May 23, 1933. G. W. McCUNE 1,910,118

SELF CENTERING RIFLING HEAD

Filed May 28, 1928 2 Sheets-Sheet 1

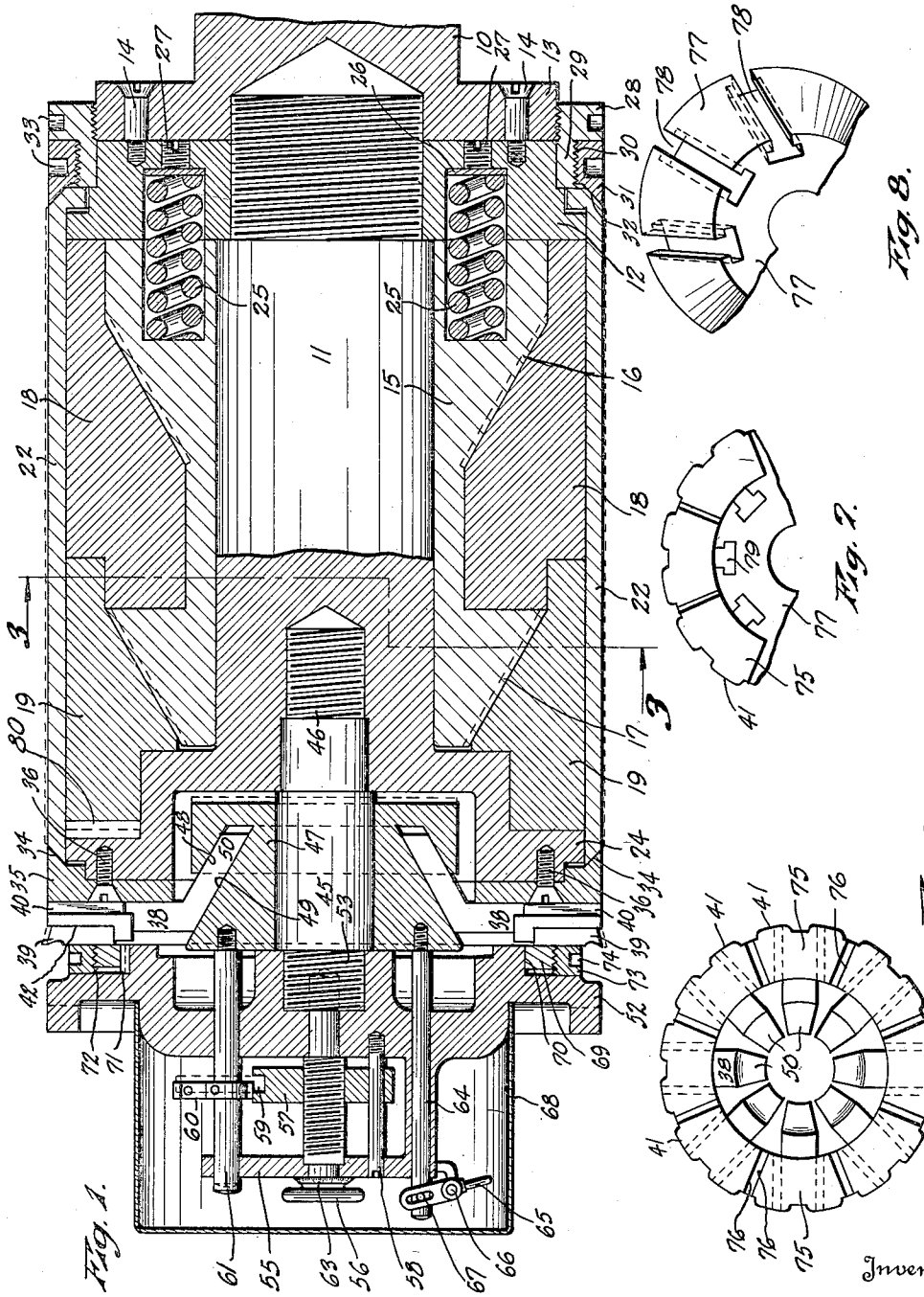


Fig. 1.

Fig. 8.

Fig. 7.

Fig. 6.

