermediate between such slots forming pockets for retaining oil.

16. In a screw-cutting device, a die-holding member comprising an annular head provided with substantially radially extending slots for the reception of the dies, and with recesses in its inner face intermediate between such slots forming pockets for retaining oil, said head being further provided with radially disposed holes for supplying oil to such pockets.

17. In a screw-cutting device, a die-holding member comprising an annular head provided with substantially radially extending slots for the reception of the dies, and with recesses in its inner face intermediate between such slots forming pockets for retaining oil, said head being further provided with holes for supplying oil to such pockets, the inner openings of said holes being alined with but not in such pockets.

Signed by me, this 23rd day of November, 1907.

LOUIS F. HART.

Attested by—
D. T. DAVIES,
JNO. F. OBERLIN.