Dec. 25, 1928. 1,696,453

J. REID

APPARATUS FOR MACHINING RADIATORS AND THE LIKE

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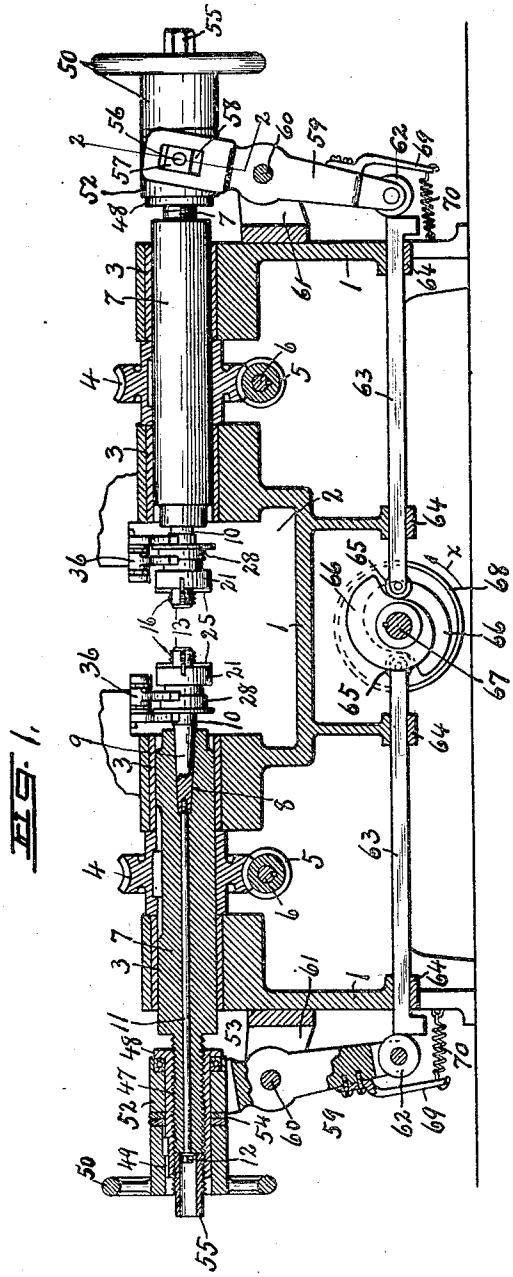


FIG. 1.

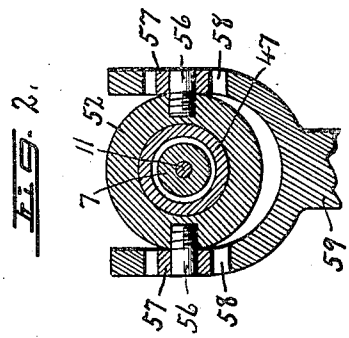


FIG. 2.

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FIG. 3.