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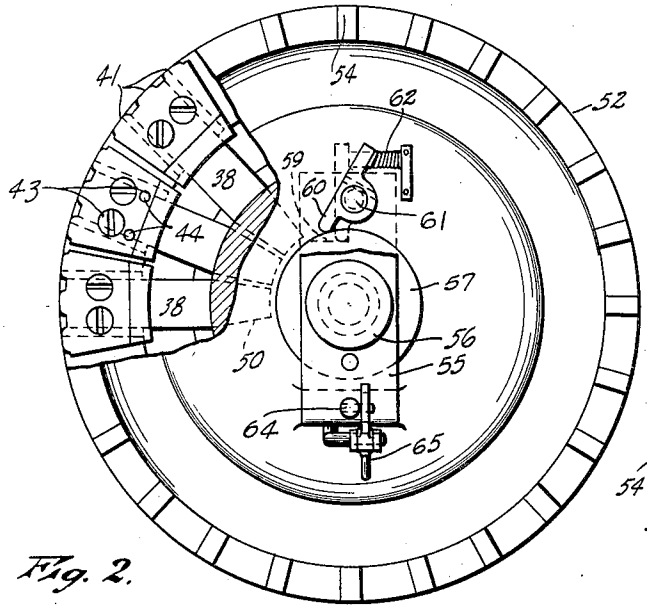


Fig. 2.

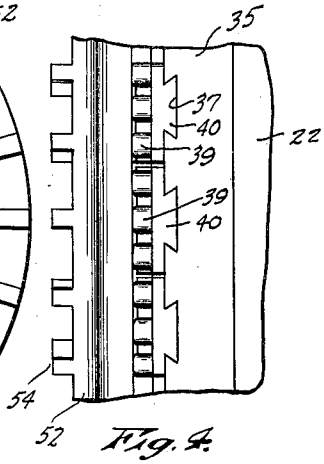


Fig. 4.

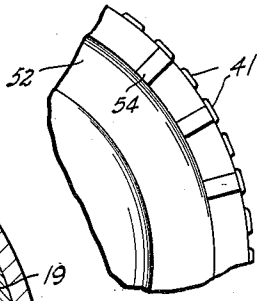


Fig. 5.

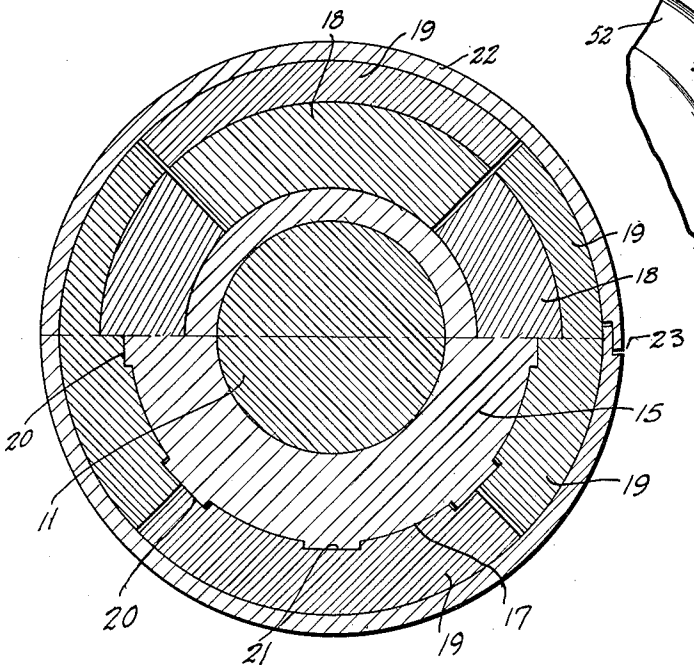


Fig. 3.

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UNITED STATES PATENT OFFICE

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SELF CENTERING RIFLING HEAD

Application filed May 28, 1928. Serial No. 281,156.

This invention relates to a rifling head and has for an object to provide an improved head of this character which will automatically adjust itself to variations in the diameter of the bore of the gun and will automatically maintain the center of the head in the center of the bore, so that the rifling will be uniform throughout the full length of the bore and will also be uniform throughout the circumference of the bore.

