(No Model.)

G. AMBORN, Jr.

EXPANDING REAMER.

No. 430,105. Patented June 17, 1890.

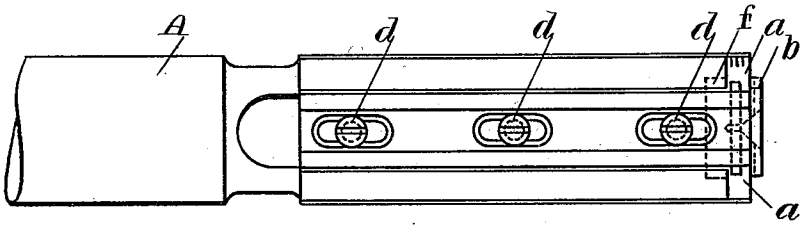

Fig. 1.

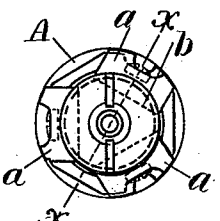

Fig. 8.

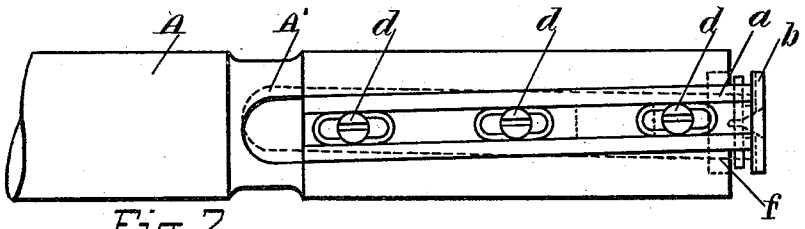

Fig. 2.

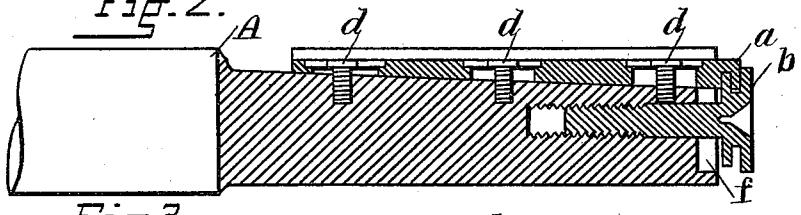

Fig. 3.

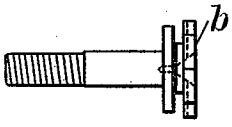

Fig. 4.

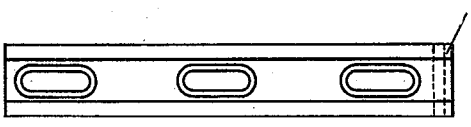

Fig. 5.

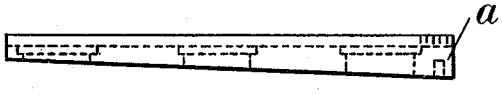

Fig. 6.

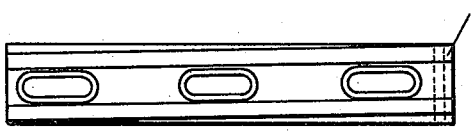

Fig. 7.

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EXPANDING REAMER.

SPECIFICATION forming part of Letters Patent No. 430,105, dated June 17, 1890.

Application filed February 6, 1890. Serial No. 339,455. (No model.)

To all whom it may concern:

Be it known that I, GEORGE AMBORN, Jr., of Pawtucket, in the county of Providence and State of Rhode Island, have invented certain new and useful Improvements in Expanding Reamers, and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

This improvement in reamers relates to those tools of that class that are termed "expanding" or "adjustable," because they are capable of being adjusted to ream holes of different sizes, or can be enlarged to make up for wear or loss by grinding in sharpening. The general objections to these reamers as before made has been a lack of rigidity, thereby making it impossible to ream a hole satisfactorily, and their being very expensive to make, which objections it is the object of this improvement to obviate.

