

Feb. 23, 1926.

1,574,631

G. E. MIRFIELD

METHOD AND APPARATUS FOR THREADING METAL ARTICLES

Filed April 22, 1922

6 Sheets-Sheet 1

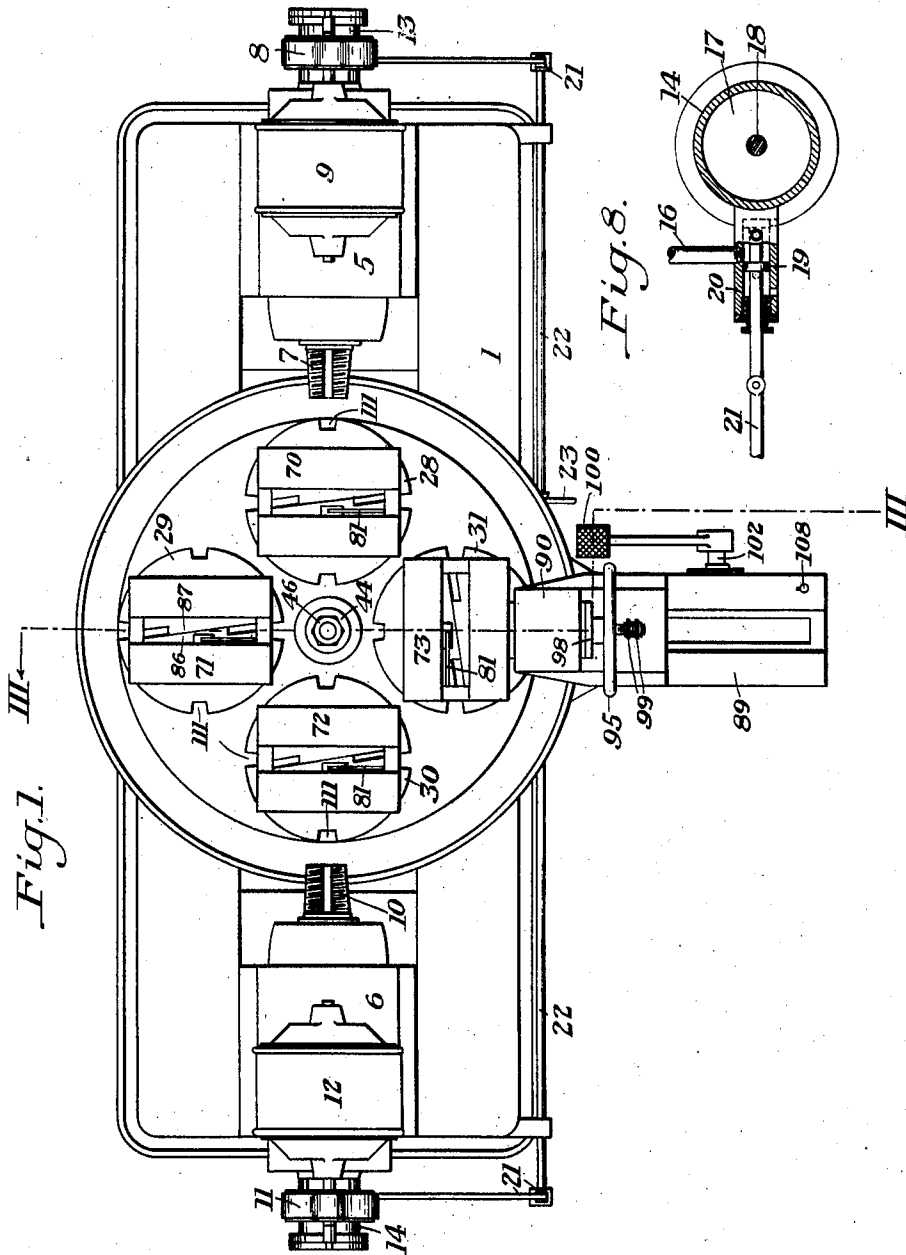


Fig. 1.

Fig. 8.

