

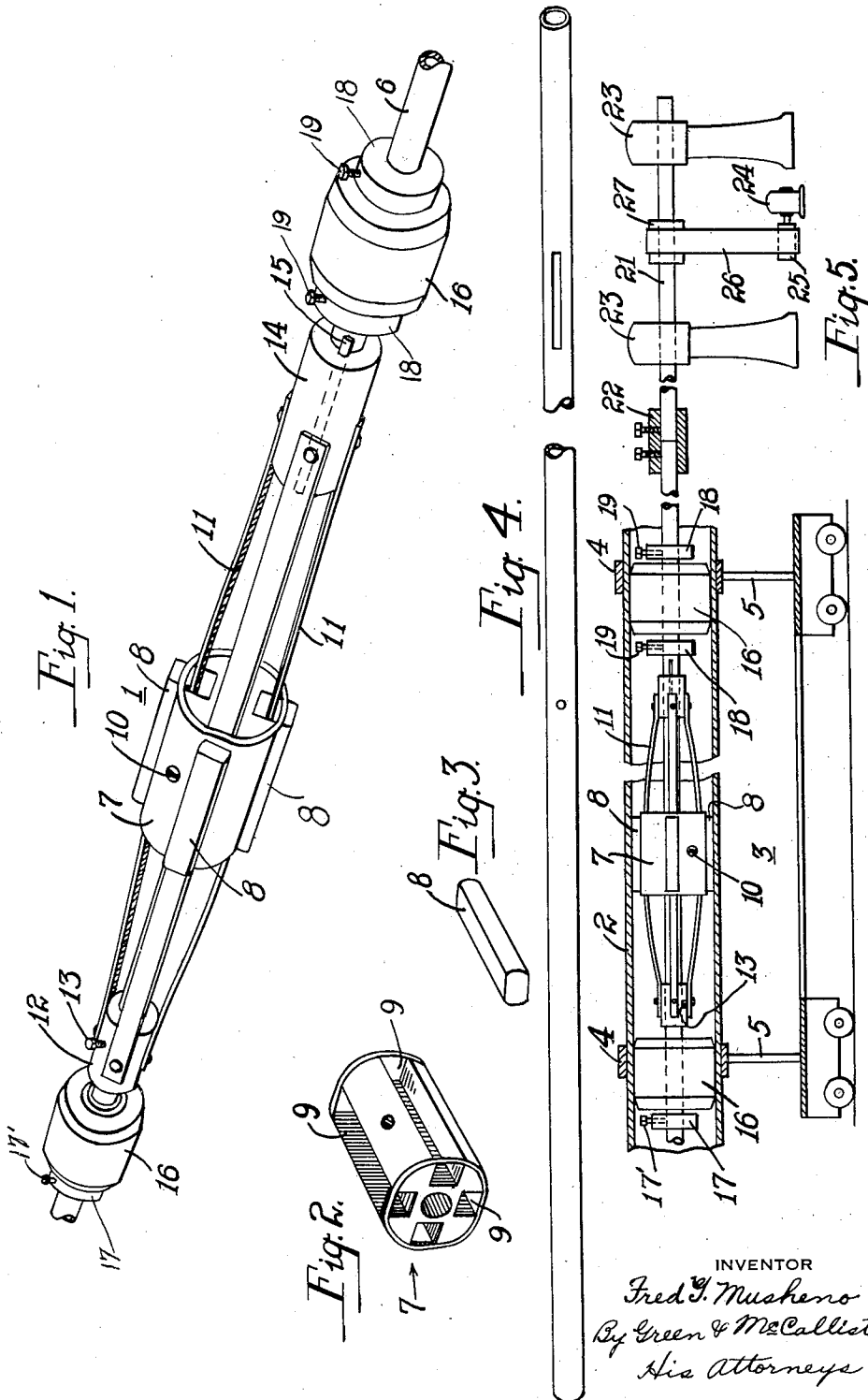
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GRINDING APPARATUS

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UNITED STATES PATENT OFFICE

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GRINDING APPARATUS

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This invention relates to the grinding and/or polishing of metallic surfaces and more particularly to grinders adapted to grind and/or polish the interior surfaces of cylinders, tubes and the like.

