Jan. 16, 1962 M. J. GROSS 3,016,660

HONE AND ABRASIVE ELEMENT THEREFOR

Filed July 31, 1959

Fig. 1

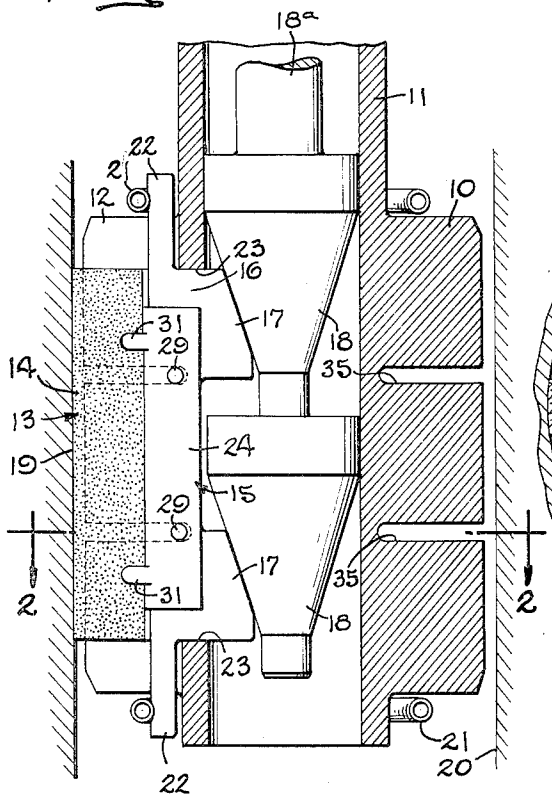


Fig. 2

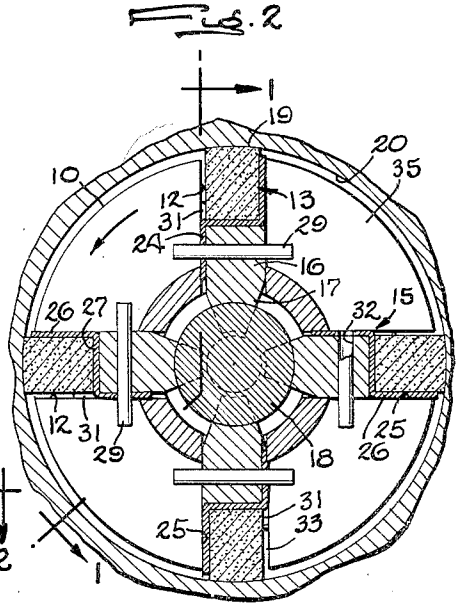


Fig. 3

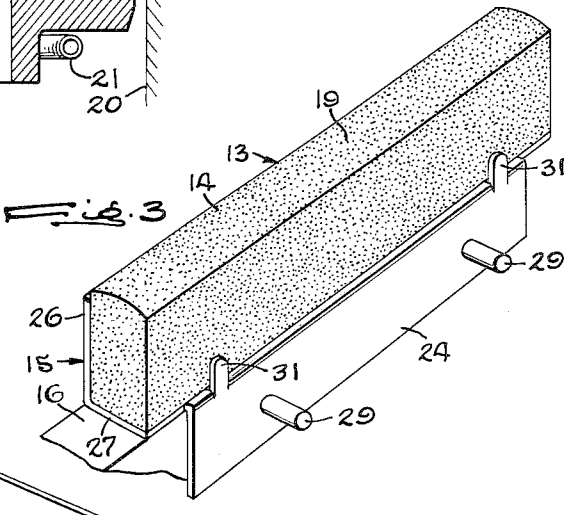
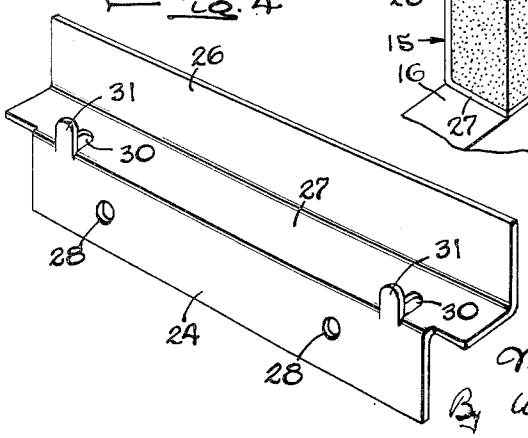