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6 Sheets-Sheet 2

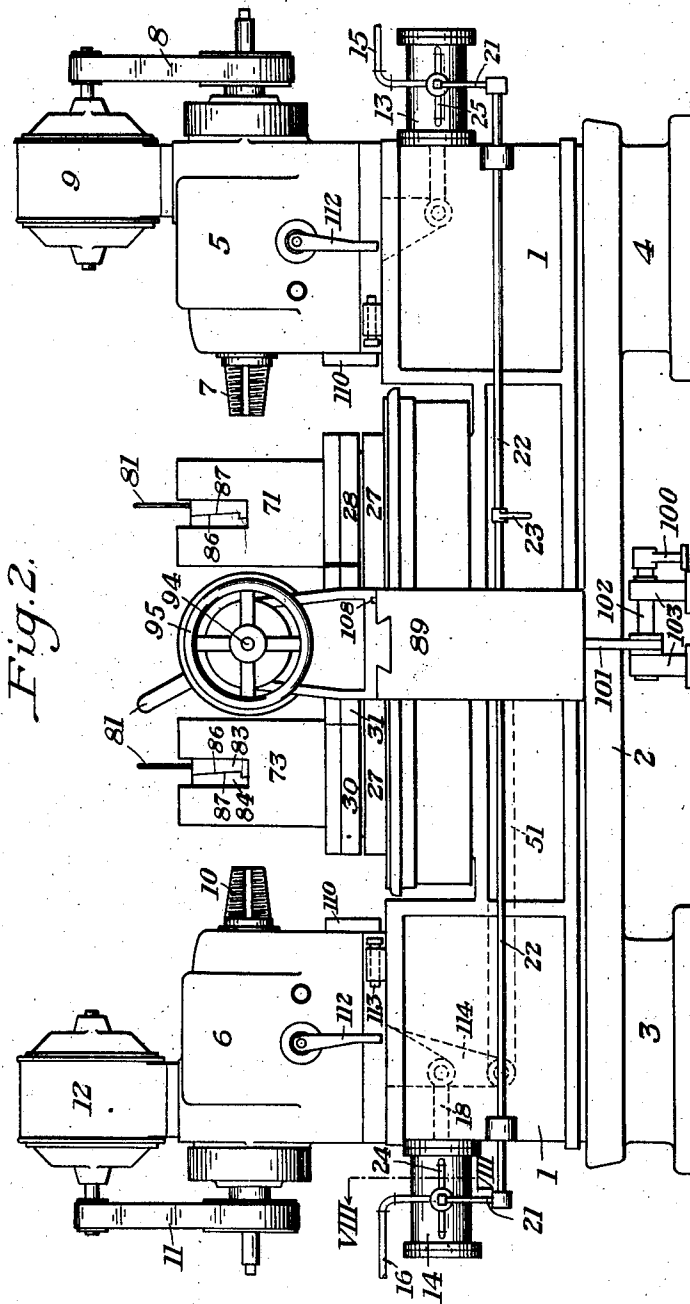


Fig. 2.

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6 Sheets-Sheet 3

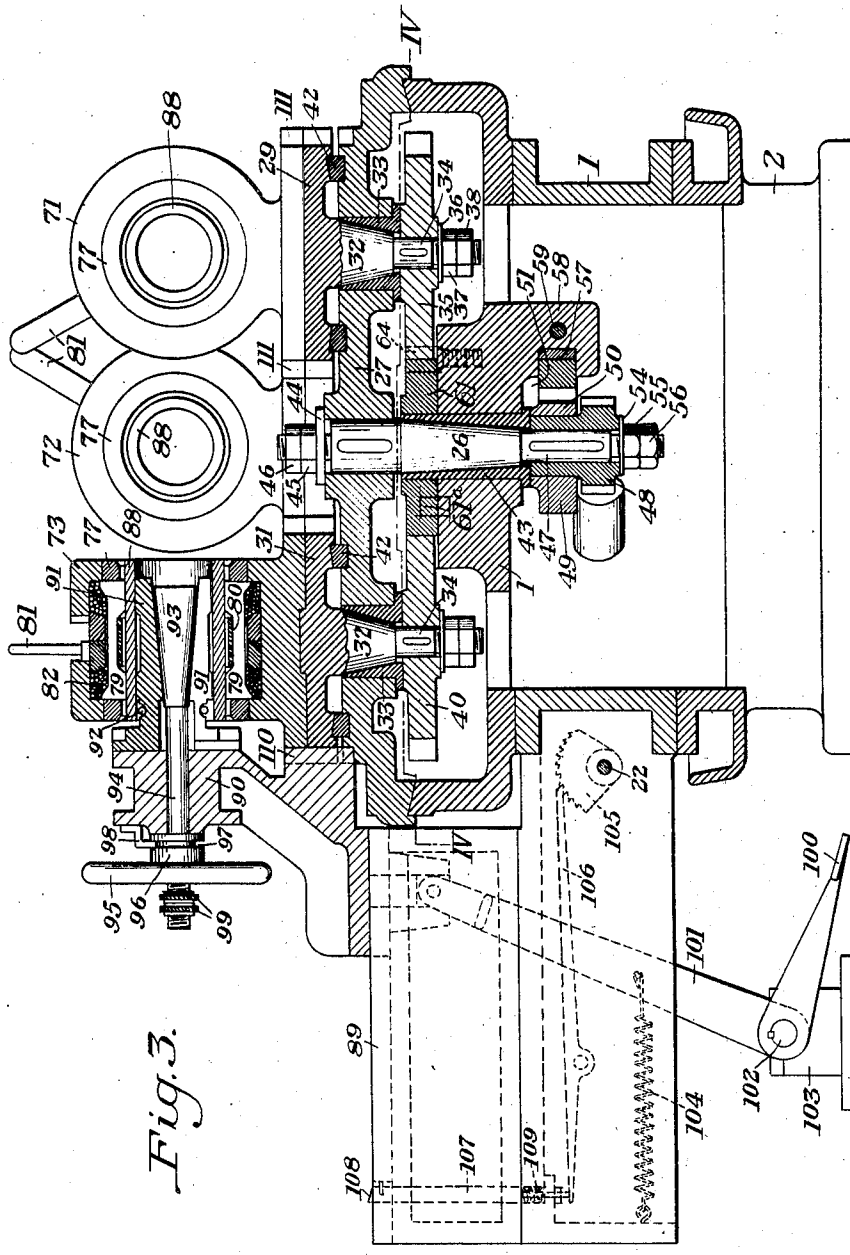


Fig. 3.

