Jan. 31, 1956 S. A. FOSTER 2,732,670

SIZE-DETERMINING GAGES FOR HONING AND GRINDING APPARATUS

Filed Oct. 9, 1953 2 Sheets-Sheet 1

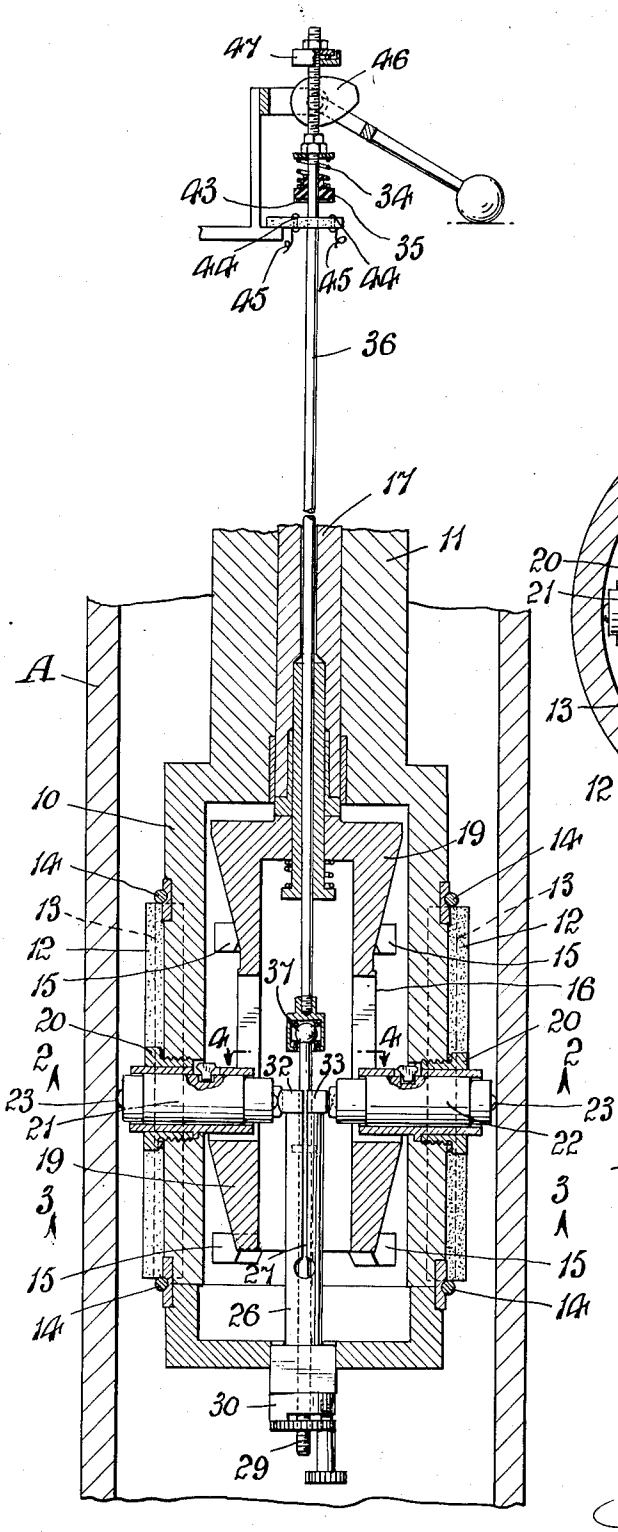


Fig. 1.

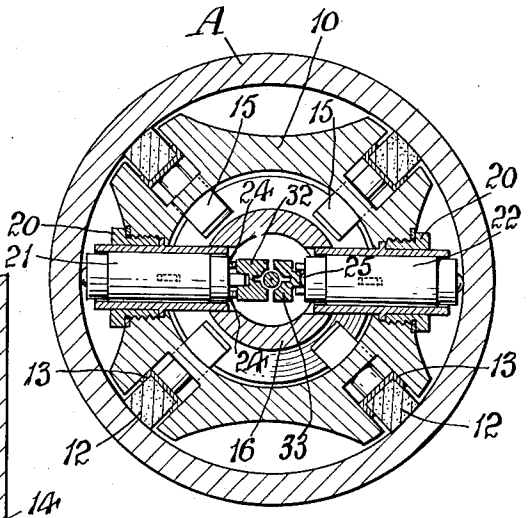


Fig. 2.

