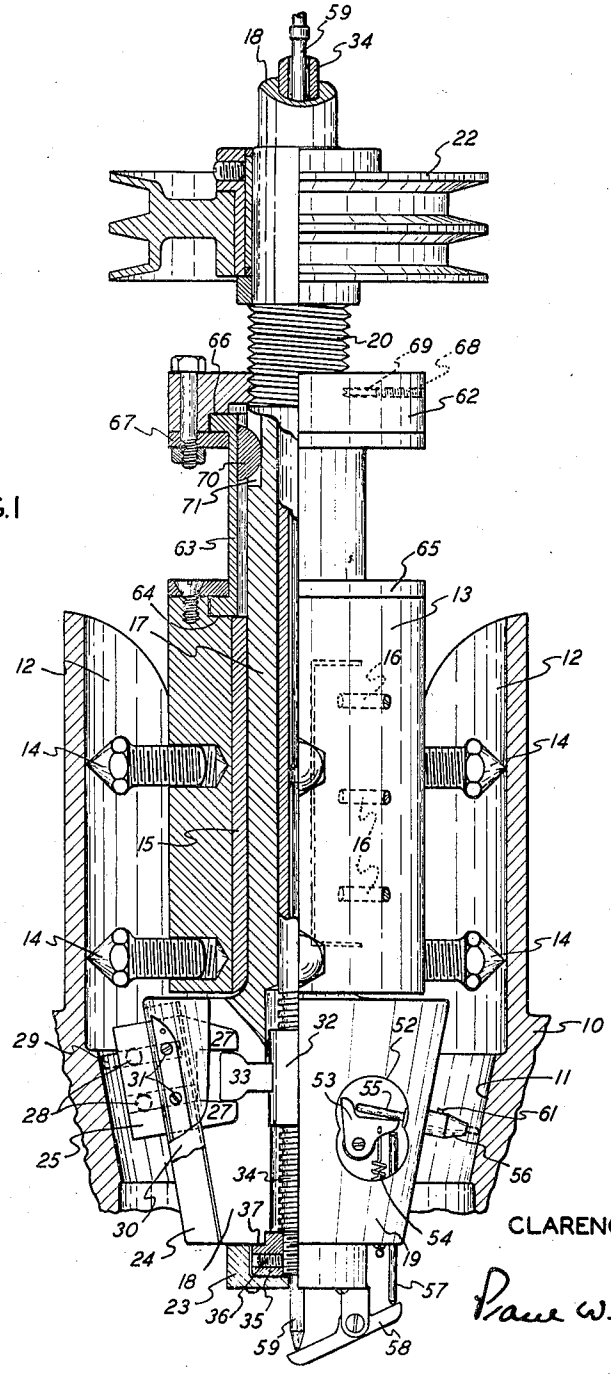
Feb. 4, 1941. C. C. LENARTH 2,230,509

PORTABLE APPARATUS FOR BORING PLUG SEATS AND THE LIKE

Filed Oct. 29, 1938 2 Sheets-Sheet 1

FIG. 1



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PORTABLE APPARATUS FOR BORING PLUG SEATS AND THE LIKE

Filed Oct. 29, 1938 2 Sheets-Sheet 2

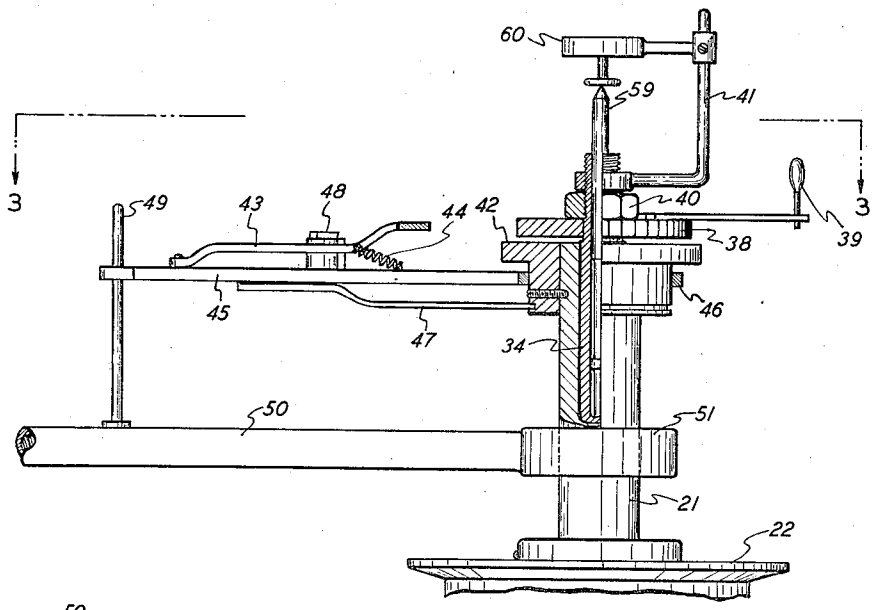


FIG. 2

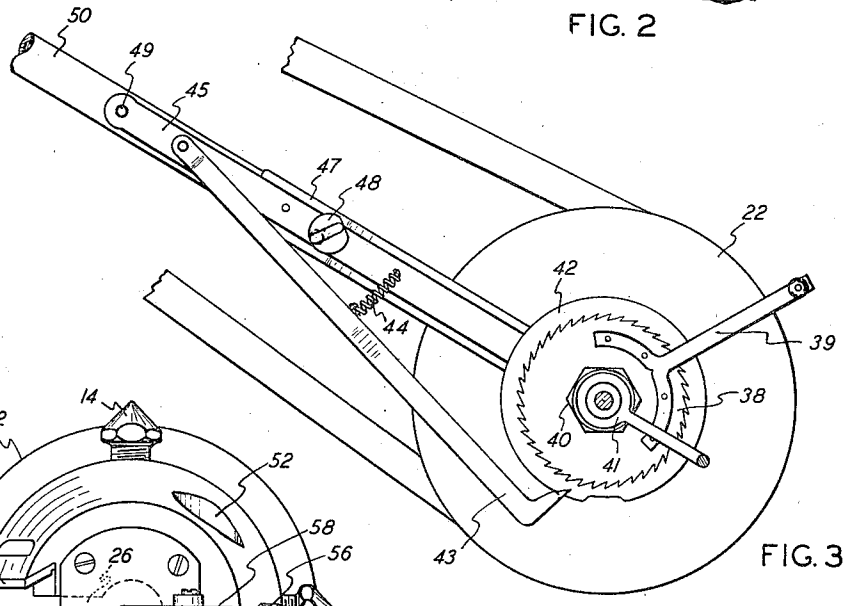


FIG. 3

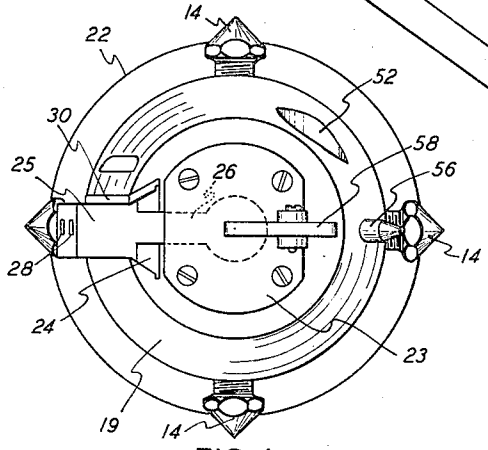


FIG. 4

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2,230,509

PORTABLE APPARATUS FOR BORING PLUG SEATS AND THE LIKE

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Application October 29, 1938, Serial No. 237,685

1 Claim. (Cl. 77—2)

It is often the case that in permanently installed apparatus there are conical valve or plug seats which, from time to time, are in need of reboring. An example of this is in the junction boxes of certain oil refinery still furnaces, which are provided with removable plugs in order that the interior of the tubes be accessible. Since it is required that these plugs prevent leakage of petroleum at high temperature and under considerable pressure, it is necessary that plugs and seats be machined to a precise fit and while the plugs may be taken to a machine shop, the plug seats are in heavy, integrally cast manifolds which may be removed from the furnace structure only with great difficulty.

The object of my invention is to provide a portable machine, capable of micrometric precision, for reboring such plug seats.

Another object of my invention is to provide means for accurately placing this machine with relation to the work.

A further object of my invention is to provide automatic feed means for progressively changing the position of the cutting tool during boring.

Further objects of my invention will appear from a consideration of the following description and of the attached drawings in which:

Fig. 1 is a view in elevation and section of my device in position at a junction box. Certain hidden portions are shown by broken lines and the upper portion is broken off.

Fig. 2 is a view in elevation and section of the upper portion of my device. Figs. 1 and 2 are continuations of one another (a portion being duplicated for additional clarity) and are shown separately solely for the purpose of avoiding undue crowding of the drawings and of the reference numerals.

Fig. 3 is a view taken as indicated by the line 3—3 of Fig. 2.

Fig. 4 is an end view of the lower end of my device, the junction box 10 of Fig. 1 being omitted.