Fig. 4



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HONE AND ABRASIVE ELEMENT THEREFOR

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This invention relates to a tool for honing a cylindrical surface and comprising a rotary slotted body carrying a plurality of abrasive sticks each comprising an elongated bar of bonded abrasive known as a stick together with a carrier through which the stick is supported laterally or backed in the tool body by material adapted to wear away with the working face of the stick during the honing operation.

The primary object of the invention is to provide a novel carrier construction which is simple and inexpensive to manufacture, which provides the desired backing for the abrasive stick while avoiding fouling of the working face of the stick, which avoids cocking of the stick and rubbing thereof against a wall of the body slot and which may be fastened easily to the stick and to a supporting member in the honing tool.

Another object is to provide a novel carrier which can be formed easily and inexpensively from a single piece of sheet material such as aluminum and fastened conveniently to the honing stick to provide a backing for the trailing side of the stone, and a depending flange for convenient attachment to the supporting member in the honing tool, while at the same time maintaining a desired spacing between the leading face of the stick and the opposed wall of the body slot.

A more detailed object is to form the carrier as a one piece stamping of Z shape having two flanges projecting in opposite directions from opposite edges of a crosspiece and respectively backing the trailing side of the stick and properly spacing the leading side from the opposed wall of the body slot.

Other objects and advantages of the invention will become apparent from the following detailed description taken in connection with the accompanying drawings, in which

FIGURE 1 is a fragmentary sectional view taken along the line 1—1 of FIG. 2 of a tool equipped with a honing element embodying the novel features of the present invention.

FIG. 2 is a fragmentary sectional view taken along the line 2—2 of FIG. 1.

FIG. 3 is a perspective view of the honing element.

FIG. 4 is a fragmentary perspective view of the carrier of the honing element.

As illustrated in the drawing, the improved honing element is especially adapted for use in a rotary honing tool of the multiple stick type comprising a hollow generally cylindrical body 10 secured to the end of a rotary spindle 11 and having a plurality of parallel sided longitudinal slots 12. The latter are angularly spaced around and open outwardly from the body, and each receives a honing element 13 comprising an abrasive stick 14 and a carrier or holder 15 therefor. Herein, each stick is an elongated rectangular block of bonded abrasive somewhat shorter and narrower than the body slot.

Rigidly backing each honing element 13 within each slot 12 is an elongated bar 16 of rectangular cross section having inwardly projecting followers 17 which engage conical cams 18 fixed on a push rod 18a. The latter is slidable axially back and forth through the hollow drive spindle 11 and, when it is shifted in one direction, herein downwardly as viewed in FIG. 1, the honing elements are shifted outwardly to project the outer faces 19 of the abrasive sticks 14 beyond the periphery of the body 10 and against the wall of a work bore 20. When the rod

is retracted upwardly, the honing elements are permitted to shift inwardly for collapse of the hone, this being effected herein by the usual garter springs 21 which encircle and engage the outer sides of projections 22 on the ends of the follower bars. To avoid axial shifting relative to the body, the bars fit closely between end walls 23 of the body slots 12 (FIG. 1).

In accordance with the present invention, the carrier 15 for each honing element 13 is formed as an elongated member of Z-shaped cross section with two parallel flanges 24 and 26 projecting in opposite directions from opposite edges of a crosspiece 27 and spaced apart a distance at least equal to and preferably somewhat greater than the width of the abrasive stick. One flange 26 lies against one side of the abrasive stick 14 to separate the strip from the trailing side wall 25 of the body slot 12 and provide a backing for the trailing edge of the working face 19. The crosspiece underlies and is secured to the bottom of the stick and cooperates with the other or mounting flange 24 to define a recess for receiving the follower bar 16, this flange being fastened detachably to the bar for movement of the element with the bar.