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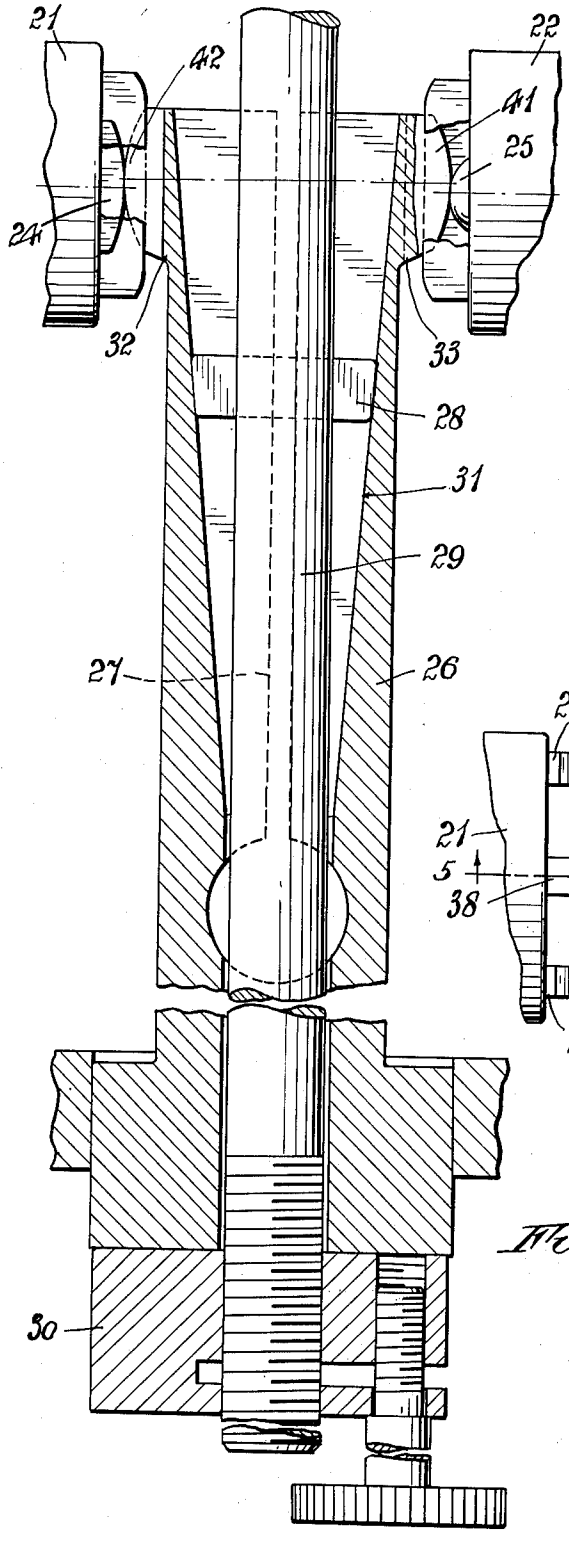


Fig. 5.

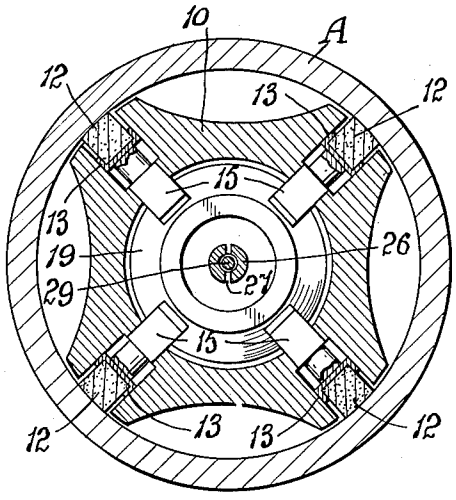


Fig. 3.