It is also an object of the invention to provide a rifling head with which all the rifling grooves may be cut simultaneously throughout the entire periphery of the bore.

It is another object of the invention to provide an improved means for adjusting the cutters to secure a greater range of adjustment, and in which the cutters will be simultaneously adjusted.

With the foregoing and other objects in view, the invention consists in certain novel features of construction, combinations and arrangements of parts as will be more fully described in connection with the accompanying drawings. In these drawings,

Fig. 1 is a longitudinal section through the head.

Fig. 2 is an end elevation looking from the left of Fig. 1 with the enclosing housing removed and a portion of the front plate broken away to more clearly show the construction.

Fig. 3 is a transverse section substantially on line 3—3 of Fig. 1.

Fig. 4 is a partial side elevation looking toward the left of Fig. 2.

Fig. 5 is a detail elevation of a portion of the front plate of Fig. 2 showing the cutters extended in cutting position.

Fig. 6 is a front elevation with the front head or plate removed showing how the device is arranged for rifling a relatively small bore.

Fig. 7 is a partial front view similar to Fig. 6 showing a modified construction of the cutter adjusting means, and

Fig. 8 is a perspective view of one-half of the adjusting means of Fig. 7.

In rifling guns, particularly large guns, it is very difficult to cut the grooves uniformly due to changes in temperature of the gun and also the rifling tools. Also any variation in the size of the bore will cause uniform rifling. The common practice is to provide a brass cylindrical block on the rifling head carrying the cutting tools which is supposed to fit the bore of the gun, but it will be apparent that an expansion of the gun due to the increase of temperature or other variation will permit the head to drop so that its axis is below the center line of the bore, and therefore, the rifling grooves will not be cut of a uniform depth. To overcome this objection I have produced a construction of head which will automatically adjust itself to variations in the diameter of the bore and will thus automatically center itself so as to maintain its axis always on the center line of the bore, and thus will cut the rifling grooves uniformly throughout the length of the bore and also throughout the periphery thereof. I have also produced a rifling head with which all of the rifling grooves required in the gun may be cut simultaneously at the same operation, and have produced a structure in which all of the cutters may be simultaneously and uniformly adjusted.

Referring to the drawings 10 represents the operating bar of any suitable length depending on the length of the gun to be bored, and which carries the rifling head. This head, as shown, comprises a cylindrical central or body member 11 which is threaded into the end of the bar 10 and also into a ring or head 12 which is secured to the flange 13 of the bar 10 by means of a plurality of screws 14. Mounted on the cylindrical portion of the member 11 is an adjusting member 15 which is preferably a continuous member and has a cylindrical bore fitting the member 11 and on which it is slidable longitudinally. This adjusting member 15 has one or more conical surfaces in the present construction two of them 16 and 17, which form cam surfaces for adjusting the intermediate members 18 and 19 respectively. These intermediate members are shown as segmental members in four parts, in other words there

are four segments on each of the conical surfaces 16 and 17 although a greater or less number may be used if found preferable. The inclined cam surfaces 16 and 17 may be continuous conical surfaces but it is preferred to provide inclined flats 20 thereon cooperating with similarly inclined flats 21 on the segmental members, as this arrangement is less likely to bind than would be a continuous conical surface. The elements 18 and 19 are enclosed by a resilient cylindrical shell or casing 22 which is slit at one side and overlapped to prevent entrance of chips, as shown at 23, so that it may expand or contract. Its tendency, however, is to expand and fit the surface of the bore. The body member 11 has a flange 24 at its inner end, and the members 18 and 19 are held against longitudinal movement by this flange and the head or ring 12.

Resilient means is provided which tend to shift the adjusting member 15 longitudinally of the member 11 to force the cam surfaces 16 and 17 against the members 18 and 19 and thus tend to force them outwardly against the casing 22, and therefore, expand this casing. This resilient means in the construction shown comprises a plurality of coiled springs 25 seated at their opposite ends in sockets in the opposed ends of the members 12 and 15. Any suitable number of these springs may be employed, preferably equally spaced around the member 15. Their outer ends may rest against plates 26 engaging adjusting screws 27 by means of which the tension of the springs may be adjusted.

