F. Machining Valve Seats in Cylinder Head

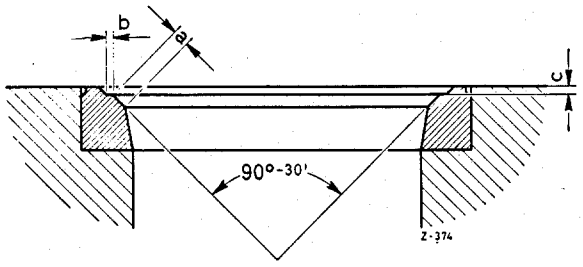

Fig. 01 — 5/12

Valve seat backed off with portable milling cutter

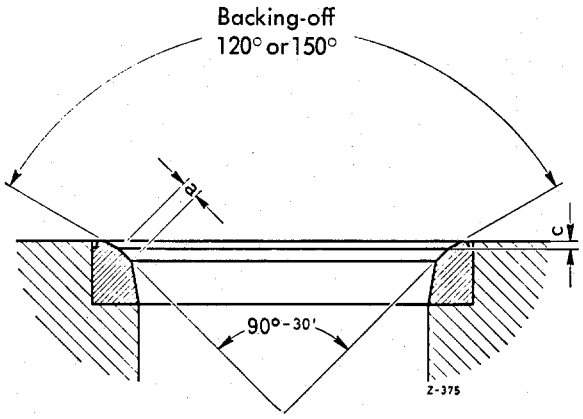

Fig. 01 — 5/13

Valve seat backed off with 120° or 150° backing-off cutter

a = Valve seat width
b = Backing-off with a portable milling cutter
c = Permissible milling depth for the backing-off

Machining of the valve seat can be carried out with the following tools:

a) with a valve seat turning tool,
b) with a backing-off cutter or
c) with a valve seat grinder.

In order to ensure that the valve seats perfectly, the valve seat should be backed-off so that the width of the seat "a" is from 1.25 to 1.75 mm. The backed-off section "b" must either be at least 0.1 mm in width or must be made at an angle of 120° or 150°.

The upper and lower edges of the valve seat on the valve must under no circumstances bear on the valve seat ring as the edges would bite into the seating, the valve would cease to form a perfect seal and would tend to burn out.

After the valve seats have been re-machined several times, they must be examined to ensure that they have not reached a level more than 1 mm lower than a new valve seat in the case of the inlet valve and 1.3 mm in the case of the exhaust valve.

The following table indicates the extent to which a valve seat can be re-machined. These measurements must be strictly adhered to and if this is not possible, a new valve seat ring must be installed (see Job No. 01 — 5, Section E).

Furthermore, care must be taken to ensure that the amount by which the cylinder head has already been re-machined (see Job No.

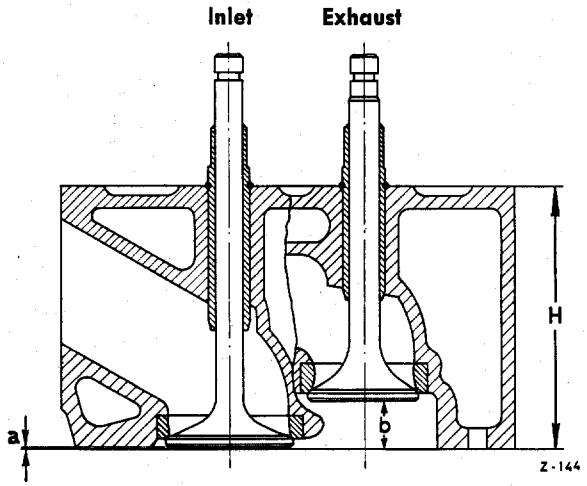

Fig. 01 — 5/14

	New valve seats		Re-machined valve seats	
	a	b	a	b
New valves	0.8	16	1.8	17.3
Re-ground valves	1.5	16.7	2.5	18

01 — 5, Section C) is subtracted from the specified dimensions before any further work is done.