My device is capable of operating in any position; it is illustrated in the drawings as being disposed vertically solely for convenience, in actual practice it will more often be placed horizontally.

Referring to the drawings, 10 represents a portion of the junction box manifold, provided with the conical plug seat 11 and ears 12—12. These ears are for the purpose of holding a screw yoke by which a plug is secured tightly in place in the plug seat, but they are used in connection with my invention as means of supporting the boring machine.

The spider body 13 is provided with a plurality of radial threaded openings adapted to receive the adjusting and supporting legs 14—14. For convenience in making the adjustments I prefer to arrange these legs in two whorls of four each, though it would be possible to use any arrangement which is capable of holding the spider body both in line with and centrally with respect to the plug seat 11. Means for making the measurements necessary for the adjusting will appear hereinafter.

Spider body 13 is also provided with a coaxial opening which holds the bushing 15; this bushing serves as the bearing for the entire rotatable portion of the machine. I have found it desirable to provide means of adjusting this bushing in order to eliminate all tendency to chatter. It is therefore slotted along three sides of a rectangle, as shown in broken lines, and screws 16—16 are provided adapted to force the rectangular portion of the bushing with any desired degree of pressure against the journal portion 17 of the boring bar generally indicated at 18—18.

Boring bar 18 is a unitary piece comprising the head 19, the journal 17, the threaded portion 20, and the tail 21 as shown in Fig. 2. Fixedly attached to the boring bar 18 are the double V belt pulley 22 and the cap 23. Coaxial with the boring bar, and running the entire length of it, is provided a cylindric opening which is enlarged through the head portion.

Head 19 is provided with guideway 24, which is preferably formed in the manner shown with three plane surfaces intersecting at 60°, more or less, and slightly indented portions at the intersections to prevent possible binding. However, the shape of this guideway is not of importance, it being required only that it be precisely straight and at the angle of the plug seat to be bored, and that it have adequate bearing surface in all directions for the tool holder 25 which is the guided member. Communicating between guideway 24 and the central opening of the boring bar is radial slot 26, shown in Fig. 4.

Tool holder 25 is adapted to fit closely but slidably in guideway 24, and is provided with a pair of ears 27—27 which project into slot 26. The tool holder is also provided with one or two holes 28 adapted to hold a cutting tool 29. It is not contemplated that more than one tool be used at once, the plurality of holes 28 is merely to make the machine adaptable to a greater variation of diameters of plug seats. In order that the quality of the fit between tool holder 25 and guideway 24 be controllable the guideway is provided with take-up strip 30 which is keyed by pins for motion transverse to the boring bar and which is adjustable by means of screws 31—31.

Running in the central opening of head 19 is feed screw nut 32 which is provided with tongue 33. This tongue projects into the slot 26 and

engages accurately the ears 27—27 of the tool holder. Thus, motion of the nut 32 lengthwise of the boring bar propels the tool holder lengthwise of the guideway 24. The nut is propelled by tubular feed screw 34 which runs the entire length of the boring bar through the above mentioned central opening, and it projects beyond the end of tail portion 21. The threaded portion of the feed screw which engages the nut 32 is entirely contained in the boring bar head 19, the remainder of the screw is smoothly cylindrical, working a free running fit in the boring-bar, except that the lower end has a threaded portion adapted to receive the thrust nut 35, and the upper end is provided with a squared portion and a threaded portion hereinafter described.

Thrust nut 35 is adapted to be screwed upon the end of feed screw 34 and is held fixed by a set screw 36; it is provided with a shoulder 37 which bears against the outer end of the boring bar thereby resisting thrust in one direction. The opposite thrust is resisted by contact with the cap 23.

It will be seen that normally feed screw 34 will rotate with the boring bar as a unit, there being considerable friction between the two, both at the thrust nut and throughout the smooth portion of the feed screw. Thus, normally, tool holder 25 will not be moved in relation to the boring bar. However, the feed screw may be forcibly held against rotation or may be rotated differently than the boring bar, thereby moving the tool holder as desired.

Means for rotating the feed screw with relation to the boring bar, both automatically and by hand, are located at the upper end of the machine shown in Fig. 2, and will now be described.

Feed screw 34, immediately above the tail end 21 of the boring box, is provided with a squared portion to receive a ratchet wheel 38. This ratchet wheel is provided with a crank 39 for hand operation. Beyond the squared portion the feed screw is provided with threads for the retaining nut 40 and for the arm 41 whose function will appear hereinafter.