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Fig. 4.

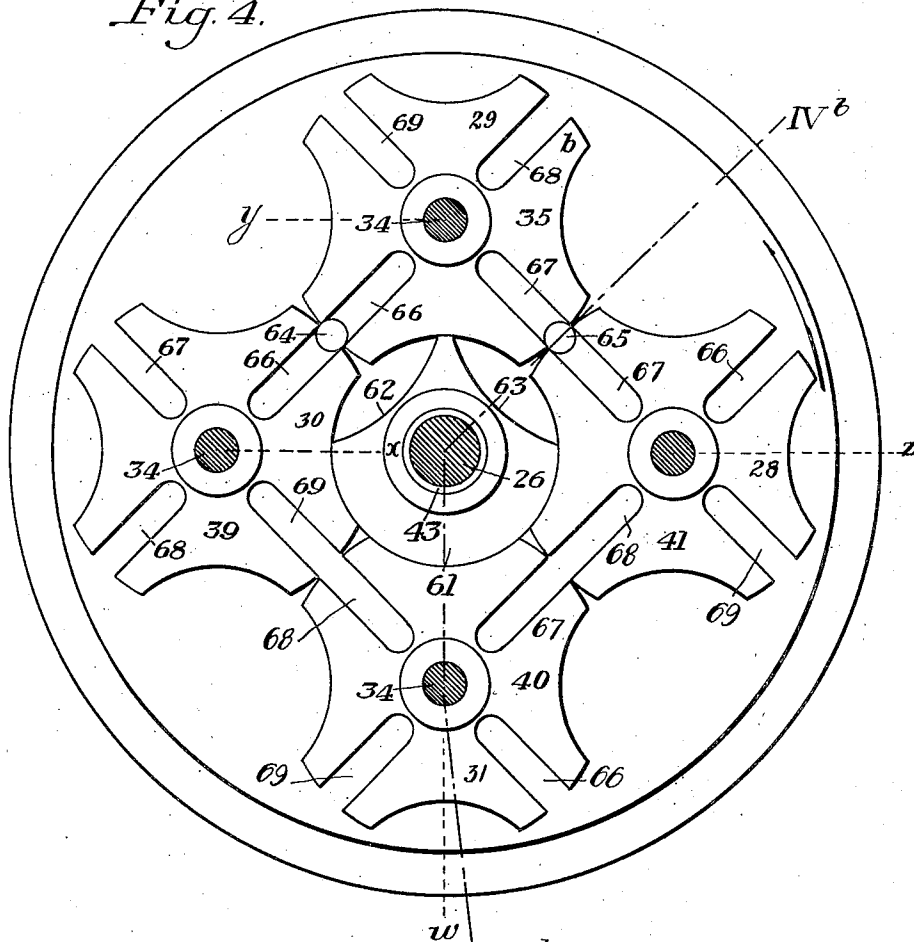
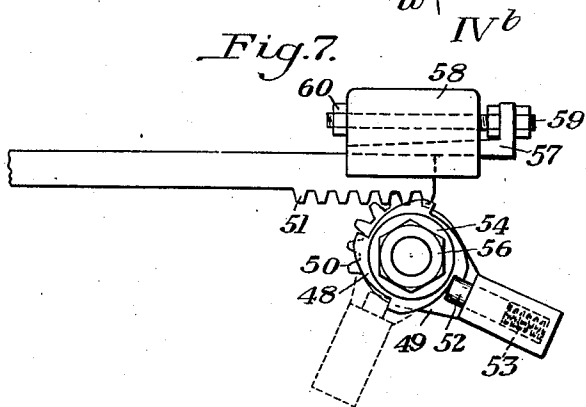


Fig. 7.



