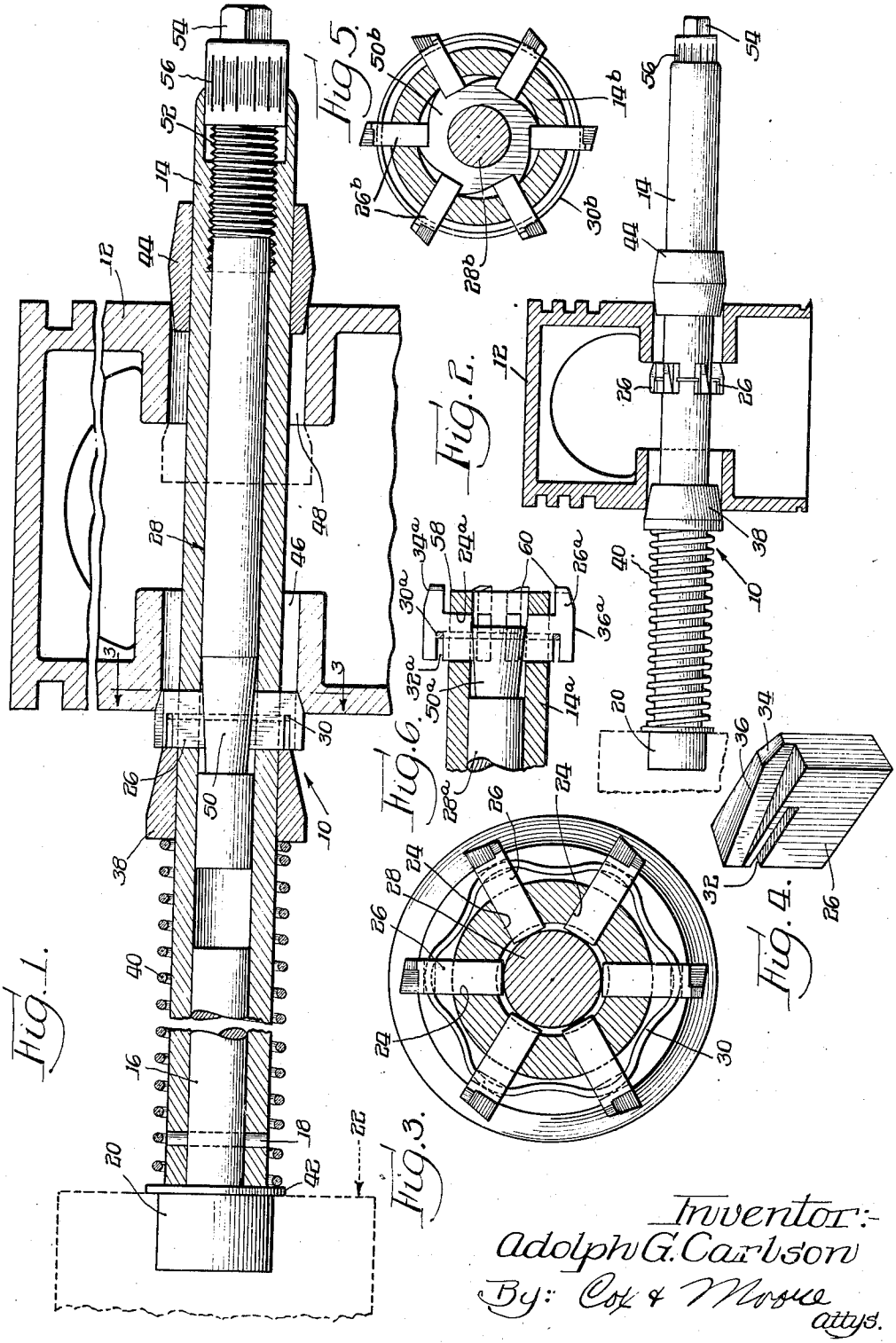
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EXPANSION REAMER

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Inventor:-
Adolph G. Carlson
By: Cox & Moore
attys.