Fastened fixedly to the upper end of the boring bar, in juxtaposition to the ratchet wheel 38, is the cam 42, which is an integral part comprising a short cylindrical body, and the cam proper, which is of the form shown in Fig. 3, circular with a short portion of the periphery interrupted. The length of this interruption controls the speed of the automatic feed. If it is desired that the machine be adaptable to various kinds of work requiring different depths of cut, replacement cams may be provided.

A pawl 43 is provided, adapted to be held from engagement with ratchet wheel 38 by cam 42 during the greater part of a cycle of rotation of the boring bar, but drawn into engagement by spring 44 whenever the interrupted portion of the cam comes around into position with the pawl. While the pawl is in engagement, the ratchet wheel, and thereby the feed screw 34, is held stationary against the rotation of the boring bar and due to the screw action in the head 19, the cutting tool is advanced the desired distance on the work.

Pawl 43 is carried pivotally by arm 45 which is supported by collar 46, loosely mounted on the cylindrical portion of cam 42. This arm also carries kicking strap 47, provided for the purpose of opposing and balancing the force applied to arm 45 at the time when the pawl engages the ratchet wheel. The eccentric cam 48 (hand operated) is provided for pushing the pawl out of operative position in order to discontinue the automatic feed when desired.

Arm 45 is restrained from rotation by means of rod 49 which passes through a hole in the outer end of the arm. Rod 49 is most conveniently attached, as shown, to a bar such as 50 provided for resisting the tension of the driving belts, but can be attached to any object which does not share the rotary motion of the boring box.

Bar 50 is an adjustable member for regulating the tension of the belts and connects collar 51 with a similar collar on the shaft of the motor, not shown but preferably an electric motor with built-in speed reduction gears.

I prefer using a double V belt drive because this machine operates at comparatively low speed (perhaps 50 R. P. M.) against considerable resistance, and a drive with less friction surface would be likely to slip.

The portions of my invention above described are those involved in the actual operation of boring; the remaining portions are those involved in the operation of placing the machine accurately in position.

The aligning of the machine may be done by simply measuring, as with a steel rule, the distances from the lip of the plug seat to some convenient portion of the boring machine, such as the belt pulley, and adjusting the legs 14—14 until the distances are the same on all sides of the machine. It is advisable, if the belt pulley is to be used for this purpose, that particular care be taken that its lower edge be accurately in a plane perpendicular to the axis of the boring bar. But the centering of the device, which requires micrometric accuracy of measurement, cannot be accomplished without the greatest of difficulty unless a measuring device be incorporated in the machine. Such a device is described in the following paragraphs.

Boring bar head 19 is provided with recess 52 which enters obliquely and deeply enough so that its floor is slightly beyond (and parallel to) a plane through the axis of the boring bar. On the floor of this recess is mounted the lever 53, to which is attached the spring in tension 54 which tends to produce clockwise motion of the lever. Communicating with lever 53 is the gauge rod 55 carried in the bushing 56; the outer end of this rod, when in use, is in contact with the plug seat as shown with broken lines in Fig. 1. Preferably, the axis of rod 55 lies in a plane through the axis of the boring bar and is perpendicular to the surface of the plug seat. However, this position is not strictly necessary.

As the boring bar is rotated, approximately in position and with cutting tool removed or placed out of contact with the plug seat, rod 55 will move back and forth in its bushing because of an eccentric effect unless the boring bar is perfectly centered. These motions of rod 55 are transmitted to lever 53, thereby to rod 57 which runs through a longitudinal hole, thereby to lever 58 which is carried by a support attached to cap 23, thereby to rod 59 which runs the entire length of the machine through the center of tubular feed screw 34, and thereby to a conventional micrometric indicator 60 of the dial type which is mounted as shown on supporting arm 41. Through this chain of rods and levers the minute variations in the distance from the plug seat to the axis of the machine are immediately visible to the operator while the boring bar turns.

I have found that if rod 59 has its frictional

area reduced as indicated and if it is kept well lubricated, the pressure of the spring contained in indicator 60 is sufficient to keep the chain of rods and levers in contact. However, it would be entirely possible to provide a spring for this purpose, such as a helical spring in compression mounted between cap 23 and a suitable collar on rod 59 near its end. Whether such a spring is used or not, spring 54 must be of sufficient strength to keep rod 55 in contact with the plug seat. Set screw 61 in bushing 56 is provided to hold rod 55 retracted from the plug seat after centering has been accomplished. This is desirable in order to avoid unnecessary wear.

The centering adjustments indicated as necessary by the above described measuring device are made by means of legs 14—14, as are the aligning adjustments.