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Filed April 22, 1922

6 Sheets-Sheet 5

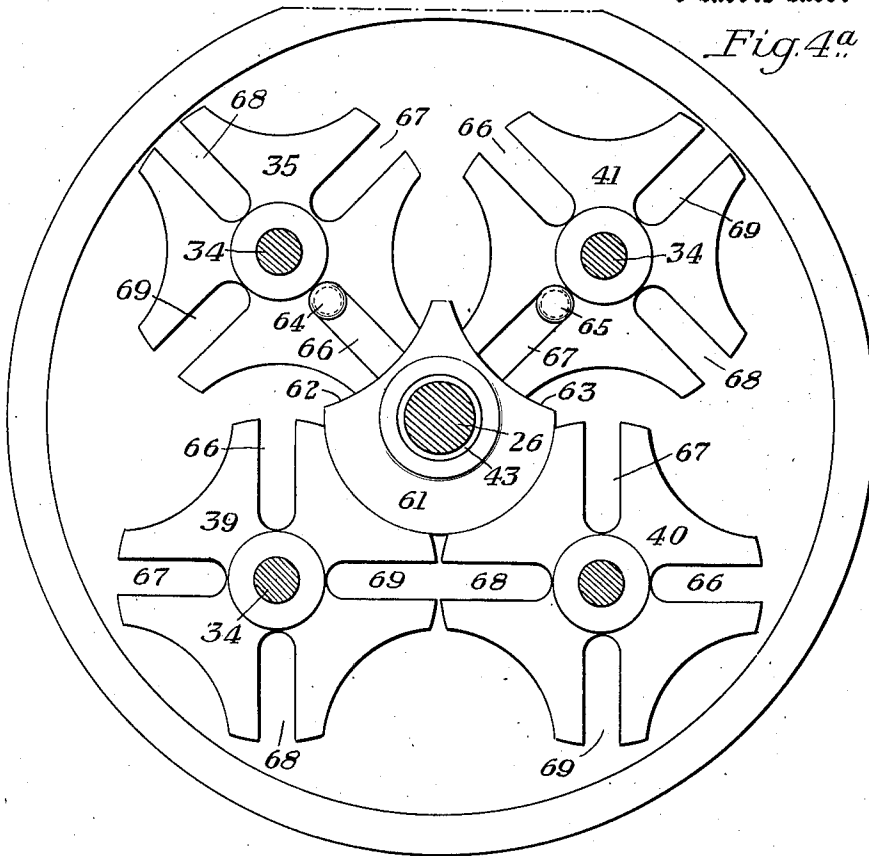


Fig. 4^a

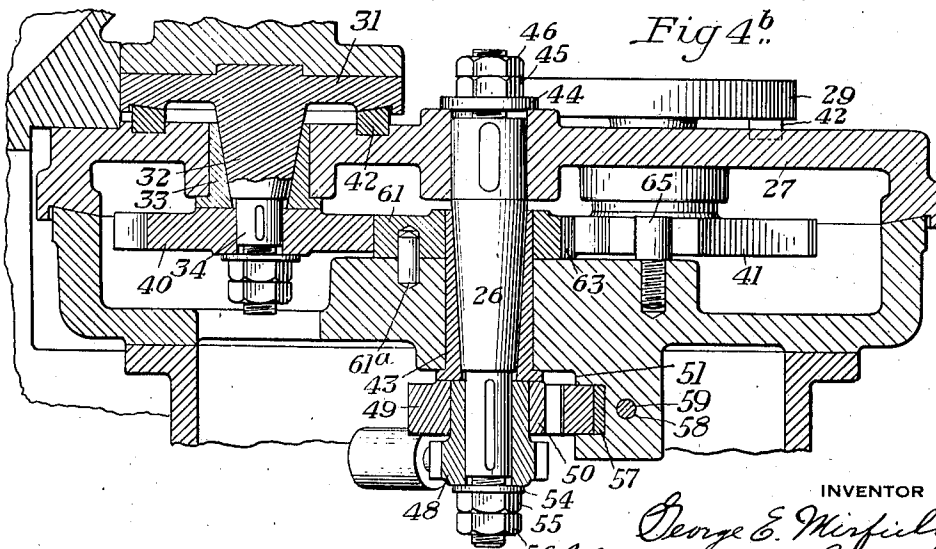


Fig. 4^b

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UNITED STATES PATENT OFFICE.

GEORGE E. MIRFIELD, OF YOUNGSTOWN, OHIO.

METHOD AND APPARATUS FOR THREADING METAL ARTICLES.

Application filed April 22, 1922. Serial No. 556,114.

To all whom it may concern:

Be it known that I, GEORGE E. MIRFIELD, a citizen of the United States, residing at Youngstown, in the county of Mahoning and State of Ohio, have invented a new and useful Improvement in Methods and Apparatus for Threading Metal Articles, of which the following is a full, clear, and exact description.

My invention relates to method of and apparatus for performing a plurality of successive mechanical operations upon metal articles, and is particularly useful in threading couplings and similar articles.

I have devised a method and apparatus whereby a coupling, for instance, may be machined from both ends about the axis of the unmachined surface and which may be machine threaded at both ends, with only one centering operation. Furthermore, the machining of one end of one coupling may be effected while the end of another coupling is being machined. In some instances three threading or similar operations may be carried out simultaneously. In all cases all the threading or other operations are carried out automatically, with but one handling of the article.