The backing flange 26 extends throughout the length of the abrasive stick 14 and is wide enough to cover all of the trailing side of the stick within the body slot 12 when the honing element is first put into service use. Preferably, as shown in FIGS. 2 and 3, the flange is made slightly narrower than the usual width of the sticks to accommodate variations in the widths of different sticks while insuring that the flange does not project beyond the working face 19. The material selected for the flange is one which wears away with the stick but does not tend to load or foul the working face, that is, clog the pores therein. Due to the Z shape of the carrier, adhesive securing the latter and the stick together may be located on the bottom of the stick so that the backing flange is detached from the trailing side of the stick. Thus, there is no adhesive which, during wearing away of the stick and the flange, is liable to load the working face and reduce the cutting efficiency of the abrasive particles.

The width of the crosspiece 27 is correlated with the thickness of the flanges 24 and 26 so that the latter substantially lie against opposite side walls of the body slot 12 when the honing element 13 is assembled on the follower bar 16 within the slot. At the same time, the flange 24 is spaced from the flange 26 a distance at least equal to the width of the abrasive stick and in any event such that the outer face of the flange 24 is disposed in or outwardly beyond the exposed side face of the abrasive stick which face, in the final assembly, opposes the leading wall of the body slot 12.

Preferably, the abrasive stick 14 is secured over the full length of its bottom to the upper side of the crosspiece 27 so that, in the event of the cracking or breaking of the stick into several pieces as often occurs in service, the individual pieces will all remain secured to the carrier 15 thus permitting continued use of the stick. A suitable adhesive is ordinary Du Pont cement applied as a film to the bottom of the stick and covering the crosspiece. The effectiveness of the adhesive is increased by forming spaced holes 30 in the crosspiece, some of the adhesive flowing into these holes to form lugs which interlock with the crosspiece when the adhesive hardens.

To assist in holding the abrasive stick 14 and the carrier 15 assembled as the unitary honing element 13 or to assist in the selection of abrasive sticks of proper width, lugs 31 bent up from the crosspiece 27 or the mounting flange 24 lie substantially in the plane of the latter and cooperate with the crosspiece and the backing flange 26 to form a channel-like seat for the stick. Preferably, the lugs are struck out of the crosspiece so as to form the holes 30 for the adhesive in the same operation. In the

event that the stick is narrower than the channel between the lugs and the backing flange, the stick is positioned against the flange and the space between the stick and the lugs is filled with adhesive.

With the lugs **31** thus disposed in the plane of the flange **24** and lying against the leading and exposed face of the abrasive stick **13**, it will be apparent that this face will, in the final assembly of the honing tool shown in FIG. 2, be separated by a gap **33** from the opposed guide wall of the body slot **12** which wall lies in flat face to face contact with the outer surface of the carrier flange **24**. By such positive spacing, the abrasive is held out of contact with this slot wall not only at the outset but throughout the service life of the stick in spite of the tendency of the honing element to cock or tilt in its mounting relative to the slot under the reaction torque exerted by the work on the working face **19**. As a result, the guide walls of the slot remain smooth and undamaged throughout the life of the tool body.

To secure the honing element assembly **13** detachably to the follower bar **16** when the latter is seated in the recess defined by the crosspiece **27** and the mounting flange **24**, at least one and preferably two fastening devices **28** are formed on the latter for interengagement with fastening devices **29** on the follower bar. In this instance, each of the devices **29** comprises a cylindrical pin fitting snugly in a hole **32** in the follower bar and projecting outwardly from the leading side thereof into a recess or hole whose defining edges constitute the other device **28** on the mounting flange **24**. The holes **28** in the carrier **15** aline with the holes **32** in the bar in the assembled relation of the two, the holes extending all the way across the bar in this instance.