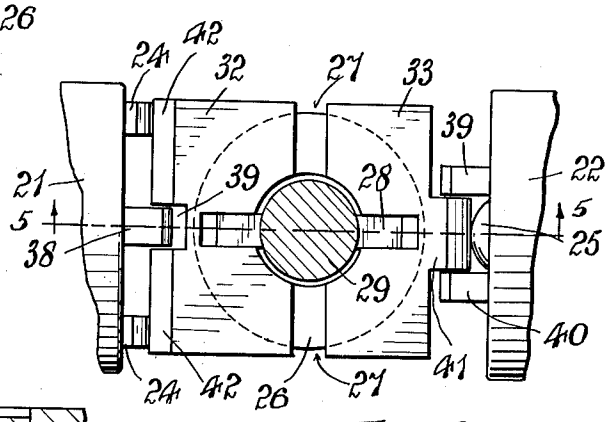


Fig. 4.

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2,732,670

Patented Jan. 31, 1956

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SIZE-DETERMINING GAGES FOR HONING AND GRINDING APPARATUS

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Application October 9, 1953, Serial No. 385,150

5 Claims. (Cl. 51—165)

This application is filed as a substitute for my abandoned application Serial No. 183,995, filed September 9, 1950, and is primarily directed to means for gaging the internal diameter of a cylindrical bore while it is being ground or honed in order to determine when the hole being ground has reached the desired diameter, it being contemplated that the gaging means may be adapted to be coupled with means for automatically controlling or stopping the action of the machine operating the hone whereby to prevent overrunning the honing of the wall of the bore beyond its finish diameter. The size-determining means constitutes the essence of this invention, however.

In grinding and honing cylinder walls, such as in motor blocks, fast automatic machinery is used to first rough and then finish grind all the cylinders at the same time. The practice usually has included first rough machining the walls to an approximate certain size and then honing the walls to a finished certain size by rapidly revolving and reciprocating the hone vertically inside the cylinder over its entire area for a certain amount of time which is calculated to remove a certain amount of material based on the speed of the tool, number of hone sticks, pressure on the sticks, and the hardness of the metal. This method of determining size has been used due to the fact that up to the instant invention no adequate gaging device was available to size the cylinders in conjunction with fast, automatic machinery.

Applicant's improved automatic control gage for hones involves the utilizing of a gage-block descending through a gap, the degree of which is determined by gaging elements, and to that extent resembling the falling gage-block system of contact control disclosed in Patent No. 2,267,559, granted to me December 23, 1941; but with certain differences of construction and operation which will become apparent from the following specific description of the construction and operation of the example shown in the drawings accompanying this present application, wherein:

Figure 1 is a vertical sectional view of the hone body and its associated elements taken on a plane indicated by the line 1—1 in Figure 2;

Figure 2 is a transverse sectional view of the same taken on a plane indicated by the line 2—2 in Figure 1;

Figure 3 is a transverse sectional view of the same taken on a plane indicated by the line 3—3 in Figure 1;

Figure 4 is a detailed top plan view of the vertical reciprocal gage block showing its working relationship to the inner ends of the radial gage pins taken on a plane indicated by the line 4—4 in Figure 1; and

Figure 5 is a vertical sectional view of the said members taken on a plane indicated by the line 5—5 in Figure 4.

The honing device illustrated in these drawings is indicated as being utilized in the boring of work in the form of a cylinder A and 10 indicates the hollow body of the honing device at the lower end of a tubular spindle 11 which, in the course of the honing operation, is usually both rotated and vertically reciprocated by suitable mechanical means such as is well known in the art.

Hone sticks 12 carried by mountings 13 located in vertical recesses in the outer wall of the head 10 are yieldably urged inwardly of the said recesses by annular springs 14 embracing the upper and lower ends of the said mountings; 15 being radial pins carried by said mountings 13 and extending freely through the wall of the hollow body 10 into the interior thereof as shown in Figure 10.

Within the said hollow body is vertically reciprocal hone stick spreader 16 secured to the lower end of a tubular push rod 17 which rod is vertically adjustable in the tubular spindle 11 of the hone (as by means not shown, such means being no part of this invention) to effect the vertical adjustment of the aforesaid spreader which is provided with a pair of downwardly tapered cones 19 whereby the tapered faces of these cones may operate to spread the pins 15 apart radially and thereby move the hone sticks 12 into working pressure contact with the wall of the work being honed. The spreader 16 is tubular to provide accommodation for other mechanism as will appear.

All of the foregoing description of the drawing relates to well-known hone construction to which the invention about to be described is applied by way of example.