Means is provided for limiting the expanding movement of the casing 22. At its outer end a ring 28 is threaded on the flange 13 and has a reduced lateral extension 29 engaging the end of the casing 22. This reduced extension is threaded, as shown at 30, for a sizing nut or ring 31 which has a beveled inner end 32 cooperating with a similar bevel formed on the end of the casing 22. These rings are provided with sockets 33 to receive spanner wrenches for operating these rings. At the opposite end the casing 22 has a similar and opposite bevel 34 cooperating with a similar bevel on a plate or ring 35 secured to the flange 24 of the member 11 by any suitable means, such as screws 36. It will be apparent that by adjusting nut 28 the casing 22 will be forced toward or allowed to recede from the ring 35, and then the nut or ring 31 may be adjusted against the bevel of the casing 22 to prevent this end expanding a greater amount than the opposite end against the ring 35, thus maintaining the casing the same size throughout, and these beveled surfaces prevent the casing 22 expanding beyond a certain maximum limit. The casing 22 is made to a greater diameter than that of the bore of the gun, say about three-sixteenths of an inch. Then a longitudinal strip is cut out of it at one side and it is then compressed, ground and lapped to size.

The cutting tools for cutting the spiral grooves of the rifle are carried at the forward or inner end of this head. The plate 35 is provided with a plurality of radial dove-tailed slots 37 in which are mounted carriers 38 for the cutters 39, and these carriers have dove-tailed ribs 40 on their back walls sliding in the dove-tailed grooves 37 so that these carriers are guided for radial movement in the ring 35. The cutters 39 may each have one or more cutting edges for cutting the rifling grooves. In the form shown in Fig. 2 each cutter has three cutting edges 41 so that each cutter will cut three grooves. In the form shown in Fig. 6 each cutter has only two cutting edges, but it will be understood that they may each have one or more cutting edges as is found desirable. The body of the carrier is recessed as indicated at 42, to receive the cutters 39, and the cutters may be secured thereto by any suitable means, such as screws 43 and properly located by dowel pins 44.

Mounted on the inner end of the member 11 is a guiding stud 45, and it may be mounted in the member 11 by threading it into the same, as indicated at 46. This stud 45 provides a support and guide for adjusting block 47 which is mounted to slide longitudinally in the member 45. This block is provided with an inclined peripheral groove providing inclined or conical surfaces 48 and 49 which are parallel to each other and bear on the opposite sides of an extension 50 on each of the carriers 38, and this extension has inclined walls on its opposite sides corresponding to the inclination of the walls 48 and 49. It will be apparent from this construction that if the block 47 is forced to the right, as viewed in Fig. 1, the carriers 38 and the cutters 39 will be forced laterally outwardly by coaction of the inclined surface 49 with those of the extensions 50, while if the block 47 is forced to the left, as viewed in Fig. 1, the inclined surface 48 will have a camming action on the other side of the extensions 50 and will draw the carriers 38 and the cutters 39 radially inwardly, and therfore, the positions of the cutting edges 41 of all the cutters may be simultaneously adjusted and for equal amounts by shifting the block 47. The cutters may be drawn inwardly until the lateral edges of the extensions 50 are in contact with each other if this amount of adjustment is desired, and therefore, with this type of adjustment I can secure maximum adjustment of the cutters. It will, of course, be obvious that the camming surfaces 48 and 49 together with

the cooperating surfaces on the extensions 50 of the cutter holders may be inclined in the opposite direction and still secure the same result. With this arrangement, however, the cutters would be shifted outwardly by moving the block 47 to the left as viewed in Fig. 1, and these cutters would be drawn inwardly by shifting block 47 to the right.

Clamped against the outer surface of the ring 35 is a plate or guiding head 52 which is threaded onto the end of the stud 45, as shown at 53, and by which it may, therefore, be clamped against the surface of the ring 35. The outside diameter of this plate or head is approximately the diameter of the bore to be rifled and serves as a guiding means to guide the head into the bore when the head is inserted in the bore to start the rifling operation, and thus protects the cutters 39 and properly positions them relative to the bore of the gun for the beginning of the rifling operation. The outer rim of the member 52 may be provided with ribs 54 to cooperate with a suitable tool for properly screwing this head onto the head 45 or unscrewing it therefrom, and clamping it against the ring 35.