By employing two pins spaced along the follower bars, the carrier **15** for each abrasive stick is located securely to its supporting follower and held positively against radial tilting. In addition, the pins **29** are utilized to perform the additional function of transmitting directly to the hone body the end thrust exerted on the working faces of the abrasive sticks during engagement of the latter with the work to be honed. This is accomplished by fitting each pin **29** snugly on the follower bar **16** and making the pin long enough to project its opposite ends beyond opposite sides of the bar and into peripheral grooves **35** cut in the exterior of the hone body **10** and disposed in the axial planes in which the carrier holes **28** and the pins **29** are disposed when the carriers are attached to their follower bars **16** and the latter are seated in the body slots **12** between the ends **23** of these slots. The grooves **30** are only slightly wider than the diameter of the pins **29** but are deep enough to accommodate the full range of radial adjustment of the carriers **15** incident to wearing away of the abrasive sticks in service use.

By virtue of its **Z** shape, the carrier **15** may be formed easily and inexpensively by simple stamping operations in which the backing flange is bent up and the mounting flange is bent down from an integral flat sheet after the cuts for the lugs **31** and the hole **28** have been made. A material found to be especially suited for such operations and capable of wearing away with the abrasive stick without loading the working face **19** is so-called "half-hard" aluminum sheeting having a thickness of approximately .025 of an inch. Another material found to be satisfactory for the carrier is a thermosetting phenolic type resin material such as Insurok T640 made by the Richardson Company.

To install the improved honing element **13** in the hone body **10**, the follower bar **16** is assembled on the element by seating the bar in the recess between the crosspiece **27** and the mounting flange **24** and projecting the pins **29** through the alined holes **28** and **32** in the carrier and follower bar leaving opposite ends of the pins projecting substantially equal distances from opposite sides of the assembly as shown in FIG. 2. Then, each assembly is pressed edgewise into a slot **12** of the body, the projecting ends of the pins **29** entering the grooves **35**. After similar assemblies have been inserted in all of the body slots with their followers **16** seated against the cams **18**, the garter springs **21** are shifted over the follower projections **22** thus completing the assembly of the tool.

This application is a continuation-in-part of my copending application Ser. No. 689,890, filed October 14, 1957, now abandoned.

I claim as my invention:

1. A honing element having, in combination, a carrier comprising a sheet of material of Z-shaped cross-section having a backing flange and a second flange paralleling each other and projecting in opposite directions from opposite sides of an intermediate crosspiece, said crosspiece and said second flange cooperating to define a bottom recess for receiving a supporting bar, means formed on said second flange for fastening the same detachably to the supporting bar, a lug upstanding from said carrier at the junction of said second flange and crosspiece and paralleling said backing flange so as to cooperate with the latter and the crosspiece in defining a channel-like seat, and a rigid generally rectangular abrasive member including a stick of bonded abrasive and secured in said seat with the bottom supported by said crosspiece and one side face lying against said backing flange, the opposite side face of said member being exposed and located in a plane which parallels and is disposed between said backing flange and said lug whereby the latter acts as a spacer for maintaining said exposed face out of contact with a flat guide wall lying against said second flange.

2. In a honing tool, the combination of, a rotary body having a radially opening slot defined by parallel walls, an elongated carrier of Z-shaped cross-section having a backing flange and a second flange paralleling each other and projecting in opposite directions from opposite side edges of an intermediate crosspiece normal to said flanges, said backing flange and said crosspiece defining a seat, a rigid generally rectangular abrasive member including a stick of bonded abrasive and secured in said seat with the bottom supported by said crosspiece and one side face lying against said backing flange, the opposite side face of the member being exposed, a radially movable mounting bar in said slot underlying said crosspiece and lying against said second flange to support said carrier and sustain the radial pressure on the radially exposed working face of said abrasive stick, means detachably securing said second flange to said bar, said abrasive member being narrower than said crosspiece so as to dispose the exposed side face of the member within the plane of the outer face of said second flange and thereby prevent rubbing contact between said exposed face of the member and the wall of said slot engaged by said second flange.

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