Before the valve seats are re-machined, the valve guides must first be examined and if necessary, replaced (see Job No. 01 — 5, Section D) and at the same time the valve seats must be examined in order to ascertain whether they have not already been re-machined too much and whether the valve seat rings must be replaced.

The best way of checking this is to use a new valve.

A dial gage is used to test the concentricity and out-of-round of the valve seats. The maximum permissible run-out is 0.05 mm (Fig. 01 — 5/15).

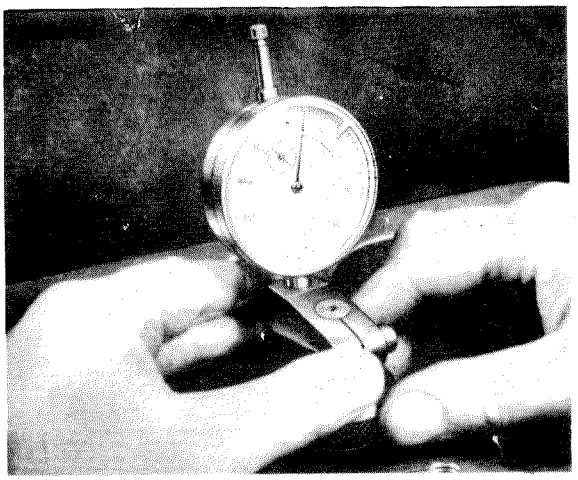

Fig. 01 — 5/15

The special tools required for this job are:

Dial Gage Holder	187 589 04 21
Testing Sleeve for Inlet Valve	187 589 02 21
with Testing Plug	187 589 05 21
Testing Sleeve for Exhaust Valve	187 589 03 21
with Testing Plug	187 589 06 21

The mating between valve and valve seat should be tested with blue dye. This test is made by turning the valve alternately one fifth to one sixth of a turn to the left and the same to the right.

In all cases, after the valve seats have been re-machined, a leakage test of the valves must be carried out, using gasoline.

The following paragraphs describe the methods of using the various tools:

a) **Machining the valve seat with Valve Seat Turning Tool 000 589 00 69.**

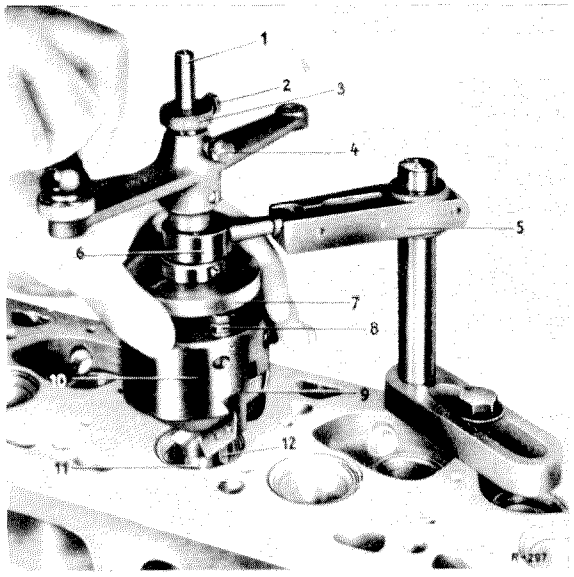

Fig. 01 — 5/16

1 Contact mandrel
2 Locking screw
3 Knurled nut for cut control
4 Locking screw
5 Holding stand
6 Holding stand bearing
7 Feed control
8 Rapid adjustment
9 Carriage
10 Head with built-in gearing
11 Pilot with collet
12 Cutter

The turning tool is centered with the aid of a combined pilot (11) and bearing on which it is supported and it is held in position by means of a holding stand (5).

If the feed control (7) is held steady and the handle is turned, the carriage (9) moves from the inside to the outside with the cutter (12), describing a spiral path.

When the rapid adjustment (8) is turned, the carriage (9) returns to its original position.

After the cutter has been moved back, care must be taken to ensure that the lower nut of the rapid adjustment is tightened up again since otherwise the automatic feed control will be inoperative.

The cut control (determining the cutting depth) is operated by turning the knurled nut (3).

One graduation on the scale = 0.1 mm.