By the use of my invention, accurate operations may be carried out in a more expeditious manner than by any means heretofore used.

My invention will be better understood by reading the following description, taken in connection with the accompanying drawings, in which:

Figure 1 is a plan view of a machine embodying my invention and for carrying out my method;

Figure 2 is a side elevation of that machine;

Figure 3 is a vertical section on the line III—III of Figure 1;

Figure 4 is a section on the line IV—IV of Figure 3;

Figure 4^a is a view similar to Figure 4, showing the intermediate positions of the gear elements 35, 39, 40 and 41 when the main turret has been turned through 45 degrees from a rest position;

Figure 4^b is a section of a portion of the machine, the section being taken on the line IV^b—IV^b of Figure 4;

Figure 5 is a section on line V—V of Figure 6;

Figure 6 is a section on line VI—VI of Figure 5;

Figure 7 is a bottom view of the turret operating means; and

Figure 8 is a section on the line VIII—VIII of Figure 2.

Referring to the drawings, Figure 2, the machine comprises a frame 1 provided with a base 2 which rests upon pedestals 3 and 4. The frame 1 is provided at its ends with tap holders 5 and 6. These tap holders may be of any standard construction, and per se form no part of the present invention. The head 5 is provided with a collapsible tap 7 which is rotated through a belt 8 driven by a motor 9. The head 6 is likewise provided with a collapsible threading die 10 which is driven through a belt 11 by a motor 12.

The tap holders 5 and 6 are mounted on suitable guideways on the frame 1 and are moved backward and forward by cylinders 13 and 14, respectively. Fluid under pressure actuating pistons in these cylinders 13 and 14 is supplied through pipes 15 and 16 respectively from any suitable source. The operation of the heads will be described, and since the operation of one head is identical with that of the other, a description of one will be sufficient. As shown in Figures 2 and 8, the cylinder 14 is provided with a piston 17 and a piston rod 18. A valve 19 in the casing 20 controls the admission of pressure fluid to and exhaust from the cylinder. The valve 19 is operated through a link 21 which is connected with a control rod 22 provided with an operating handle 23. When the handle 23 is thrown downwardly as viewed in Figure 2, fluid pressure is admitted to cylinder 14 through the pipe 24, and as the valve for cylinder 13 is similarly actuated pressure is admitted to cylinder 13 through pipe 25, whereupon the tap holders are moved away from each other.

Mounted in the intermediate portion of the frame 1 is a vertical shaft 26 to the upper end of which is keyed the main turret 27. The turret 27, as shown in Figures 1 and 3, is provided with four sub-turrets 28, 29, 30 and 31. Each of these sub-turrets is provided with a conical projection 32 which extends downwardly through an opening in the turret 27. The openings in the turret 27 are each provided with a conically shaped bearing member 33 which fits the conical portion 32. The projections on the sub-

turrets are also provided with a cylindrical portion 34 to each of which is keyed a Geneva gear element. These gear elements are designated by the reference characters 35, 39, 40 and 41, and are connected to the respective turrets 29, 30, 31 and 28, by washers 36, nuts 37 and jam nuts 38. Each of the sub-turrets 28 to 31 rests upon a circular track or guideway 42 upon the main turret 27. The shaft 26, to which the main turret 27 is keyed, is provided with a frusto-conical portion which engages a bearing member 43 in the frame 1. The upper end of shaft 26 is threaded and provided with collar 44 which is held in place by a nut 45 and lock nut 46. On the lower end of shaft 26 a ratchet wheel 48 is mounted to turn with the shaft and has a hub extension engaging the bearing member 43. The ratchet wheel 48 is provided with as many teeth as there are sub-turrets mounted on the main turret 27. Journalled on the hub extension of the ratchet wheel 48 is a pawl carrier 49 which is provided with a gear segment 50, as shown in Figure 7. A rack 51 is provided with teeth which engage the teeth on the gear segment 50. The rack is pivotally connected at one end to an arm 114 projecting downwardly from the tap holder 6 whereby movements of the holder back and forth on its guideway are effective to reciprocate the rack. The pawl carrier 49 is provided with a socket for a pawl 52 and a spring 53 which keeps the pawl normally in engagement with the ratchet wheel 48. The ratchet wheel 48 is held in place by a washer 54, nut 55 and lock nut 56. The rack 51 reciprocates against a wear plate 57 which is held in place in a recess in a projection 58 on the frame 1 by a bolt 59 and nut 60. The wear plate 57 is tapered and may be adjusted to take up any wear which takes place between the rack 51 and the gear segment 50, as shown in Figure 7. 61 is a Geneva gear element fixed to the frame 1 by a dowel 61^a. It surrounds the bearing 43 on shaft 26 and co-acts with the Geneva gear elements on the sub-turrets to rotate said turrets about their axes. The gear element 61 is provided with two cut away portions 62 and 63 for permitting the gear elements 35, 39, 40 and 41 to rotate about their axes when passing such portions. The gear elements 35, 39, 40 and 41 are rotated by the movement of turret 27 about its axis and fixed pins 64 and 65 which are mounted in the frame in fixed relation to the cut away portions 62 and 63, as shown in Figures 3 and 4, and engage slots in the gear elements 35, 39, 40 and 41. Each of these gear elements 35, 39, 40 and 41 is provided with four slots 66, 67, 68 and 69, and every time that the main turret 27 is rotated 90 degrees as hereinafter explained one of the slots in each of two adjacent gear elements 35, 39, 40 or

41 will be engaged by the pins 64 and 65, which will rotate said two gear elements together with their sub-turrets 180 degrees about their axes for the purpose hereinafter described.