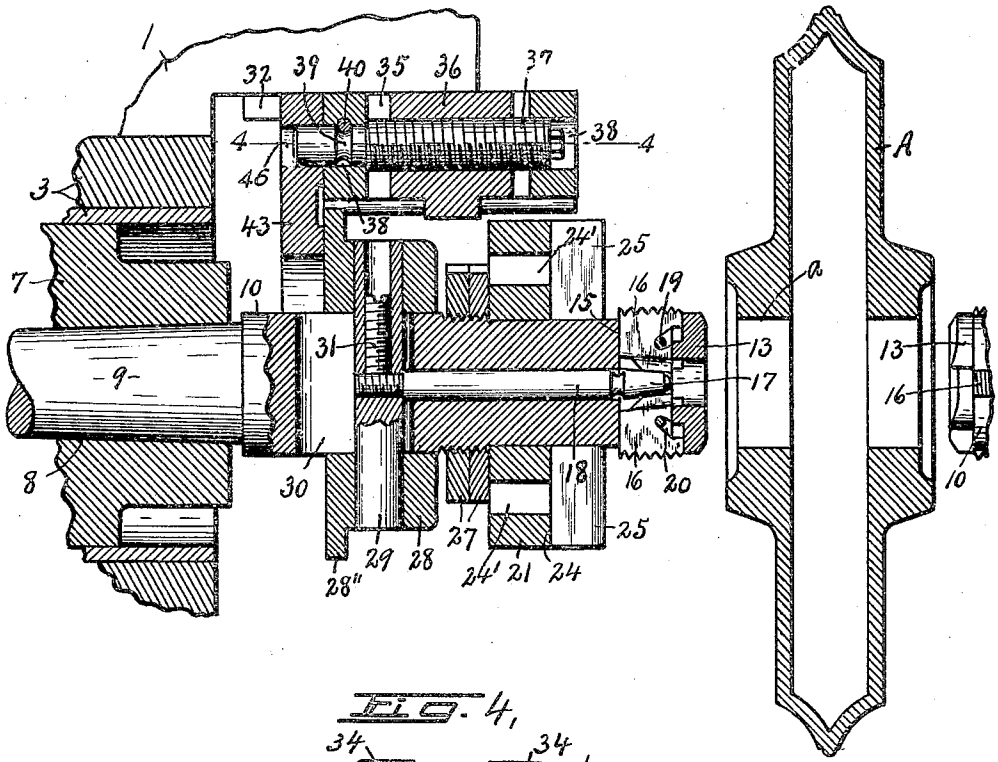
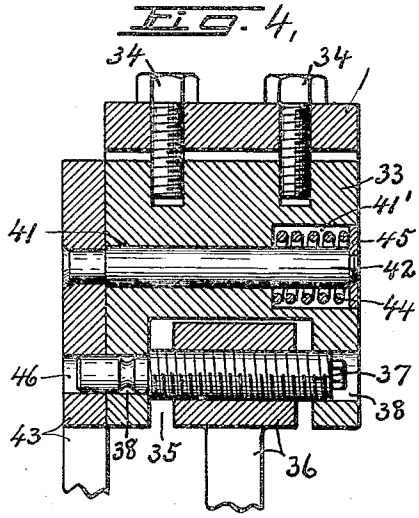


FIG. 4.



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Fig. 5.

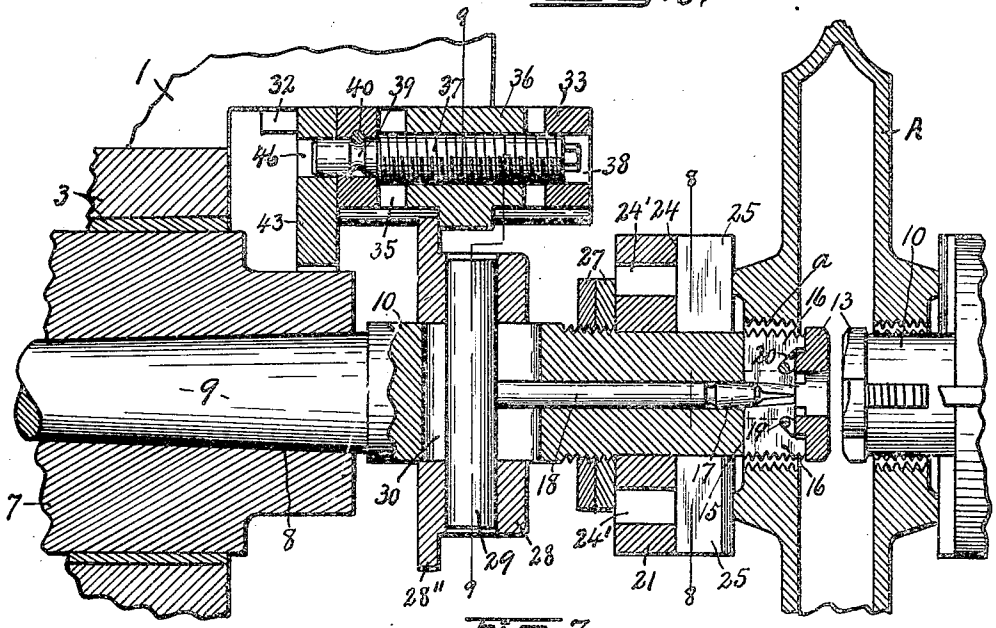


Fig. 7.

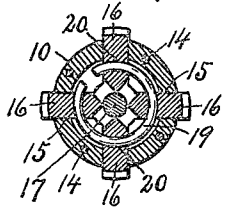


Fig. 6.

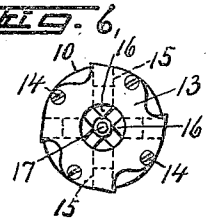


Fig. 9.

