This invention consists of a fixture used in conjunction with modern tool grinding machines making it possible to quickly and accurately grind and regrind the cutting tips of gun drills, gun bores, reamers, etc. This fixture can accomplish the grinding of various point angles, clearance angles, offsets, radii, cylindrical relief, and back slash; also rework of gun drill cutting faces, and clearance slash reliefs, with only one insertion of the tool into the fixture. The invention consists of a rectangular bar to which a front head and a rear head are attached. The front head mounts and clamps in the tool holder of the machine to be used, initially positions the tool to be ground and then supports the front end or tip of the tool during the grinding operation. The rear head is designed to hold and clamp the rear end or shank of the tool to be ground against any forward or backward movement but at the same time allows the tool to be cylindrically rotated and indexed to various positions during the grinding operation.

1 Claim, 4 Drawing Figures
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GUN DRILL AND BORE GRINDING FIXTURE

This invention relates generally to fixtures used in conjunction with tool grinding machines for the purpose of grinding such cutting tools as gun drills, gun bores, reamers, etc., and particularly to a fixture which allows the grinding of all cutting angles, primary and secondary relief angles, and offsets, with only one tool insertion into the fixture.

At the present time there are machines and fixtures available for grinding these tools. However, in order to accomplish this, many different set-ups are required. The tool which is being ground has to be relocated within the fixture for each different set-up. This is a much time consuming operation, making such grinding costly. Also, with methods used prior to this invention, it was not possible to grind a radius into the tip design of the tool.

Therefore the primary object of this invention is to provide a tool grinding fixture into which the tool can be inserted and held securely to perform all the necessary grinding such as point angles, primary and secondary clearance angles, offsets with or without radii, and backlash and cylindrical reliefs, without the necessity of removing the cutting tool from within the fixture.

The many advantages in the use of this invention can be listed as follows:

a. One tool insertion and grinding set-up eliminates as many as seven separate set-ups, thereby reducing the grinding time to one quarter of the time required by present conventional methods.

b. The accuracy and microscopically perfect finish which is a result of this method, increases the life span of the tool, thereby reducing the cost of tools, the cost of grinding, and tool change time.

c. Reduction in the number of scrap production parts.

d. Elimination of expensive precision grinding machines and numerous fixtures.

e. Easy operation.

In describing the invention reference will be made to the attached drawings in which:

FIG. 1 is a plan view of the invention.
FIG. 2 is an elevation of the invention in section.
FIG. 3 shows the invention located upon a grinding machine.
FIG. 4 shows an enlarged diagram of one style of gun bore cutting end or tip.

The invention consists of a rectangular bar 1 which is used as a connecting beam, one end has a recessed set screw hole to which a rear head body 19 which has a line-up groove 23 is positioned and securely attached to by means of set screw 17. The other end of said bar has a long recessed slot 22 to which a front head 2 is also positioned by means of its line-up groove and is secured by set screw 20. The front head 2 can be secured anywhere along the slot 22 depending upon the length of the tool to be ground. If longer length adjustment is needed, rectangular bar 1 can be interchanged for a longer one of same design.

The front head 2 of the fixture is externally shaped to readily fit the tool carriage A of the grinding machine upon which it is to be used. The head 2 is provided with a drill bushing 3 to hold the forward head of the drill to be ground. Because all drills do not have the same exterior shape or size, the bushing 3 is interchangeable on its interior to fit the various drills used in a particular establishment. However, its exterior is kept the same in order to fit its cavity in head 2, wherein it is held by locking screw 21. The head 2 is also provided at its front end with a centrally located setting finger 4.

The finger 4 rotates upon a dowel 5 and is held in place by a cover 6 which is fastened to head 2 by set screw 7. This finger is used to initially position the cutting edge of the tool to proper center line for grinding.

The rear head 8 of the fixture is designed to hold and lock securely the rear end or shank 24 of the tool B, and to cylindrically revolve and index the tool in various positions. The outer body 19 of the rear head 8 is bored to take a press fitted and axial bushing 13; a sleeve 11 is free to revolve inside said bushing and is held in place in the said rear body by thrust bushing 9 and threaded locking rings 15 and 16.

An interchangeable tool shank adapter 10 is securely held in sleeve 11 by means of a locking screw 18. An indexing cam 12 which can be interchanged, is fastened to the outside of sleeve 11 by three set screws 25, and a spring loaded rocker 14 is mounted on the body 19 and rides upon and into the grooves of the indexing cam 12.