Mounted upon each of the sub-turrets 28 to 31 are identical chucks 70, 71, 72, 73, respectively. These chucks operate upon the principle disclosed in my application Serial No. 439,959, filed January 26, 1921. Each of the chucks is provided with a casing 74 of generally cylindrical shape and provided with a base 75 which rests upon the sub-turret and which is also provided with a projection 76 which fits in a corresponding depression in the sub-turret. The base 75 may be bolted or otherwise securely fastened to the sub-turret. The casing 74 is provided with a central opening into which is fitted a fixed sleeve 77 having a plurality of radial slots 78 in the central portion thereof and in which slots are fitted the jaw members 79. The slots 78 are of such width and length as to permit free movement of the jaw members 79. The sleeve 77 has portions at its ends which are not slotted and which portions are utilized to effectively hold the member 77 in the casing 74. A spring band 80 is arranged, as shown in Figures 5 and 6, and acts normally to hold the gripping members 79 in the retracted or non-gripping position.

Rotatably mounted in the chuck casing 74 are jaw actuating rings 83 and 84. The ring 84 is restrained against rotary movement while the ring 83 is provided with an actuating handle, which extends outwardly through a central slot in the chuck casing. The adjacent faces of rings 83 and 84 are provided with cams which are arranged to spread the rings laterally along the axis of the chuck when ring 83 is rotated in one direction and to permit said rings to be moved toward each other when ring 83 is rotated in the opposite direction. The space within the chuck casing 74 and confined by the casing 74, sloping outer faces of rings 83 and 84, outer faces of jaw members 79 and portions of sleeve 77, is filled with a shiftable non-compressible pressure applying medium such as a plurality of steel balls 82, which acts in a manner similar to a non-compressible liquid.

Mounted on the guides 89 attached to the frame 1 of the machine, is a centering head 90 which is provided with an expanding chuck, as shown in Figures 3, 5 and 6. This chuck comprises three expansible jaws 91, normally held in retracted position by a coil spring 92 which surrounds the jaws near one end. A frusto-conical expander 93 is centrally mounted in the centering head and is engaged by the inner faces of jaws 91, as best shown in Figure 6. This expander 93 is provided with a threaded extension 94 en-

gaging a hand wheel 95 having a boss 96 thereon. The boss 96 is provided with an annular slot 97 in which is seated a retainer 98 attached to the head 90 so that upon rotation of the hand wheel 95 in one direction or the other the expander 93 is positively moved to expand or permit the retraction of the jaws 91. The screw threaded portion of the projection 94 is also provided with lock nuts 99 which limit the movement of the expanding member 93 in one direction. The head 90 may be moved to the position shown in Figures 1 and 3 by means of a treadle 100 through a lever 101. The treadle 100 and lever 101 are keyed to a shaft 102 which is journaled in supports 103 attached to the base of the machine. A spring 104 acts to move the head 90 to the left, as viewed in Figure 3, when the operating pressure is removed from the treadle 100.

Fastened to the control rod 22 is a ratchet segment 105 and 106 is a pawl one end of which engages the teeth on the segment 105 while the other end is engaged by a shifter slidably mounted in one of the guideways 89 for the centering head. The shifter 107 has a beveled upper end 108 which is engaged by the head 90 when the head is in its retracted position for lifting pawl 106 clear of ratchet segment 105. The arrangement thus described renders it impossible for the operator to actuate the thread milling heads 5 and 6 so long as the head 90 is removed from engagement with the upper end 108 of shifter member 107, or when the centering head is in a chuck. A spring 109 is arranged to hold the shifter 107 in its raised position when the head is moved inward, as shown in Figure 3.

The tap holders 5 and 6 and the centering head 90 are provided each with a tongue 110 which is adapted to engage in slots 111 in the sub-turrets 28, 29, 30 and 31 to lock the sub-turrets against any tendency to turn on their axes when the tap holders or the centering head are moved into operative relation to the sub-turrets.

The operation of my device is as follows:

For convenience in the description of the operation of the machine, attention is called to Figures 1, 3, 4 and 5, in which dotted lines *w*, *x*, *y* and *z* in Figure 4 designate the centers of the threading chucks on sub-turrets 31, 30, 29 and 28 respectively. The reference letters *w*, *x*, *y* and *z*, being at the ends of the chucks through which the couplings to be threaded are inserted for the cycle of the machine to be described.