The means for adjusting the block 47 may take different forms but that shown in the drawing is a very effective one. In this arrangement as shown the plate 52 has an extension or support 55 carrying an adjusting screw 56 which is supported at its opposite end in the body of the member 52 and has threaded engagement with a nut 57 which is held against rotation by a pin 58. The nut 57 has a notch 59 in its outer edge cooperating with a holding pawl 60 pivotally mounted on a sliding pin 61 connected to the block 47, and a spring 62 normally tends to hold the pawl 60 in the notch in the nut 57. The adjusting screw 56 may be provided with a suitable calibrated gauge 63 to indicate the amount of adjustment. The block 47 may be shifted manually to contract or collapse the cutters 39 by means of a rod 64 connected to the block and slidable in the head 52. This rod has a connecting pivoted lever 65 carried by the head 52 and the pivot 66 and has a pin and slot connection 67 with the rod 64. When the pawl 60 is released the block 47 may be shifted by means of the lever 65 either to draw the cutters 39 inwardly or force them outwardly as desired. This adjusting means may be enclosed in a suitable casing 68 mounted on the head 52.

Means is provided for guiding the cutters 39 in their radial movements and also to prevent entrance of chips into the adjusting mechanism. The inner wall of the head 52 is recessed and carries an annular clamping member 69 which is guided for lateral movements on a cylindrical shoulder 70. The ring 69 is held against turning movements by a key 71 and it is threaded on its outer wall, as shown at 72, for threaded engagement with an adjusting ring 73 which fills the space between the head 52, the cutters 39 and the front face of the ring 35. This ring 73 has sockets 74 for insertion of a spanner wrench or other suitable tool for rotating this ring. By turning this ring the clamping ring 69 is adjusted to give the proper pressure on the cutters 39 to assist in holding them in proper position and prevent their chattering, but it should be sufficiently loose when shifting the block 47 to permit the cutters 39 to be moved radially under the action of the adjusting block 47. After adjustment the ring 69 may be tightly clamped against the cutters 39 to hold them in proper position and prevent chattering during the cutting stroke.

The operation is as follows: As indicated the head or plate 52 will guide the device into the bore of the gun and prevent injury to the cutters or the gun by positioning the head central in the bore. After the pawl 60 is seated in the nut 57 the adjusting screw 56 is turned to bring the cutters 39 in proper position for the first cut and then the head is forced through the gun in the usual manner to cut the rifling grooves, and it will be apparent that sufficient cutters may be carried by this head to simultaneously cut all of the grooves. At the end of the inward movement of the head the pawl 60 may be released from the nut 57 and then the operator by manipulating the lever 65 may shift the block 47 to the left as viewed in Fig. 1, which will cause the inclined walls 48 coacting with the extensions 50 on the cutter carriers 38 to draw the cutters inwardly to the full line position of Fig. 1, so that the head may be withdrawn from the bore for the next operation. After the head is drawn back to the inlet end, the lever 65 is manipulated to force the block 47 to the right which will force the cutters outwardly. The pawl 60 is again seated in the notch 59 in the nut 57 to hold the block 47, and therefore, the cutters 39 in proper position. The adjusting screw 56 may be rotated to force the block 47 inwardly or to the right, as viewed in Fig. 1, to force the cutters outwardly the proper amount for the next step which may be accurately determined by the calibrated flange 63. The head is now in condition for making the next cut and the operation is repeated.

During the advance movement of the head the center of the head is always automatically held in the center of the bore of the gun regardless of variations in diameter of this bore due to changes in temperature or other reasons. This is accomplished by the members 15, 18, 19 and 22 and cooperating elements. The springs 25 tend to force the adjusting member 15 to the left, as shown