Radially slidable in bushings 20 mounted opposite each other in the head of the hone 10 are gaging pins 21 and 22, the outer ends of which are provided with wear-resisting buttons, such as diamonds 23, with the inner end of the pin 21 provided with widely spaced wear-resisting projections 24 while the inner end of the pin 22 is similarly provided with a wear-resisting projection 25 which I have shown as being spherical in form.

It will be seen that the wall of the spreader 16 is slotted so that the inner ends of these pins may extend therethrough into the bore of the said spreader and approach each other to a degree determined by the bore of the work; so that the spacing of the inner ends of the said gaging pins 21 and 22 is a function of the extent of which the honing of the work has proceeded, it being understood that the buttons 23 of the gaging pins are maintained in contact with the bore of the work during the honing operation. My unique method of insuring maintenance of this contact between the buttons 23 and the bore of the work during the honing operation, and at the same time determining precisely when the honing operation is completed to the degree desired, will now be explained.

Extending upwardly through the lower end of the body 10 of the hone and within the body of the spreader 16 to a point normally above the projections 24 and 25 of the gaging pins 21 and 22 is a tubular sleeve 26, the upper end of which is bifurcated, as at 27, on a plane at right angles to the axes of the said gaging pins 21 and 22. Thus, the upper end of the said spindle may be spread in the direction of said gaging pins by the wedging action of a wedge element in the form of an enlargement 28 formed on or carried by an adjusting spindle 29 which is located in the bore of the split sleeve 26 and threaded through an adjusting nut 30 mounted on the lower end of the said sleeve 26.

Rotation of this adjusting nut 30, in one or the other direction, may be caused to draw the wedge element 28 downwardly against a tapered shoulder 31 formed in the bore of the said sleeve whereby to expand the upper end thereof; and rotation of the nut 30 in the opposite direction will permit the wedge element 28 to move upwardly due to the resiliency of the tapered shoulder portion of split sleeve 26 and permit the contraction of the upper end of the sleeve 26, as will be obvious.

The uppermost bifurcated end portions of the said sleeve 26 are enlarged, as at 32 and 33, to form what is hereinafter referred to as a "sizing-block" wherein an outer edge of the member 32 is presented in the direction of the projections 24 of the gaging pin 21 and the outer edge of the member 33 of the sizing-block presented in the direction of the projection 25 of the gaging pin 22. Thus, dependent upon the extent to which these elements of the sizing-block are spread apart by the wedge element 28, the said block may or may not pass downwardly between the projections 24 and 25 of the gaging pins 21 and 22, dependent upon the spacing of these projections 24 from the said projection 25. This spacing is, in turn, dependent upon the limit which the diameter of the bore of the work imposes upon the outward radial movement of the said gaging pins 21 and 22.

It will, therefore, be seen that by means of the adjusting nut 30 the expanding of the sizing-block may be set so that it may only pass downwardly between the aforesaid projections 24 and 25 when grinding of the bore of the work has reached a degree wherein the gaging pins have moved outwardly from each other to an extent previously decided upon.

It will also be noted that, while the gaging pins may move outwardly into contact with the bore of the work centrifugally, as a result of rotation of the honing device, the downward pressure of the sizing-block against the said projections 24 and 25 will promote this radial movement of the gaging pins; and it is proposed to provide arcuate contacting surfaces between the said projections and the said sizing block, as clearly shown in Figure 5, to enhance this tendency of the sizing-block to spread the gaging pins.

Downward pressure is also exerted, to some extent, through a suitably mounted coil spring 34 arranged to press upon a collar 35 carried by the upper end of a rod 36, which rod extends downwardly through the center of the tubular push rod 17 and operates as a link to connect to the upper end of the spindle 29 by means of a suitable coupling, such as the ball and socket joint 37.

To prevent undue rotation of the sizing-block 32—33, between the gage pins 21 and 22, the inner end of the gage pin 21 is shown as being provided with a guide in the form of a rib 38 extending into a vertical recess 39 formed in the adjacent wall of the member 32, and the inner end of the gage pin 22 is shown as being provided with two vertical parallel ribs 39 and 40 straddling the projection 41 formed on the adjacent wall of the member 33 of the sizing-block.

This projection 41 has an outerly arcuate face for impinging the opposed projection 25 of the gage pin 22, similar arcuate faces being provided at 42 on the member 32 of the said sizing-block to impinge the opposed projections 24 of the gage pin 21 for the obvious purpose of facilitating the described coaction between the said sizing-block and the said gage pins 21 and 22.