Assuming all of the threading chucks on the sub-turrets to be empty and expanded and the centering head 90 retracted and over the upper end of shifter 108.

A coupling such as shown at 88 in Figure 5 is put on in the chuck on the centering head, the centering chuck is then expanded

to center the coupling with relation to the opening therethrough. The chuck and centered coupling are then moved into the threading chuck 73 on turret 31 along the line *w*. The threading chuck 73 is then contracted to grip the periphery of the coupling and due to its construction the coupling will be fixed in chuck 73 in the position held by the centering chuck, regardless of whether the periphery of the coupling is concentric with the opening therethrough or not. The centering chuck is now collapsed and the centering head returned to its position over shifter 108 and thereby releases the control rod 22. Control rod 22 is now shifted to cause taps 7 and 10 to be moved toward each other, but as there are no couplings in chucks 70 and 72 on sub-turrets 28 and 30, the movement of the taps will be an idle one. In the forward movement of tap holder 6, pawl 52, will be moved back over one tooth on ratchet wheel 48. After tap holders 5 and 6 have been moved to their full limit toward each other, the operator reverses control rod 22, to return the tap holders 5 and 6 to the positions shown in the drawings. During this return movement of tap holder 6, turret 27 will be rotated 90 degrees in a counter-clockwise direction through the medium of pawl 52 and ratchet wheel 48, and shift the sub-turrets 90 degrees from the positions shown in the drawings. This shifting of the sub-turrets will bring charged threading chuck 73 in line with tap holder 5, and rotate both sub-turrets 28 and 29, 180 degrees about their own axes through the medium of pins 65 and 64, respectively, engaging the slots in gear members 41 and 35. It will therefore be seen that at all times when turret 27 is at rest, the axis of a threading chuck will be in alignment with the axis of the centering chuck, while the axes of the other three chucks will be at right angles thereto, as shown in Figure 4. The operator now charges threading chuck 72 as above described, repeats the operation for threading above described and threads the coupling in chuck 73. During the return movement of the tap holders 5 and 6 in the second cycle, turret 27 will again be shifted 90 degrees, again rotate two of the turrets 180 degrees about their own axes and shift the sub-turrets 90 degrees.

It will therefore be seen, that after the machine has been in operation for three cycles, both taps will thread a coupling when shifted into threading relation with the couplings in the threading chucks. Tap 7 will thread one end of each coupling while tap 10 will thread the other end of each coupling in a successive manner. This threading of the couplings from opposite ends by taps 7 and 10 is accomplished by rotating the sub-turrets 360 degrees on their own axes by pins 65 and 64, in their move-

ment from their positions in front of tap 7 to their positions in front of tap 10.

From the foregoing, it will be evident that my invention has many advantages, among which may be mentioned that both ends of a coupling or similar article may be automatically threaded without the necessity of a centering operation between each threading operation; a plurality of articles may be operated upon simultaneously and automatically; by reason of the arrangement of the parts, the machine operates in a more expeditious manner than any machine heretofore constructed, and the work is turned out in a more accurate form than is the case where a separate centering operation is required; both threading operations are carried out with the same centering so that the threads produced are in proper alinement with each other, thus avoiding any possible defect by misalinement of the threads. Further objects will be apparent to those skilled in the art.

While I have described one embodiment of my invention, I do not desire to be limited to the exact arrangement shown. It is sometimes advisable to perform a threading or similar operation at the station y , as, for instance, when a T-coupling is being acted upon. In such event, a third tap holder would be provided at the station y and the articles so placed upon the sub-turrets that the third portion of the article would be presented radially to the tap holder at the station y . I therefore desire it to be understood that my invention is broad enough to include that and other modifications of the specific device shown and described.

A further advantage results from the provision of a method and apparatus for machining articles whereby the article to be machined is centered with relation to the machine tools, secured in such centered position, the centering means being then removed and the article and machine tool are then moved into machining relation.

By the use of such an apparatus I am enabled to chuck articles having openings therein which are to be machined, by first centering the opening on the centering chuck and then chucking the article in its centered position, regardless of the exterior contour. This eliminates the cutting away of surplus metal if the opening is not central of the article, and also insures a fully machined face.

I claim:

1. The method of machining different portions of an article, comprising centering the article on a carrier, moving a machining tool and the article relative to each other to machine one portion thereof, and moving the article on the carrier to bring another portion of the article into machining position relative to a second tool, and then

moving the article and the second machining tool relative to each other to machine the second portion of the article.

2. In the method of performing two machining operations on an article, the steps of centering an article on an axis about which it is to be moved, bringing the article and a machining tool into machining relation and machining one portion of the article, then rotating the article about the axis on which it is centered to shift the machined portion of the article and bring another portion of the article into machining position and moving the article and first axis about a second axis to bring the second portion of the article into machining relation to a second machining tool, and then machining the second portion of the article.