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EXPANSION REAMER

Adolph G. Carlson, Chicago, Ill.

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1 Claim. (Cl. 77—76)

My invention relates generally to rotary type cutting tools, and more particularly to reamers of the expansion type.

Many of the conventional expansion type reamers with which I am familiar are arranged so as to require the longitudinal shifting of blades or sections with respect to a support therefor in order to effect an adjustment in diameter. Such conventional devices are considerably weakened as a result of the arrangement of the slots and blades therein. Furthermore, difficulty has been experienced in the use of conventional reamers in maintaining the proper radius or diameter of the reamer when it occupies its expanded state. This is particularly true where the sections of the reamer associated with the blades must be expanded in order to effect the radial movement or expansion of the blades. My invention contemplates overcoming the aforementioned and numerous other disadvantages which have been experienced heretofore.

Another advantage in reamer construction contemplated by the present invention is the reduction in the length of the blades to eliminate chatter when in use. I propose to provide relatively short, expansible blades which will eliminate the presence of chatter during the cutting operation, and to this end I propose to provide, in combination with the relatively short blades, a support for the work which will cooperate in maintaining absolute alinement of the bored hole in the work. As an example of an instance wherein my invention has a very practical application, I call attention to the art of finishing wrist pin bearing surfaces in piston heads. Each piston is provided with a pair of oppositely disposed apertures which must be reamed to size and maintained in absolute alinement. By using conventional types of reamers wherein the blades are relatively long, the work must be supported solely by the blades of the reamer, thereby enhancing the possibility of introducing inaccuracies in the finished work. By employing my invention, the possibility of such inaccuracies is completely obviated.

A further object of my invention is to provide a cutting tool of the type mentioned above, which is extremely simple in construction, of durable design, and very economical to produce.

The foregoing and numerous other objects and advantages will be more apparent from the following detailed description when considered in connection with the accompanying drawing, wherein—

Figure 1 is a central longitudinal sectional view of a cutting tool constructed in accordance with the teachings of my invention, said tool being shown in operative association with a work piece or piston during the initial reaming thereof;

Figure 2 is a view similar to Figure 1, with the cutting tool shown in elevation and advanced into the work a sufficient distance to bring into play both of the supporting sleeves or collars, which serve to maintain absolute alinement of the holes in the work piece;

Figure 3 is an enlarged transverse sectional view taken substantially along the line 3—3 of Figure 1;

Figure 4 is an enlarged perspective view of one of the reamer blades;

Figure 5 discloses a modified adjusting mechanism wherein the central adjusting rod may be rotated to effect radial adjustment of the blades through the agency of a ratchetlike cam member; and

Figure 6 is a fragmentary view of a modified construction to illustrate the manner in which my invention may be adapted to end mills.

Referring now to the drawing more in detail wherein like numerals have been employed to designate similar parts throughout the various figures, it will be seen that for purposes of illustration I have disclosed my cutting tool or reamer 10 in operative association with a work piece or piston 12 (Figures 1 and 2). The reamer 10 of Figures 1 to 4, inclusive, includes a body or sleeve member 14 connected at one extremity with a shaft 16, which is coupled to the sleeve through the agency of a transverse pin 18. The free or outer end of the shaft 16 is formed with a head 20 adapted to be gripped by any conventional tool holding mechanism, such as a rotary chuck 22 indicated by dotted lines in Figures 1 and 2.

An intermediate portion of the body or sleeve 14 is provided with a plurality of radial slots 24, which are adapted to slidably receive companion cutter elements 26. The axial length of the slots 24 is such as to prevent longitudinal movement of the cutter elements 26, the inner ends of the elements 26 being normally maintained in contact with the peripheral surface of an adjusting member 28 through the agency of a suitable spring member 30. The cutter elements or blades 26 are suitably recessed at 32 to receive the spring 30 (as clearly indicated in Figures 1 and 4). To facilitate the cutting action of the elements 26, I prefer to provide a slight bevel or chamfer 34. I also prefer to form the cutting edge 36 of the blade or element 26 with a slight lead or rake (as indicated in Figure 4). This I accomplish by

milling or otherwise removing a portion of the material of the stock at the outer end of each of the blades.