Since the development of the art relating to the manufacture of seamless tubing, pipe, cylinders and the like, industry has found many and varied applications for their use. Some applications require that the interior surface of such tubing, cylinders, pipe and the like be smooth and polished.

Usually the tubing, cylinders, pipe and the like referred to above are made in relatively long lengths; therefore the smoothing, grinding and/or polishing of the interior surfaces thereof present a difficult problem because special grinders are required. Grinders for this class of work require holders for the abrasive elements or stones, so constructed that the grinding and polishing operations may be worked out effectively and quickly.

An object of this invention is to provide an internal grinder for the aforesaid purpose that shall be simple in construction and efficient in operation.

Another object of the invention is to provide for supporting abrasive elements, such as grinding stones, within pipe, tubing, cylinders and the like and yieldingly urging the elements or stones into engagement with the surfaces to be ground and/or polished. The invention comprises the details of construction and the arrangement and combination of parts as will be more fully set forth in detail.

Other objects of the invention will, in part, be apparent, and will, in part, be obvious from the following description taken in conjunction with the accompanying drawing in which:—

Figure 1 is a view in perspective of an assembled grinder arranged and constructed in accordance with an embodiment of the invention;

Fig. 2 is a view in perspective of a holder for abrasive elements or stones embodied in the arrangement shown in Fig. 1;

Fig. 3 is a view in perspective of an abrasive element or stone;

Fig. 4 is a view of a shaft or mandrel embodied in the structure shown in Fig. 1;

Fig. 5 is a diagrammatic illustration of apparatus for driving the grinder and moving the pipe, cylinder or the like, over the grinder in the process of grinding and/or polishing the bore or the internal surface of the same.

Throughout the drawing and the specification like reference characters indicate like parts.

Referring to the drawing, an internal grinder 1 is illustrated which is adapted to be rotatably disposed within the bore of a cylinder, tube or pipe 2. The pipe may be supported on a carriage or conveyor 3 arranged for reciprocating travel. The carriage 3 includes collars or clamps 4 mounted on standards 5 carried by the carriage for holding the pipe, tube or cylinder 2 in such position that its longitudinal axis is in alignment and coincides with the axis of rotation of the grinder 1.

While the pipe is shown as being movable and the grinder stationary, it will be appreciated that the pipe may be held stationary and the grinder moved longitudinally therein.

The carriage 3 may be driven by a motor (not shown), suitable control (not shown) being employed to reverse the motor at predetermined intervals, thereby to reverse the direction of movement of the carriage at predetermined intervals or when it has traveled a predetermined distance in one direction or the other.

The grinder comprises a shaft or mandrel 6 on which a holder 7, for abrasive elements or grinding stones 8 is secured. The holder is illustrated more clearly in Fig. 2 and comprises a cylinder having a plurality of pockets or recesses 9 disposed parallel to the axis of the cylinder and, also, to the axis of rotation of shaft 6. The holder 7 may be secured to the shaft 6 by means of a set screw 10. As illustrated the pockets or recesses 9 are substantially rectangular in transverse section and spaced approximately

ninety degrees apart, however, the shape and number of recesses or pockets employed and the angular spacing thereof may vary as requirements dictate.

5 The abrasive elements or stones 8 are illustrated more particularly in Fig. 3. As there illustrated, each stone or abrasive element 8 is relatively long as compared to the depth of the pockets or recesses 9 and
10 may be substantially rectangular in transverse section. The stones are preferably of such size that they may move freely into and out of the pockets or recesses 9.

In order that the stones or abrasive elements 8 may be yieldingly urged outwardly of the pockets or recesses 9 and into engagement with the internal surface of the pipe, tube or cylinder 2, a plurality of springs 11 are provided. As shown the springs comprise relatively long strips of spring metal and extend through the pockets or recesses 9 in the holder 7.