3. In the method of successively machining two surfaces of an article, machining articles in a successive manner and simultaneously machining a portion of two articles, the steps of successively centering the articles to be machined on axes movable about another axis, successively bringing each article so centered into machining relation to two machining tools as the articles are moved about said axis, rotating each article for a portion of a cycle about the axis on which it is centered after the first machining and before the second machining, and simultaneously moving both machining tools into machining relation to two articles whereby one portion of each article is machined by one tool and the other portion by another tool.

4. In the method of successively threading pipe fittings having two separately threaded portions and simultaneously threading a portion of two fittings, the steps of successively centering the fittings on successive movable axes rotatable about a fixed axis, with the axes of the bores in the fittings normal to the movable axes and in the plane of the axes of two threading tools, moving the fittings in a step by step manner after centering to the threading tools, simultaneously moving the threading tools into threading relation with different fittings, and successively rotating the fittings about the movable axes on which they are centered while moving said fittings about the fixed axis from one threading tool to the other threading tool.

5. In the method of successively threading pipe couplings from opposite ends, the steps of successively centering the openings in the couplings on movable axes rotatable about a fixed axis, with the axes of the openings in the couplings normal to the movable axes and in the plane of the axes of two threading tools, moving the fittings in a step by step manner after centering to the threading tools, simultaneously moving the threading tools into threading relation

with two couplings, and successively rotating the couplings 360 degrees about the movable axes on which they are mounted while moving them from one threading tool to the other threading tool about the fixed axis.

6. In the method of threading annular surfaces of articles, the steps of engaging the surface to be machined by a centering chuck whose center is in the plane of the center of the machining tool for finishing such surfaces, securing the article to a holder in such centered position, removing the centering chuck, and then moving the machining tool and article into machining relation and machining said surface.

7. In the method of threading pipe fittings, the steps of engaging the surface to be threaded by a centering chuck whose center is in the plane of the center of a threading tool for finishing such surface, securing the pipe fitting to a holder in such centered position, removing the centering chuck, and then moving the threading tool and article into threading relation and threading such surface.

8. In the method of threading the openings of pipe fittings, the steps of engaging the wall of the opening to be machined by a centering chuck whose center is in the plane of the center of the threading tool, securing the fitting to a holder in such position, removing the centering chuck, and then moving the threading tool and the fitting into threading relation and threading the opening in the fitting.

9. In the method of threading the interior of pipe couplings from both ends, the steps of engaging the wall of the opening through the coupling by a centering chuck whose center is in the plane of two threading dies, securing the article in a holder in such centered position, removing the centering chuck, and then moving the coupling first into threading engagement with one threading die and then with another threading die.

10. In the method of threading pipe couplings, the steps of engaging the wall of the opening through the coupling by a centering chuck whose center is in the plane of the center of two threading dies, securing the coupling to a holder in such centered position, removing the centering chuck, then moving a threading die into threading relation with one end of the coupling, then moving the coupling into threading relation with the second threading die and turning the coupling end for end after the first threading operation and before the second threading op-

eration, and then threading the other end of the coupling with a second die.

11. A device of the character described having an article holder, a centering chuck, means for moving the centering chuck toward and from the article holder, means on the article holder for securing the article in a position centered by the chuck, and a machining tool for machining the centered surface.

12. A machine of the character described having a main turret, a plurality of sub-turrets mounted on the main turret, a radially disposed centering chuck, means for moving the centering chuck toward and from the sub-turrets, a holding chuck on each of the sub-turrets for holding the article in the position centered by the centering chuck, and a machining tool for machining the centered surface.

13. A machine for threading pipe fittings comprising a main turret, a plurality of sub-turrets mounted on the main turret, a hydraulic chuck on each sub-turret arranged to grasp the exterior of a pipe fitting, a centering chuck arranged to engage the walls of an opening in a pipe fitting for centering the opening with relation to the centering chuck, means for moving the centering chuck to position the centered fitting into a holding chuck on a sub-turret, a plurality of threading dies radially disposed with relation to the main turret, means for moving the threading dies into and out of couplings in the chucks, and means for rotating the sub-turrets when the main turret is rotated to shift the sub-turrets from one threading die to the other.

14. A machine for threading pipe couplings comprising a rotatable main turret, a plurality of sub-turrets rotatably mounted on the main turret, a hydraulic chuck on each sub-turret arranged to engage the outer surface of a pipe coupling, two threading dies radially disposed with relation to the main turret, a centering chuck arranged to engage the walls of the opening through a coupling and hold it in a position centered relative to the centering chuck and in the plane of the threading dies, means for moving the centering chuck together with the coupling thereon within a chuck on a sub-turret, means for simultaneously moving the threading dies into two couplings in chucks on sub-turrets, and means for turning the sub-turrets 360 degrees in their movement from one threading die to the other.

In testimony whereof I hereunto set my hand.

GEORGE E. MIRFIELD,