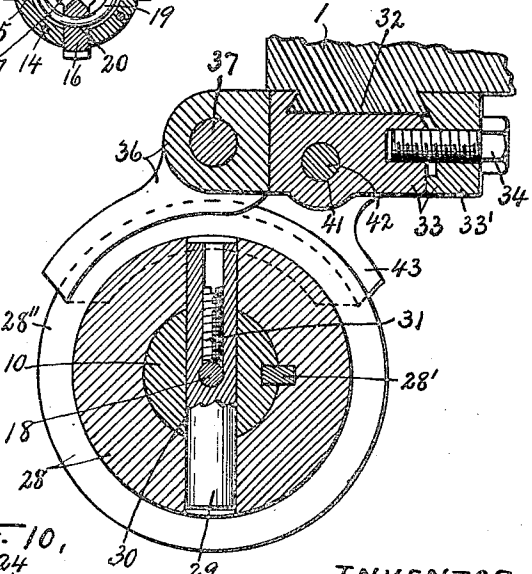


Fig. 8

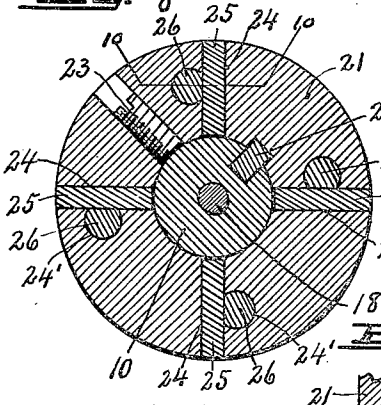
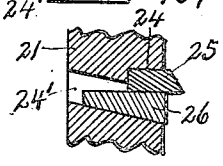


Fig. 10.



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UNITED STATES PATENT OFFICE.

JAMES REID, OF SYRACUSE, NEW YORK; EMMA F. REID AND CHARLES T. REID ADMINISTRATORS OF SAID JAMES REID, DECEASED.

APPARATUS FOR MACHINING RADIATORS AND THE LIKE.

Application filed May 1, 1926. Serial No. 106,007.

This invention relates to a method of and apparatus for machining radiator sections and analogous objects requiring boring, tapping and facing on one or both sides, and frequently at different portions thereof for the reception of nipples, pipes or other connections commonly used for the circulation of the heating agents such as steam or hot water through one or more radiator sections.

The main object is to provide simple and efficient means for boring, tapping and facing one or more parts of the radiator or other object in one and the same operation or by the continuous movement of the tool holder in one and the same direction.

Another object is to assure a uniform facing of different radiator sections or other objects operated upon so that when the machine is set for operation upon opposite sides of a radiator section the dressed surfaces will be uniform distances apart.

A further object is to provide means whereby the tapping members commonly known as "chasers" will be automatically released and retracted from the tapping positions at the end of the tapping stroke and immediately following the beginning of the facing operation.

A further object is to provide means for adjusting the cutting tool axially relatively to the boring and tapping tools for varying the axial depth of cut on the face of the object or distance between the dressed faces when both sides of the object are operated upon simultaneously.

Another object is to provide adjustable means for regulating the time of release of the tapping members from their tapping positions relatively to the boring and facing operations.

Other objects and uses relating to specific parts of the device will be brought out in the following description.

In the drawings:—

Figure 1 is a longitudinal vertical sectional view, partly in elevation, of a machine embodying the various features of my invention for operating upon opposite sides of a radiator section or similar hollow object, the tool holders and actuating means therefor being shown in their retracted positions.

Figure 2 is an enlarged detail sectional view taken on line 2—2, Figure 1.

Figure 3 is an enlarged longitudinal vertical sectional view of a part of the same machine showing a radiator section in position to be operated upon.

Figure 4 is a horiontal sectional view taken in the plane of line 4—4, Figure 3.

Figure 5 is an enlarged longitudinal sectional view similar to Figure 3 showing the opposed tool holders in their extreme inward positions after performing their respective boring, tapping and facing operations, the tapping members being shown in their retracted positions.

Figure 6 is an end face view of the boring tool and adjacent end of the holder therefor.

Figure 7 is a transverse sectional view through the tapping members and holder showing the retracting spring for said members.

Figures 8 and 9 are transverse sectional views taken in the planes of lines 8—8, and 9—9, respectively of Figure 5.

Figure 10 is a detail sectional view taken in the plane of line 10—10, Figure 8.