in Fig. 1, and as this member is guided on the cylindrical member 11 it is always concentric with the member 11. This sliding movement of the member 15 through the cam surfaces 16 and 17 tends to force the blocks 18 and 19 radially outward as they are guided at their opposite ends by the head or ring 12 and the flange 24. These blocks 18 and 19 are, therefore, concentrically arranged about the member 11 and are pressed against the inner surface of the resilient split casing 22. They, therefore, expand this casing so that its outer surface always fits the surface of the bore of the gun. The outward or expanding movement, however, is limited by the beveled surfaces 32 and 34 at the opposite ends of this casing, and as indicated above this maximum expansion may be adjusted for the maximum bore of the gun by manipulation of the wing nuts 28 and 31. As the head moves through the bore of the gun the casing 22 is held snugly against the surface of the bore, as indicated by the action of the springs 25. Should a portion of the bore be somewhat smaller because of contraction of the gun walls by reduction in temperature the surface of the bore will press the casing 22 inwardly to correspond with the size of the bore and against the action of the spring 25, but during the expansion and contraction of the casing 22 the center of the head will always correspond with the center of the bore due to the peculiar arrangement of the elements, and therefore, the head is always automatically centered in the bore and the rifling cutters 39 are all uniformly and properly positioned throughout the periphery of the head, and the rifling grooves are all cut to a uniform depth throughout their entire length.

The head as shown in Fig. 1, is for a relatively large gun. Fig. 6 shows how the same principal may be used for rifling a relatively small gun. In this arrangement each carrier 38 supports a cutter 75 having only two cutting edges 41, or the cutter may have only one cutting edge as desired, and as the sides 76 of this cutter may be arranged parallel to each other and radially of the head I am enabled to secure maximum adjustment.

In Figs. 7 and 8, I have shown an adjusting block 77 to take the place of the block 47, Fig. 1, of somewhat different construction. This block, however, is not as desirable as the block 47 because it is more expensive to make and does not permit as great a range of adjustment as the block 47. It is a conical block provided with T-shaped slots 78 in its outer inclined surface in which similar T-shaped extensions 79 on carriers corresponding to the carriers 48 for the cutters 75 are guided. Thus as the block 77 is shifted the same as the block 47 these T-shaped slots cooperating with T-shaped extensions 79 will shift the cutters inwardly and outwardly.

A key 80 may be inserted in opposed grooves in the flange 24 and members 19 to prevent these members turning in the body.

Having thus set forth the nature of my invention, what I claim is:

1. In a rifling head, a cylindrical body member, a continuous member having a cylindrical bore mounted to slide longitudinally on the body member, a plurality of segments outside the continuous member, coacting cam surfaces on the continuous member and said segments, resilient means tending to shift the continuous member to shift the segments outwardly, and a split casing embracing the segments adapted to fit the bore of a gun and held in engagement therewith by said segments.

2. In a rifling head, a cylindrical body member, an adjusting member having a bore to fit the body member and slidable longitudinally thereon, a plurality of segments outside the adjusting member, cooperating cam surfaces on the adjusting member and the segments, a split resilient casing embracing the segments, and one or more springs tending to shift the adjusting member to expand said casing to fit the bore of a gun and center the head therein.

3. In a rifling head, a cylindrical guiding member, an adjusting member having a cylindrical bore to fit that of the guiding member and slidable longitudinally thereon, said adjusting member being provided with cam surfaces inclined to the axis of the head, a plurality of laterally movable members engaging said cam surfaces, one or more springs tending to shift the adjusting member to move the laterally movable members outwardly, a split resilient cylindrical casing enclosing said laterally movable members adapted to fit the bore of a gun and held in engagement therewith by said members, and cutters carried by said head.

4. In a rifling head, a cylindrical guiding member, an adjusting member having a cylindrical bore to fit that of the guiding member and slidable longitudinally thereon, said adjusting member being provided with cam surfaces inclined to the axis of the head, a plurality of laterally movable members engaging said cam surfaces, one or more springs tending to shift the adjusting member to force the laterally movable members outwardly, a split resilient cylindrical casing enclosing said laterally movable members and adjusted thereby to fit the bore of a gun, and adjustable means for limiting the expansion of said casing.

5. In a rifling head, a cylindrical guiding member, an adjusting member having a cylindrical bore to fit that of the guiding member and slidable longitudinally thereon,

said adjusting member being provided with cam surfaces inclined to the axis of the head, a plurality of laterally movable members engaging said cam surfaces, one or more springs tending to shift the adjusting member to force the laterally movable members outwardly, a split resilient cylindrical casing enclosing said laterally movable members and adjusted thereby to fit the bore of a gun, adjustable means for limiting the expansion of said casing, a plurality of cutters carried by said head, and means for simultaneously adjusting said cutters.