As illustrated in Figs. 1 and 5, the springs are so positioned that the central portions thereof are within the pockets of the holder 7. The springs may be bowed upwardly from the opposite ends thereof towards their middle portions. By so bowing the springs, the abrasive elements or stones will yieldingly engage the internal surface of the pipe or cylinder 2 at all times as the grinding stones or elements are worn away.

The tension of the springs may be so adjusted that the pressure at which the grinding stones or elements bear upon the surface of the pipe or tube being ground, will be of that value conducive to efficient, quality grinding and/or polishing. The rate of grinding or cutting away of the surface metal may be regulated by the speed of rotation of the mandrel shaft 6 and by the type of abrasive element or stone selected. Likewise the quality or character of the polished surface desired may be controlled by choosing the proper type of grinding element or stone. It is to be understood that other factors enter into the rate of grinding and the quality of surface polish and these factors are generally known to those skilled in this particular art.

As shown in Figs. 1 and 5, the left hand ends of springs 11, as seen in the drawing, are secured to a collar or cylinder 12 which is held fast to the shaft 6 by means of a set screw 13. The opposite ends of the springs are secured to a collar or cylinder 14 which is movable longitudinally of shaft 6 as the springs 11 expand or contract. In order to prevent turning of collar or cylinder 14 on shaft 6, the shaft and collar may be provided with key-ways for accommodating a key 15.

In practice sufficient clearance should be provided between the key 15 and the key-way in the collar so that the collar 14 may

move rather freely along the shaft 6 as the springs 11 expand or contract.

In order that the grinder 1 may be held or supported centrally within the tube or pipe 2, bearing members 16 of suitable bearing material are provided. The bearing members 16 may be mounted adjacent to collars 12 and 14, as shown more particularly in Figs. 1 and 5. It is preferred to mount the bearing members 16 loosely on the shaft 6 so that they may turn thereon and also permit the tube or cylinder to slide freely thereover.

In order to limit the longitudinal movement of bearing member 16 adjacent to collar 12, a collar 17 is mounted on the shaft and secured thereto by a set screw 17' or other suitable means. Bearing member 16 may, therefore, move between collars 12 and 17. In order to limit the longitudinal movement of bearing 16 adjacent to collar 14, collars 18 are mounted on the shaft 6 at opposite ends of the bearing, the collars being secured to the shaft by set screws 19, or other suitable means.

In operation, a tube, pipe or cylinder is mounted fast in the collars or clamps 4 of the carriage and the grinder inserted into the bore to be ground. One end of the grinder mandrel 6 is coupled to a driven shaft 21 by a coupler 22. Shaft 21 is journaled in pedestal bearings 23.

In order that the grinder may be driven at the proper speed, a motor 24, coupled to shaft 21 by pulley 25, belt 26 and pulley 27, is provided.

When the grinder and tube or cylinder have been set up, as shown in Fig. 5, the motor 24 is started and adjusted to the desired speed. The grinder will, therefore, be driven at the speed required for the type of grinding to be carried out. As the grinder rotates, carriage 3 is driven reciprocatingly thereby reciprocating the pipe longitudinally of the grinder.

The grinder may be lubricated in any manner desired so long as sufficient fluid is supplied to the surfaces being ground.

When grinder 1 is rotating within the pipe, tube or cylinder 2, the springs and the centrifugal forces acting on the stones or abrasive elements 8 tend to force them outwardly against the surface being ground and/or polished. Also the centrifugal forces acting on springs 11, tend to hold the springs firmly against the stones, thereby preventing chattering of the stones and springs. The springs in conjunction with movable collar 14 automatically vary the force exerted on the abrasive elements while the machine is in operation, in accordance with the contour of the surface being ground and the speed of rotation of the mandrel 6.

While only a single embodiment of the invention has been described and illustrated,

it is to be understood that several and various modifications and changes may be made in the grinder without departing from the spirit and scope of the invention. It is desired, therefore, that only such limitations shall be placed on the invention as are imposed by the prior art and the appended claims.