As illustrated, this machine comprises a main supporting frame —1— having a central transverse recess —2— in its upper side midway between its ends for receiving a radiator section as A or other object to be operated upon, said frame being provided with opposite pairs of co-axial bearings —3— at opposite ends of the central recess or opening —2—, the bearings —3— of each pair being also spaced apart axially for receiving between them suitable worm gears —4— and worms —5— which are mounted upon transversely extending shafts —6— for rotating the gears —4— at uniform speed.

Each pair of bearings —3— is adapted to receive and support a rotary and axially movable shaft —7— so that the two shafts may be arranged in co-axial alinement with their inner ends facing each other at opposite ends of the opening —2—.

The gears —4— are splined upon their respective shafts —7— for imparting rotary motion thereto and permitting said shafts to be moved endwise relatively to the gears which are held against axial movement by and between the bearings —3— of the corresponding pair.

Tool holders.

Each shaft —7— is provided with a co-axial tapered socket —8— in its inner end

for receiving a correspondingly tapered shank —9— of a tool holder —10— which, when placed in operative position, extends inwardly some distance beyond the inner end of the shaft and into the opening —2—.

The tapered shank —9— of each tool holder is tightly wedged in its corresponding socket —8— to rotate with the shaft —7— and is additionally held in operative position by means of a clamping bolt —11— extending through a central lengthwise opening in the shaft —7— and having its inner end threaded and engaged in the threaded socket in the shank —8— and its outer end provided with a head —12— abutting against the outer end face of the shaft —7— for retaining the tool holder in operative engagement with the shaft against relative endwise or angular movement.

A boring tool —13— is secured by screws —14—to the inner end face of each of the tool holders —10— to rotate therewith, said tool holder being also provided with radial slots —15— for receiving radially movable tapping members —16— commonly known as "chasers", said slots and tapping members being arranged in uniformly spaced relation circumferentially adjacent the boring tool —13—.

The slots —15—preferably extend through the inner end face of the corresponding holder —10— to permit the insertion and removal of the tapping members —16— therethrough but are normally closed by the boring tool —13— which also serves to retain the tapping members against inward displacement from their respective slots and assist in guiding the tapping members in their radial movement.

The peripheral edges of the tapping members —16— are provided with inwardly tapered threads for cutting the desired threads as at —*a*— in the walls of the opening, previously formed by the boring tool —13— immediately following the passage of the boring tool through the adjacent side of the radiator.

The inner edges of the tapping members —16— are preferably smooth and tapered axially and inwardly for cooperative engagement with a tapered inner end —17— of an axially movable plunger —18— centrally within the tool holder —10— for moving the tapping members outwardly against the action of a retracting spring —19— and permitting them to be drawn inwardly by said spring when the tapered portion —17— of the plunger rod —18— is withdrawn in a manner hereinafter described.

The retracting spring —19— for the tapping members or jaws —16— preferably consists of a split ring seated in suitable slots —20— in the inner edges of the jaws, said slots being inclined toward the axis of the holder —10— for retaining the ring in operative position.

The facing tool comprises a cylindrical collar —21— splined upon the tool holder —10— by means of a key —22— and held in operative position against axial movement by a set screw —23—, Figure 8.

This collar is provided with a series of radial slots —24— arranged in uniformly spaced relation circumferentially for receiving a corsponding number of cutter blades —25— which are held in operative position by tapered keys —26— or wedges inserted in corresponding openings —24'— in the collar —21—, Figs. 8 and 10.

The collar —21— is adjustable axially on the tool holder —10— to take up wear of the cutters —25— by means of nuts —27— which are engaged with a threaded peripheral portion of the tool holder —10—.

Suitable means is provided for automatically shifting the plunger —18— axially for controlling the radial movements of the chasers or tap members —16—, said means consisting in this instance of a collar —28— slidable axially of an upon a cylindrical portion of the tool-holder —10— between the nuts 27 and inner end of the shaft —10— and splined thereto by a key —28'— and provided with a diametrically extending cross pin —29— which is movable in an axially elongated diametrical slot —30— in the tool holder —10—.

The outer end of the plunger —18— is threaded and engaged in a correspondingly threaded aperture in the cross pin —29— where it is held in place by a set screw —31— in one side of the cross pin —29— as shown in Figure 3 whereby the reciprocation of the collar —28— along the tool holder —10— will cause a similar movement of the tapered inner end —17— of the plunger —18— for extending the members —16— when the plunger is moved inwardly and for releasing said members —16— to be drawn inwardly by the spring —19— when the plunger is moved outwardly.