One more adjustment means is required, since the depth to which the boring box is inserted determines the size of plug seat that may be bored. Alignment and centering being accomplished and spider body 13 being thus fixed in its proper position, the boring bar may be moved longitudinally with relation to the spider body by means of bar feed nut 62 operating on the threaded portion 20 of the boring bar.

Nut 62 is held at a fixed distance from spider body 13 by means of sleeve 63 which is provided with an outwardly projecting flange at each end. An annular recess is formed in the spider body between a shoulder 64 and a ring-shaped plate 65; a similar recess is formed in the bar feed nut between shoulder 66 and plate 67. The flanges on sleeve 63 fit closely in these recesses. Thus as nut 62 is turned upon the boring bar, the spider body being held fixed, the head of the boring bar is pushed into or drawn from the plug seat.

This lengthwise adjustment having been made, it is necessary that it be preserved. For this purpose is provided set screw 68 acting upon plug 69 which engages the threaded portion 20 of the boring bar, preventing accidental rotation of the nut 62 with respect to the boring bar. In order that the threads not be damaged, the inward end of plug 69 is provided with a notched surface to fit the threads. As an additional safeguard, in order that there be no frictional force tending to move nut 62, sleeve 63 is keyed, by means of key 70 and longitudinal keyway 71, for rotation with the boring bar. As a still further safeguard, the threads 20 of the boring bar are made left-handed in order that if nut 62 is accidentally engaged by some extraneous object while the bar is rotating, the cutting tool will be withdrawn from the work instead of being forced deeply into it.

Having described the embodiment of my invention illustrated in the attached drawings, I will now briefly describe the method of using it.

The machine is placed approximately in position by hand and the spider legs 14—14 are tightened sufficiently to hold it in place. While this is done, the tool holder 25 is preferably kept retracted from the work at or nearly at its limit of motion toward the upper end of Fig. 1, in order that the cutting tool not impinge on the plug seat during adjustment.

Measurements are then taken with any suitable rule or tape between the lip of the plug seat and the edge of the belt pulley 22 and the machine accordingly aligned with the work by suitable adjustments of legs 14—14. At this time it is convenient to center the machine as closely as may be done by rough measurement or visual estimation.

The machine being approximately in position, the belts are placed on pulley 22 and the driving pulley of the motor, and tightened by means of a length adjustment on bar 50. In this tightening, the motor, which may be mounted slidably on a suitable track, is the movable member and the tension of the belts is exerted entirely as compression on bar 50; thus there is no torque on the spider caused by the drive means which would tend to pull the machine out of alignment.

Set screw 61 is loosened, allowing gauge rod 55 to make contact with the plug seat and to move freely in its bushing 56. Indicator 60 is placed in position on arm 41 and set at zero reading and the motor is started. As the boring bar rotates, its eccentricity in the plug seat is shown by variations on the dial of indicator 60 and suitable adjustments of the spider legs 14—14 may be made to eliminate the eccentricity. At this time it may be convenient to make the final aligning adjustments also. For satisfactory and economical operation the centering should be done with an accuracy of the order of a thousandth of an inch or better, which will not be difficult with the apparatus described.

Centering and alignment being accomplished and the motor being stopped, gauge rod 55 is pushed back into its bushing and held retracted by tightening set screw 61. Then longitudinal adjustment is made by means of nut 62 and the tool holder 25 is moved in its guideway by means of crank 39 until the edge of the cutting tool is exactly in position at the lip of the plug seat, ready to begin boring. Then set screw 68 is tightened firmly and the motor is started and allowed to run until the boring is completed.

It is to be understood that the particular embodiment of my invention herein shown and described is susceptible of various changes and I reserve the right to such modifications as come within the scope of the appended claim.

I claim as my invention:

Portable apparatus for boring conical plug seats and the like, comprising: a rotatable boring bar provided with a longitudinal central opening and having a head provided with a guideway disposed at an angle to the axis of said boring bar, said angle being equal to the angle between a genatrix and the axis of the conical surface to be bored and provided with a radial slot communicating between said guideway and said central opening; a tool holder adapted to move in said guideway; a feed screw adapted to rotate within said central opening and to frictionally engage said boring bar; a nut threadedly engaging said feed screw and having a tongue which extends into said radial slot and which is arranged to engage transversely disposed surfaces of said tool holder in such manner as to transmit longitudinal motion of said nut to said tool holder while leaving said tool holder free to approach and recede from said feed screw; means for rotating said feed screw relative to said boring bar at intervals; means for maintaining said rotatable boring bar coaxial with the conical surface to be bored and in fixed longitudinal relation thereto throughout the boring operation; and means for rotating said boring bar.

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