A tapered sleeve or collar **38** slidably mounted upon the body **14** is resiliently urged into engagement with the rear extremities of the cutter elements **26** by means of a coiled spring **40** (as clearly shown in Figure 1). This spring **40** is interposed between the sleeve **38** and a flange or collar **42**. A second tapered sleeve or collar **44** slidably mounted upon the body **14** is also employed in instances where the device is used for reaming a plurality of alined apertures such as the apertures **46** and **48** of the piston **12**. The functioning of these sleeves **38** and **44** will be more clear as the description progresses.

Radial adjustment of the cutter elements or blades **26** is accomplished by means of the adjusting member **28**, which is formed with a tapered section **50**. The inner extremities of the cutter elements **28** rest upon the peripheral surface of the tapered section **50**, and, when the member **28** is shifted longitudinally of the body **14**, the cutter elements or blades **26** will shift radially. One extremity of the adjusting member **28** is formed with a screw **52**, which travels within companion threads provided within the body **14**. By gripping the squared end **54** of the member **28** with a suitable turning tool, longitudinal adjustment of the member **28** may be conveniently effected. By providing suitable graduations **56** on an enlarged end of the member **28**, the actual amount of adjustment of the member **28** can be accurately determined.

From the foregoing it will be apparent that, when a work piece such as the piston **12** is to be reamed, the cutting tool **10** is mounted within a suitable chuck or holding device **22** (as indicated in Figure 1). The piston is also mounted in proper position with respect to the cutter blades **26**, and the initial cutting takes place at the left side of the work piece **12**. By either moving the rotating tool **10** to the right or moving the work piece **12** to the left, the reaming of the aperture **46** takes place. After relative movement of the parts takes place for a sufficient period of time, the surface surrounding the reamed extremity of the aperture **46** is carried into engagement with the tapered peripheral surface of the collar **38** (as clearly shown in Figure 2). Continued relative movement between the piston **12** and the cutting tool **10** eventually brings the cutting tool into operative association with the oppositely disposed aperture **48** of the piston. It will be noted that after the piston is carried into operative association with the tapered surface of the collar **38**, said piston is supported from opposite sides, thereby maintaining absolute alinement with respect to the axis of the cutting tool. Relative movement between the piston and cutting tool is continued until the surface surrounding the aperture **48** has been completely reamed. The piston may then be slipped off from the extremity of the sleeve **14**, and another piston put in its place. The coil spring **40** serves to yieldably urge the tapered alining collar **38** into operative association with the piston. Obviously the described device is not limited to a single set of radial cutter blades, but also contemplates the provision of a series of radially disposed blades, depending entirely upon the nature of the work to be performed.

The foregoing mechanism must be clearly distinguished from conventional apparatus for reaming, with which I am familiar—for example, there are conventional reamers equipped with resilient sections formed integral with a shank, said sections being flexed or resiliently urged in a radial direction to cause variation in diameter of combined radial blades. In such devices the blades are not in themselves radially shiftable within a body, but depend entirely for their adjustment upon the amount of springing or flexing to which the sections are subjected. In these devices the required accuracy in external diameter with respect to the pilot end thereof is frequently not maintained, due to variations in hardness or other inherent qualities of the steel. In such constructions, the only portion of the blades which are directly engaged by a support are those portions which experience expansion, a considerable part of the reaming portions being unsupported, thereby introducing the possibility for further inaccuracies in blade positioning.