The frame —1— is provided at opposite sides of the opening —2— with lengthwise ribs —32— preferably dove-tail in cross section for receiving and supporting sectional brackets —33— having dove-tailed grooves for receiving the ribs —32—, one of the sections as —33'— of each bracket being clamped to the other section by clamping bolts —34— which permits lengthwise adjustment of the bracket and also serves to hold said brackets in their adjusted positions.

Each bracket extends lengthwise of and across the periphery of and preferably above the collar —28— and is provided in its front side with an axially elongated recess —35— for receiving the hub of an axially adjustable stop arm —36— having a concave inner face

concentric with the axis of the collar —28— and projecting into the path of movement of an annular flange —28″— of said collar as the tool holder is moved toward the work.

The hub of the arm —36— is provided with a central lengthwise threaded aperture engaged by the threaded portion of a screw shaft —37— which is journaled in suitable openings —38— in the opposite end walls of the recess —35— as shown in Figure 4, the axial length of the hub of the arm —36— being somewhat less than the corresponding length of the recess —35— to permit the stop arm —36— to be adjusted endwise as may be required for varying the length of stroke of the collar —28— and plunger —18— and thereby to vary the period of release of the chasers —16— immediately following the boring and tapping operations and just preceding the facing operation which is dependent upon the means for reciprocating the shafts —7—.

The outer end of the screw shaft —37— is provided with an annular groove —39— in which is seated a cross pin —40— in the adjacent end of the bracket —33— for holding the shaft against endwise movement when adjusting the arm —36—.

The bracket —33— is also provided with a central lengthwise opening —41— in which a cylindrical rod —42— is reciprocally movable axially and has its outer end rigidly secured to an additional stop arm —43— so that the arm and rod may move together axially of the shaft —7— and tool holder —18—.

The inner end of the opening —41— is enlarged to form a cylindrical socket —41′— in which is mounted a coiled spring —44— and a washer —45—, said washer being secured to the inner end of the rod —42— while the spring —44— is interposed between said washer and the end wall of the socket —41′— for yieldingly holding the stop arm —43— against the outer end face of the bracket —33— as shown in Figure 4.

The stop arm —43— projects inwardly partially across the outer end face of the collar —28— to limit the outward axial movement thereof as shown in Figure 3 when the tool holder is returned to its starting position after the tools have performed the several operations upon the work, the spring —44— serving as a shock absorber to relieve the stop arm —43— from extensive strains incidental to the return of the collar —28— thereagainst.

The outer end of the screw shaft —37— is extended into an axially alined opening —46— in the stop arm —43— to assist in holding said arm against lateral rocking movement about the axis of its supporting rod —42—.

Shaft reciprocating means.

The outer ends of the supporting shafts —7— for the tool holders are reduced in diameter and threaded externally and are engaged by internally threaded sleeves —47— having their inner ends provided with annular flanges —48— and their outer ends keyed at —49— to the hub of a hand wheel —50— which is mounted on the outer end of the sleeve.

The intermediate portion of the sleeve —47— is journaled in a collar —52— between the flange —48— and inner end of the hub of the hand wheel —50— with suitable end thrust bearings —53— and —54— for holding the collar against axial movement relatively to the sleeve.

Tubular lock nuts —55— are engaged in the outer ends of the sleeves —47— to bear against the corresponding outer ends of the shafts —7— for holding the sleeves against accidental turning movement on their respective shafts.

Each of the collars —52— is provided with diametrically opposite radial studs —56— carrying suitable blocks —57— loose thereon, said blocks being engaged in slots —58— in the opposite arms of Y-shaped levers —59—.

These levers are pivoted at —60— to suitable brackets —61— on opposite ends of the frame —1— to swing about horizontal axes transversely of and below the outer ends of the shafts —7—.

The lower ends of said levers are provided with rollers —62— bearing against the outer ends of a pair of longitudinally extending slide bars —63— which are mounted in suitable guides —64— on the frame —1— and are provided at their inner ends with rollers —65— bearing against the peripheries of a pair of cams —66—.

These cams are keyed or otherwise secured in opposite relation to a cross shaft —67— which is journaled in suitable bearings on the main supporting frame —1— substantially midway between the ends of said frame and directly below the opening —2— in said frame, said shaft being provided with a pulley —68— adapted to be connected to any available source of power for rotating said shaft in the direction indicated by arrow —*x*—, Figure 1.