1. Place the pilot with the collet (11) in the bore of the valve guide and fix it in position.

2. Screw the cutter (12) onto the carriage (9) by means of the carriage screw.

3. Release the lower nut of the rapid adjustment (8), slide the turning tool over the guide bolt and, by turning the upper nut, move the rapid adjustment so that the cutter is located at the middle of the valve seat. Do not allow the tool to drop.

4. Now press the contact mandrel (1) for the pilot (11) downward and lock it by means of the screw (2). When this is done, the knurled nut (3) must be screwed downward and the locking screw (4) tightened.

5. Set up the holding stand (5) so that its bearing end is centrally located. When this is done, the ball at the bearing of the holding stand must be free all the way round and the distance between the holding stand bearing (6) and the handle must be approximately 5 mm.

6. By turning the upper nut on the rapid adjustment, move the cutter to a position near the inner edge of the seat and then tighten the lower nut. **Do not advance the cut control mechanism yet.** Hold the feed control (7) steady and turn the handle. When this is done, the cut is usually irregular.

   After completing the cut, release the lock nut of the rapid adjustment and once more move the cutter inward.

7. Release the locking screw (4) and turn the knurled nut (3) approx. ½ to 2 graduations (1 graduation = 0.1 mm) to the left. Lock the locking screw (4) and immobilize the rapid adjustment once more and make a further cut.

8. The cut control must be advanced and a cut made often enough for the seat to be clean-cut, after which a further turn should be given without advancing the cut control (a "clearing cut").

9. The backing-off of the valve seat can also be done with this turning tool since the tool has a second carriage which sets its cutter to an angle of 120°.

   When backing off at 120° or 150°, the peened surfaces of the valve seat ring must under no circumstances be turned off.

   It is therefore recommended that the backing-off be made at an angle of 90° in accordance with Fig. 01 — 5/12.

b) **Machining the valve seat with a backing-off cutter.**

Special tools:

Cutting Arbor for	
Inlet	636 589 06 31
Exhaust	187 589 02 31
Handle for	
Cutting Arbor	187 589 06 31
Valve Seat Milling Cutter for	
Inlet	187 589 01 51
Exhaust	187 589 04 51
Portable Milling Cutter for	
Inlet	121 589 00 51
Exhaust	121 589 01 51

1. If the valve seat is insufficiently backed-off or is not backed-off at all, this must now be done. The backing-off "b" must be at least

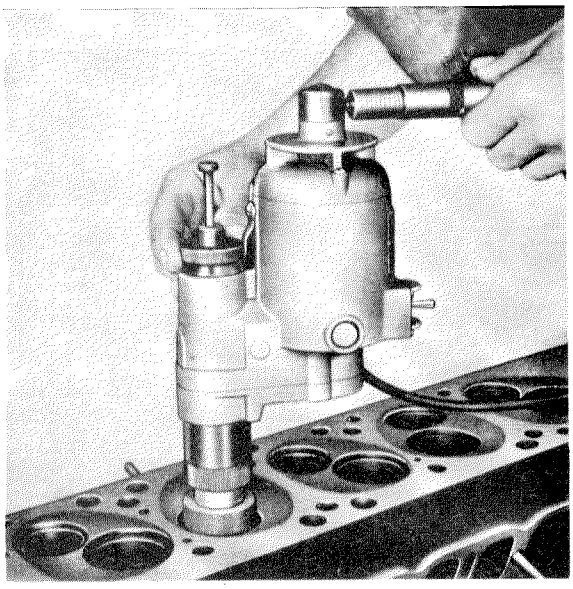

Fig. 01 — 5/17

0.1 mm in width or should be made at an angle of 120° or 150° (see Figs. 01 — 5/12 and 01 — 5/13).

2. After the seat has been backed-off, it should be rough-milled and finish-milled or alternatively, surface-ground. Surface-grinding should only be done with a very slight central pressure on the milling spindle.

c) **Machining of the valve seat with an eccentric valve seat grinder** (Fig. 01 — 5/17).

1. Set the grinding head on the angle grinder to an angle of exactly 90° — 30'.

2. Rough-grind the valve-seat and then finish-grind.