When the described sizing-block is permitted to fall downwardly between the inner ends of the gaging pins (as when the bore of the work has been ground to the desired extent), it is intended that such falling shall result in some indicating or other actuation which is desirable at such stage of the grinding operation. This may simply be in the nature of the actuation of some signal or device indicating to the operator that such a grinding stage has been reached; and in this example, I have shown the upper end portion of the rod 36 as provided

with a conductor 43 beneath the collar 35 for the purpose of closing a contact between a pair of terminals 44, which terminals may be electrically connected, as by leads 45, with any apparatus or device which the described arrangement may be intended to control. In actual practice, I connect these leads with electrical apparatus (not shown) designed to stop the operation of the grinding machine upon a circuit being closed through the said terminals 44.

46 is simply a manually operable cam, the lobe of which may be raised to impinge beneath an abutment 47, which is adjustably mounted on the upper end of the rod 36, whereby to effect the raising of the sizing-block above the level of the projections 24 and 25 of the gaging pins 21 and 22 prior to the commencement of a grinding operation. Thereafter, by means of lowering of the lobe of the cam, the arcuate members 42 and 44 of the said sizing-block may be caused to rest upon the said projections 24 and 25 of the gaging pins.

The described device is quite sensitive and accurate in its operation and may be readily set or adjusted so that the sizing-block will be released, from its engagement between the opposed projections of the gaging pins, with considerable precision to thereby accurately indicate the completion of the grinding operation or to result in the actuation of such means as the device is intended to control at such time.

This invention may be developed within the scope of the following claims without departing from the essential features of the said invention, and it is desired that the specification and drawing be read as being merely illustrative of a practical embodiment of the same and not in strictly limiting sense.

What I claim is:

1. A stopping mechanism for an internal bore grinding machine having a rotary head, comprising a pair of radially extending gage pins oppositely mounted in the head, said pins being radially slidable within the head so that the outer ends of said pins being extended radially outwardly from said head to contact the walls of a bore, the inner ends of said pins being spaced from one another, a sizing block resting upon said inner ends of the pin and being of such a dimension as to pass between the pins completely from one side of said pins to the opposite side thereof when the pins slide radially to a predetermined distance, and a switch means operatively associated with said block and actuated by the passing block to shut off the grinding action of the head.

2. A stopping mechanism for a rotary internal grinding head as defined in claim 1, said switch means comprising a link member connected to said sizing block, means on the link to actuate an electric stopping switch when the sizing block falls between the gage pins.

3. A sizing gage mechanism for an internal bore grinding machine having a rotary head, comprising a plurality of radially extending gage pins oppositely mounted in said said, said pins being radially slidable within the head so that the outer ends of said pins may contact the walls of a bored hole, the inner ends of said pins being spaced from one another; a split cylinder, extending between the inner ends of said pins, and having an enlarged sizing block having a portion formed on each of the split portions of the cylinder and each adapted to rest on said inner ends, means within the split cylinder to spread the portion of the cylinder at the sizing block to adjust the sizing block to various external dimensions.

4. A sizing gage mechanism as defined in claim 3, having means attached to said split cylinder to move the sizing block through the pins when the pins slide apart a predetermined distance, thereby actuating a control means to stop the grinding action.

5. An automatic sizing gage for an internal cylindrical bore comprising a rotary head, gage pins radially mounted in the head, the gage pins being radially slidable within the head with the outer ends of the pins being adapted

to contact the walls of a bore hole, and the inner ends of the pins being spaced apart; a sizing block resting on said inner ends and being movable between the pins, when the pins are spread apart a pre-determined distance, completely from one side of said pins to the opposite side thereof, thereby indicating the bored hole to be of a pre-determined internal size; said sizing block being formed in two parts on a split cylinder with each of said parts being separately formed on one of the split portions of said cylinder, means to enlarge the split cylinder at the sizing block so that the external dimensions of the sizing block may be varied.

References Cited in the file of this patent

UNITED STATES PATENTS

1,831,172	Hall	Nov. 10, 1931
2,267,559	Foster	Dec. 23, 1941
2,454,246	Worthen	Nov. 16, 1948
2,638,801	Klaasen	May 19, 1953

FOREIGN PATENTS

571,998	Great Britain	Sept. 18, 1945
694,284	Germany	July 29, 1940