The lower ends of the levers —59— are provided with pendant arms —69— which are connected by springs —70— to the adjacent ends of the frame —1— for retracting the levers —59— and holding their rollers —62— in contact with the adjacent ends of the slide bars —63—.

The apparatus shown is adapted to perform similar operations simultaneously upon opposite sides of a radiator or other objects and, therefore, the mechanisms for performing these operations are similar but reversed so that the description of one mechanism may serve for both mechanisms and if desired

these mechanisms may be multiplied indefinitely for work requiring similar operations on one or both sides or one of the mechanisms may be used separately.

Operation.

Assuming now that the cams —66— are in the position shown in Figure 1 with their low sides presented to their respective rollers —65— thereby allowing the springs —70— to operate their respective levers —59— to draw the corresponding shafts —7— outwardly until limited by the engagement of the rollers —62— with the outer ends of the corresponding slide bars —63—, the shafts —7— and tool holders carried thereby being then in their starting positions.

The work such as a radiator A is then clamped in place upon the frame of the machine in the opening —2— and between the boring tools —13— with the openings to be bored in the radiator registering with said tools.

Now if the shafts —7— are rotated by their driving members —5— and the cam shaft —67— is rotated in the direction indicated by the arrow —*x*—, the rotation of the cams —66— will transmit motion through the bars —63— to the lower ends of the levers —59— thereby forcing the shafts —7— inwardly toward each other so that the boring tools —13— will first enter opposite sides of the radiator and this boring operation will be immediately followed by the chasers or tapping members —16— for threading the bores in both sides of the radiator simultaneously.

This inward axial movement of the shaft —7— and tool holders —10— will cause a similar axial movement of the cutting tools —25— to machine the opposite outer faces of the radiator around the previously bored and tapped holes.

When the shafts —7— are in their starting positions as shown more clearly in Figures 1 and 3, the collars —28— will be drawn back against their respective stops —43— while the shafts —7— and tool holders —10— will be drawn back still further, thereby forcing the tapered ends —17— of the plungers —18— between and against the inner edges of their respective tapping members —16— to project said members outwardly to their cutting positions against the action of their corresponding springs —19—.

Then as the shafts —7— and tool holders —10— are advanced to the work the collars —28— will be carried with the tool holders until the tapping members —16— have completed their thread cutting operation in the radiator at which time the flanges —28″— of the collars —28— will have engaged their respective stop members —36— thereby limiting the further movement of the collars and plungers —18— while the shafts —7— and tool holders —10— continue their inward movement to bring the cutting tools —25— into cutting engagement with opposite faces of the radiator.

This limitation of the inward movements of the collars —28— causes the tapered portions —17— of the plungers —18— to be withdrawn from between the chasers —16— thus permitting said chasers to be retracted inwardly by their respective springs —19— thereby freeing the chasers from engagement with the radiator at about the time the high points of the cams —66— contact with their respective rollers —65—.

Relatively short arcs of the cam surfaces at the high points of the cams are concentric with the axis of the shaft —67— to allow a limited dwell of the shafts —7— and tool holders —10— at their innermost positions for completing the facing operations and permitting the withdrawal of the tapping members —16— from their cutting positions.

The descents of the cams from the high points to the low points are rather abrupt to permit quick return of the shafts —7— and tool holders to their starting positions through the medium of the springs —70— ready for a repetition of the operations just described.

What I claim is:—

1. In a device for machining radiators and the like, a rotary and axially movable tool holder, tapping members slidable transversely of and upon the tool holder, a boring tool secured to the tool holder at one end of the tapping members, a facing tool mounted on the tool holder at the other end of the tapping members, a tapered member slidable lengthwise of and between the tapping members for moving the same outwardly when the tapered member is moved in one direction and for permitting inward movement of the tapping members when the tapered member is moved in the opposite direction, a collar reciprocally movable lengthwise of and upon the tool holder, means for transmitting reciprocal motion from the collar to the tapered member, means for stopping the axial movement of the collar as the tool holder is moved into the work to cause the tool holder to move the tapping members away from the tapered member, and automatic means for stopping the axial movement of the collar in the opposite direction as the tool holder is withdrawn from the work.

2. A device for machining radiators and the like as in claim 1 in which one of the collar stopping means is yielding to reduce the shock upon the collar as the tool holder is returned to its starting position.

In witness whereof I have hereunto set my hand this 24th day of April 1926.

JAMES REID.