All the above mentioned parts are hardened and ground to a high degree of accuracy.

In order to describe the operation of the invention, a typical gun bore, the cutting end of which is shown in FIG. 4, is used by way of example. This particular gun bore is a standard ¼ inch single flute, 14 inches long gun bore having cutting angles $e = 40^\circ$ and $f = 20^\circ$; an offset $k = 0.063$ inch; a point radius $r = 0.005$ inch; back slash angle and relief $g = 45^\circ$; and cutting edge clearances of $15^\circ$ primary and $25^\circ$ secondary.

The above described fixture is adjusted for length to fit the length of the gun bore by loosening set screw 20, and sliding beam 1 forward or back in alignment slot of front head 2; the screw 20 is then securely tightened.

Insert ¼ inch bushing 3 into front bore of head 2 and secure in place with set screw 21. The fixture is then properly positioned into tool holder carriage A of the machine to be used. The machine used in this example is a De Vlieg micropoint grinder equipped with a 320 grit diamond wheel. Adjust the grinding machine as per the normal adjusting instructions, i.e., right and left angle protractor stops to 20° and 40°; roll setting 0; left offset 0.065; radius setting 0.002; upper cylindrical clearance setting 0; lower conical clearance setting 15° wheel traverse setting three-fourth; then position wheel head and start grinder.

Select the proper shank to fixture adapter 10 and fasten it to the shank of the bore by means of the set screw in the adapter. Position cam 12 and rocker 14 on rear head 8 into main position and hold groove. Insert gun bore through hole in sleeve 11 and continue through front head 2 and bushing 3, far enough to clear fixture during grinding.

Swivel locating finger 4 to the gun bore point edge and after positioning gun bore in proper grinding position, securely lock adapter 10 into rear head 8 with locking screw 18, then swing locating finger 4 out of the way.

Using the controls on the Micropoint machine in the prescribed manner, feed and grind the 15° clearance angle on the front 20° and 40° cutting angles, offset, and radius. Move the lower conical protractor to the
25° clearance angle, swing tool carriage A to 40° angle, and secondary clearance is ground. Rotate bore by means of the rear head revolving unit between the appropriate stop and location grooves on index cam 12, and the cylindrical relief is ground. Swing carriage A to 20° angle stop, and again rotating rear head unit between the appropriate cam stop grooves, and the back slash angle and relief are ground.

The grinding operation is now finished and the tool carriage A is backed off from the grinding wheel. The locking screw 18 is loosened and the bore with the adapter 10 attached thereto is removed from the fixture. Then the said adapter is removed from the finished gun bore.

An actual time study of the above regrinding operation by an experienced grinding operator, showed it to have taken place in slightly under one minute. During the grinding operation, an oil mist coolant was used; 0.05 inch carbide was removed; and at no time has there been any heat build up dangerous to the carbide.

Having described my invention what I claim is:

1. A fixture for use in conjunction with grinding machines for grinding gun drills, gun bores, reamers and other similar tools comprising in combination a rectangular bar, the front end of which is provided with a recessed elongated slot, and the rear end of which is provided with a recessed set screw hole; a front head, the external shape of which fits into the holder of the grinding machine, and the underside of which is provided with a line up groove for slidably adjusting for the length of the tool to be held therein and securing the said head to the slot in the said rectangular bar; an interchangeable drill bushing of various internal diameters which is inserted into the forward end of the front head and held therein by means of a set screw, for the purpose of holding the front end of the drill therein; a finger, swivably attached to the front head, located above the drill bushing and extending slightly beyond it, for initially positioning the tool to the proper center line for grinding; a rear head which is attached to the rear end of said rectangular bar by means of a set screw passing through said recessed set screw hole, said rear head being able to contain the Shank of the tool to be ground, to hold the tool fixed against forward or backward movement, and to allow cylindrical and indexed rotation of said tool; all by means of a bushing located within the body of said rear head; a sleeve which is fitted inside said bushing, which is free to rotate therein, and which is held within said bushing by a thrust washer and locking rings; an interchangeable cam which is indexed with grooves which is attached to the outside of said sleeve by a plurality of set screws; a spring loaded locating rocker mounted on top of the rear head body which engages the various indexing grooves of said cam; a tool shank adapter to fit individual tool shanks, attached to the end of said tool shank, and a main locking screw for clamping the tool and its adapter after insertion into said sleeve of the fixture.

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