It is illustrated in the accompanying drawings, in which—

Figure 1 is a horizontal side elevation of the reamer with a straight cutter, and an end view. Fig. 2 is the same as Fig. 1, only it shows diagonal or inclined cutters. Fig. 3 is a vertical section taken lengthwise of the reamer through the center. Fig. 4 shows the adjusting-screw separately, with an end view. Fig. 5 shows a top and end view of one of the cutters. Fig. 6 is a side view of Fig. 5. Fig. 7 shows a cutter having inclined cutting-edges. Fig. 8 is a front view of reamer.

The body A of the reamer is made very much in the usual form—a round bar having one end made square to receive a wrench and grooved out in the middle with a straight portion beyond to hold the cutters *a*, which are fitted to slide smoothly and easily in longitudinal grooves milled out of the body of the reamer.

The cutters are represented in the drawings as being three in number with six cutting-edges, but there may be more or less of them, according to the size of the reamer. The grooves are made deeper near the end of the reamer, so as to form a rising incline from the end to the middle of the reamer. The cutters *a* have their under sides made with an incline in the opposite direction to that of the bottom of the grooves, that when they are in place in the grooves their cutting-edges will be parallel to the center line of the reamer, excepting the inclined cutters, as will be explained. The faces of the cutters *a* are grooved out to form two cutting-edges *a' a'*, end view, Fig. 5. This groove is also for the purpose of affording room for the chips made by the cutting-edges. A screw *b*, Fig. 4, is fitted to screw into the center of the cutter end of the reamer, and the end is also recessed to receive the head of the screw. (See *f*, Fig. 3.) The head of the screw *b* has a groove made in its periphery, and a transverse groove is made in the under side of the cutters near their outer ends, into which that part of the screw-head inside of its groove fits, while that part of the cutter outside of its transverse groove fits into the groove in the screw-head. By this arrangement the cutters are moved in and out in their grooves when the screw *b* is turned in or out. Fig. 2 shows one of the cutters set on an incline to the line of the reamer center, while another is set at the opposite angle, as shown in dotted line A' in the same figure—that is, with right and left hand inclines—the third cutter being straight, as shown in Fig. 1, thus crossing the cuts and making it impossible for the cutting-edges to come twice in the same place in reaming a hole, prevent all "chattering;" but the same effect may be produced by making the inclines in the cutting-edges of the cutters as shown in Fig. 7, and placing them in the straight groove in the reamer. The screw *b* is graduated on its outer face, (see Fig. 4,) so that it can be turned a definite distance and turned back again to the same point with certainty, if desired, and graduation-marks are also shown on one of the cutters *a*, Fig. 3, and by a combination of the two sets of marks any desired movement up to thousandths of an inch can be made on the cutters to set them in or out. In setting or adjusting the cutters the screws *d* are first loosened with a screw-driver, and by screwing the screw *b* in the cutters will be pushed in, and the two inclined surfaces of the cutter and bottom of the groove will cause the cutters to rise up as they go in and increase the outside diameter of the circle cut by them, and then the screws *d* being screwed in tightly

the cutters will be rigidly held on a broad firm bearing, with a solid backing at their edges.

Having thus described my improvement, what I claim as my invention is—

1. A reamer having longitudinal grooves with inclined bottoms made therein, substantially as described, with cutters fitting said grooves and having their under sides inclined in the opposite direction, with screws to hold them in place, and an adjusting-screw fitted into the end of said reamer and having a groove in the periphery of its head to connect with the cutters, substantially as and for the purpose set forth.

2. A reamer constructed with grooves and cutters, substantially as described, and having an adjusting-screw in its cutting end graduated on its outer face, in combination with graduation-marks on one of the cutters, substantially as and for the purpose specified.

3. A reamer constructed with grooves and cutters, substantially as set forth, the said cutters having longitudinal grooves made in their upper face, making two cutting-edges to each cutter with screws to hold them in place, substantially as described.

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Witnesses:
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