What I claim as new and desire to secure by Letters Patent is:—

1. An internal grinder comprising a shaft, a holder for abrasive elements fixed to said shaft, abrasive elements disposed in said holder, means yieldingly urging said elements outwardly of the holder, and means movable along the shaft adapted to automatically vary the force exerted by said yielding means on the abrasive elements in the operation of said grinder.

2. An internal grinder comprising a shaft, a holder for abrasive elements fixed to said shaft, abrasive elements disposed in said holder, means yieldingly urging said elements outwardly of the holder and bearing members on said shaft disposed at each side of the holder for supporting the grinder centrally within the bore of a tube, cylinder or the like.

3. An internal grinder comprising a shaft, a holder fixed to said shaft and having pockets therein concentrically disposed thereabout, leaf springs extending through said pockets, means rigidly securing said springs at one end to the shaft, means movably securing said springs at the other to said shaft and abrasive elements in said pockets and bearing on said springs.

4. An internal grinder comprising a shaft, a holder fixed to said shaft and having pockets therein concentrically disposed thereabout, leaf springs extending through said pockets, means rigidly securing said springs at one end to the shaft, means movably securing said springs at the other to said shaft, abrasive elements in said pockets and bearing on said springs and bearing members mounted on the shaft adjacent said spring securing means.

5. An internal grinder comprising a shaft, a holder fixed to said shaft and having pockets therein concentrically disposed thereabout, a collar rigidly secured to said shaft on one side of the holder, a collar movably mounted on said shaft on the other side of said holder, leaf springs extending through said pockets, the ends of said springs being secured to said collars and abrasive elements in said pockets and bearing on said springs.

6. An internal grinder comprising a shaft, a holder fixed to said shaft and having pockets therein concentrically disposed thereabout, a collar rigidly secured to said shaft to one side of the holder, a collar movably mounted on said shaft on the other side of

said holder, leaf springs extending through said pockets, the ends of said springs being secured to said collars, abrasive elements in said pockets and bearing on said springs and bearing members on said shaft adjacent to the outer ends of said collars for supporting the grinder centrally within the bore of a tube, cylinder or the like.

7. An internal grinder comprising a shaft, a holder fixed to said shaft and having pockets therein concentrically disposed thereabout, a collar rigidly secured to said shaft to one side of the holder, a collar movably mounted on said shaft on the other side of said holder, resilient strips extending through said pockets, said strips being bowed outwardly at the pockets, the ends of said strips being secured to said collars, and abrasive elements mounted in said pockets and bearing upon said strips.

8. An internal grinder comprising a shaft, a holder fixed to said shaft and having pockets therein concentrically disposed thereabout, a collar rigidly secured to said shaft to one side of the holder, a collar movably mounted on said shaft on the other side of said holder, resilient strips extending through said pockets, said strips being bowed outwardly at the pockets, the ends of said strips being secured to said collars, abrasive elements mounted in said pockets and bearing upon said strips and bearing members on said shaft adjacent to the outer ends of said collars for supporting the grinder centrally within the bore of a tube, cylinder or the like.

9. An internal grinder comprising a shaft, a holder on said shaft and having at least one guideway therein, a member secured to the shaft at one end of the holder, a member movably mounted on said shaft at the other end of the holder, a resilient strip extending through said guideway and having its opposite ends secured to said members, and an abrasive element mounted in said guideway and bearing on said strip.

10. An internal grinder comprising a shaft, a holder on said shaft and having at least one guideway therein, a member secured to the shaft at one end of the holder, a member movably mounted on said shaft at the other end of the holder, a resilient strip extending through said guideway, said strip being secured to said members, and an abrasive element mounted in said guideway and bearing on said strip.

11. An internal grinder comprising a shaft, a holder on said shaft, said holder having at least one guideway therein disposed longitudinally of and opening radially outward with respect to the axis of rotation of the shaft, a member secured to the shaft at one end of the holder, a member movably mounted on said shaft at the other end of the holder, a resilient strip extending

through said guideway and having its opposite ends secured to said members, and an abrasive element mounted in said guideway and bearing on said strip.

⁵ In testimony whereof, I have hereunto subscribed my name this 21st day of August, 1931.

FRED G. MUSHENO.

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