Attention is also directed to the fact that the above described invention precludes the necessity of employing the reamer blades as supporting elements for the work. That is to say, it has been common practice to employ reamers having relatively long blades, the blades providing a support for the work after the reaming operation has progressed a sufficient distance. In my device, I employ relatively short blades and am able to do this because of the auxiliary supporting sleeves **38** and **44**. These sleeves serve to carry the weight or load of the work piece, and hence cooperate in relieving the blades of unnecessary strains and stresses in addition to insuring perfect alinement in the finished product.

In Figure 6 I have shown the manner in which blades **26*a***, corresponding to the blades **26** previously described, may be combined with a sleeve **14*a*** to serve as an end mill, as well as a reamer. It will be noted that the blades **26** need only be recessed at **58** (Figure 6). The sleeve **14*a*** corresponding to the sleeve **14** is provided with slots **24*a*** corresponding to the radial slots **24**. These slots **24*a*** are positioned near the free extremity of the sleeve as distinguished from the intermediate position shown in Figure 1. An adjusting member **28*a*** longitudinally shiftable within the sleeve **14*a*** is provided with a tapered extremity **50*a***, which functionally coacts with the blades **26*a*** in the same manner as the surface **50** coacts with the blades **26**. In other words, longitudinal shifting of the member **28*a*** within the sleeve **14*a*** controls the radial adjustment of the blades. A suitable spring **30*a*** provided within recesses **32*a*** serves to normally urge the blades into supporting contact with the tapered surface **50*a***. The blades **26*a*** are also provided with end cutting edges **60** in addition to the peripheral cutting edges **36*a***. I prefer also to provide a slight bevel or chamfer **34*a*** on the blades **26*a*** to facilitate the initial cutting action of the blades.

In Figure 5 I have disclosed a modified blade adjusting mechanism which includes a rotary adjusting member **28*b***, which corresponds functionally with the longitudinally shiftable adjusting members **28** and **28*a*** previously described. The blades **26*b*** are normally held in engagement with the peripheral surface of a ratchetlike adjusting member **50*b*** through the agency of a suitable spring **30*b***. To cause the blades **26*b*** to be shifted outwardly, it is only necessary to impart a slight rotary movement to the member **50*b*** with respect to the sleeve **14*b***. Obviously other variations and modifications in adjusting devices may be employed without depart-

ing from the spirit and scope of my present invention.

From the foregoing it will be apparent that my invention provides a very simple and economically produced reaming device, which makes for increase in accuracy in the work, and also insures efficient operation of the cutting elements or blades, and precludes chatter and distortion. By reducing the length of the blades to a minimum and providing the auxiliary work supporting and alining sleeves **38** and **44**, many of the difficulties and disadvantages heretofore experienced are obviated. While I have disclosed specific embodiments of the invention for purposes of illustration, it will be understood that the invention is not limited to the specific disclosures made herein. By having my adjusting member **28** arranged in such a manner that the tapered portion or surface **50** is positioned between cylindrical sections of the member **28**, no lateral distortion of the tapered surface is experienced as a result of the radial stresses experienced by the blades. This contributes materially toward the perfect alinement of the cutter body with respect to the blades.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:

An adjustable reamer comprising an elongated cylindrical body having a uniform cylindrical axial bore therein and radial slots through the walls of said body into the bore, a plurality of apertured blades relatively short in a direction parallel to the axis of the body and long in a direction through the slots, extending through the slots into the bore and being movable in the slots radially of the body, the inner faces of the blades being at an angle to the axis of the body, an adjusting member within the bore and having two cylindrical sections of approximately the same diameter as the bore and a conical section between the cylindrical sections, of smaller diameter at all points than said cylindrical sections, the surface of the conical section being at the same angle to the axis of the body as the inner faces of the blades and being adapted for engaging the inner faces of the blades to hold the blades in selected position in the slots, and a spring comprising a single strand extending through the apertures in such blades in a direction generally circumferentially about the body with a generally polygonal configuration and urging the blades against said conical section, said aperture being a groove and said adjusting member being adjustable longitudinally of the body by rotation thereof within the bore relative to the body.

ADOLPH G. CARLSON.