6. In a rifling head, an expansible cylindrical casing to fit the bore of the gun, an adjusting member movable longitudinally of the head and having cam surfaces inclined to the axis of the head, a plurality of segments enclosed by the casing and located between said casing and the adjusting member, said segments being capable of radial movement under action of said cam surfaces, resilient means tending to shift the adjusting member to force said segments outwardly to expand the casing, means to maintain said adjusting member concentric with the axis of the head, and a plurality of cutters carried by the head.

7. In a rifling head, an expansible cylindrical casing to fit the bore of the gun, an adjusting member movable longitudinally of the head and having cam surfaces inclined to the axis of the head, a plurality of radially movable members between the adjusting member and the casing and arranged to be shifted by the action of said cam surfaces, resilient means tending to shift the adjusting member to expand the casing, adjustable means to limit the expansion of the casing, a plurality of cutters carried by the head, and means for simultaneously adjusting the cutters radially of the head.

8. In a rifling head, means for guiding the head in the bore of a gun, a plurality of radially movable cutter supports carried by said head, an adjusting block movable longitudinally of the head, cooperating means on the block and the supports to shift the supports by movement of the block, an adjusting screw, a nut operated by said screw, a detachable connection between the nut and the block to hold the block in a given position depending on the position of the nut, and independent means for shifting the block to shift the cutter supports when said connection is disconnected.

9. In a rifling head, means for guiding the head in the bore of a gun, radial guides, cutter supports in said guides, rifling cutters carried by said supports, a head forwardly of said cutters, a clamping ring mounted for sliding movement on said head and adapted to engage and guide the cutters, and an adjusting ring closing the space between the head and the cutters and having threaded engagement with the clamping ring to adjust the same toward and from the cutters in a direction axially of the head to clamp the cutters in adjusted positions and to release them.

10. In a rifling head, means movable with the head for automatically maintaining the axis of the head in the center of the bore regardless of changes in the sizes of the bore, comprising a split resilient casing free to expand and contract and tending to expand so as to fit the bore regardless of changes in the diameter thereof, and self acting means enclosed by said casing free to expand and contract with the casing, means for mounting said latter means so that it is always coaxially with the head for automatically maintaining the casing coaxial with the axis of the head, and rifling cutters carried by said head.

11. In a rifling head, a split resilient casing free to expand and contract to fit the bore of the gun and movable with the head, an adjusting means enclosed by said casing adapted to expand the casing, resilient means tending to shift the adjusting means to expand the casing and automatically maintain it the size of the bore, means concentric with the axis of the head for mounting said adjusting means, and a series of cutters for rifling grooves carried by said head.

12. In a head for rifling the bore of a gun, a split resilient casing adapted to expand and contract so as to fit the bore of the gun in spite of variations in the size of this bore and movable with the head, resilient means tending to expand the casing to automatically maintain it the size of the gun bore, a plurality of cutters for simultaneously cutting a plurality of rifling grooves in the bore carried by said head, and means for simultaneously adjusting the cutters radially of the head.

13. In a head for rifling the bore of a gun, a split resilient casing movable with the head and adapted to expand and contract so as to at all times fit the bore of the gun, an adjusting means enclosed by said casing, resilient means tending to shift the adjusting means to expand the casing and automatically maintain it the same size as the gun bore, means to maintain the casing always concentric with the axis of the head, a plurality of cutters carried by the head adapted to simultaneously cut a plurality of rifling grooves in the bore, and means simultaneously adjusting the cutters radially of the head.

14. In a head for rifling the bore of a gun, a resilient split casing movable with the head and adapted to expand and contract so as to at all times fit the bore of the gun, resilient means tending to expand the casing to automatically maintain it the same size

as the bore, adjustable means to engage the casing to limit the expansion of the casing, a plurality of cutters carried by the head adapted to simultaneously cut a plurality of rifling grooves in the bore, and means for simultaneously adjusting said cutters radially of the head.

In testimony whereof I affix my signature.

GEORGE W. McCUNE.