This invention relates primarily to the grinding of the ends of valve stems to obtain proper length and clearance thereof preparatory to mounting in an engine cylinder block, so that when the valves are properly seated in the blocks their stems will have the proper clearance relation to the operating tappets or rods of the engine. In the gauging and grinding of valve stems for a set of valves to make each valve stem of proper length and clearance, which usually differs from the several valves of a set, it has heretofore been the practice, so far as I am aware, to first gauge and grind one valve stem and then another and necessitating a separate setting of the grinding machine for each valve stem.

One of the objects of the present invention is the provision of certain improvements in the grinding machines for such valve stems, whereby after the several valve stems of a set have been first gauged as to proper length and clearance and such information noted as to each valve, the grinding machine, by the use of a length determining gauge, may then be initially set to suit the noted reading for the first valve to be ground and thereafter be quickly secondarily adjusted to suit the length requirement for each successive valve of the set without further use of the length gauge and without necessitating repeated trips between the engine block and the grinding machine and entirely separate adjustments for each valve, thus saving labor, time and expense in the operation.

A further object of the invention is the provision in a valve stem grinding machine of a mounting means for the valve stems that is capable of movement to rotate about its axis during a grinding operation.

A further object of the invention is the provision of simple and efficient means for rotating the valve stem during a grinding operation.

A further object is the provision in a machine of the class described of means for angularly adjusting the valve stem support relative to the grinding member to permit grinding a stem end in right angular relation to the stem axis or at a predetermined inclination to such right angular position to produce a centered protuberance or crown on the stem end.

Further objects and advantages of the invention will be apparent from the following detailed description and from the accompanying drawings, in which—

Figure 1 is a plan view of a valve grinding machine embodying the invention, with a valve mounted therein and disposed in grinding relation to the grinding wheel to grind the stem end in right angular relation to its axis; Fig. 2 is a side elevation of the machine, with parts broken away to show the manner of mounting of a valve and its stem therein and the feeding means therefor; Fig. 3 is an enlarged cross-section on the line 3—3 in Fig. 1; Fig. 4 is an enlarged fragmentary section on the line 4—4 in Fig. 1; Fig. 5 is an enlarged sectional detail of the valve stem mounting means with such means adjusted to place the axis of the valve stem slightly out of true right angular relation to the grinding wheel face to permit the grinding of a crown on the stem end; Fig. 6 is an enlarged detail of the grinding coaction of a stem end and grinding wheel; Fig. 7 is an enlarged section on the line 6—6 in Fig. 1; Fig. 8 is a fragmentary end view of the machine similar to Fig. 2, with a mechanical rotating means applied to the valve stem mounting; Fig. 9 is a fragmentary plan view of the machine shown in Fig. 8, with parts broken away, illustrating the application of the valve stem mounting driving means; Figs. 10 and 11 are fragmentary sections on the lines 10—10 and 11—11, respectively, in Fig. 9; Fig. 12 is a side elevation of a valve length gauge adapted for use in connection with the machine and illustrating the gauging position in a cylinder block, and Fig. 13 is a somewhat diagrammatical illustration of the index portion of the length gauge to illustrate its action.

Referring to the drawings, I designates the main frame of a valve grinding machine embodying the invention on the top of which, at one end thereof and at its rear portion in the present instance, is mounted a motor 2 and in advance of this a bearing frame 3 having a grinding wheel carrying shaft 4 mounted therein lengthwise of the frame or substantially in parallel relation to the front and rear sides of the frame. The shaft 4 carries at its outermost end a pulley 5 by which it is connected through a belt 6 to a pulley 7 on the motor shaft and carries at its inner or opposite end a grinding wheel 8 which, in the present instance, is disposed near the central portion of the frame 1.

A table 19 is mounted for forward and rearward sliding horizontal adjustment on the top of the frame 1 at the end thereof opposite to that on which the motor 2 and grinding wheel are mounted, and carries a head 11 disposed at a side of the grinding wheel 8 and positioned with the axis of its chuck 12 (Fig. 9) disposed at an oblique angle to the grinding wheel axis, as well understood in the art. The chuck 12 is carried within a sleeve 13 which is rotatably mounted in the head 11 and carries at its rear end a pulley 14 that is connected by a belt 15 to a drive pulley 16. The pulley 16 is connected by a flexible shaft 17 which is connected to and driven by a pulley 18 connected by a belt 19 to a small pulley 20 on the motor shaft. The chuck head 11 is mounted for axial adjusting movements on the table 19. This adjustment, however, has nothing to do with the present invention and...
need not, therefore, be described. When a valve is having its seating surface ground, its stem is engaged within the chuck 12.

Adjustment is imparted to the table 10 by turning the hand wheel 21 engaged with the rack 22. This shaft is rotatably mounted in a flange 23 at the front end of the table in a manner to prevent axial movements of the screw shaft therein and has its rear end threaded through a bushing 24 fixedly mounted in the frame. For the purpose of a rotatably mounted bracket plate 28 is mounted on the forward end of the table 10 transversely thereof and has one end projecting beyond the inner edge portion of the table and provided with a valve carrying head 29 in advance of the circumferential grinding face of the grinding wheel 8. The head 29, in the present instance, is mounted for forward and rearward adjustment on the plate 28, being secured in adjusted position by a clamping screw 30 (Fig. 2) extended through the plate 28 and threads into said head. A valve head carrying sleeve 31 is rotatably mounted in the upper end of the head 29 with its axis substantially aligned with a radius of the grinding wheel 8 and its inner end spaced outwardly a distance from the periphery of such wheel, as best shown in Fig. 2. In the present instance, the outer end of the sleeve 31 is enlarged and shouldered against the head 29 and its inner end extends beyond such head and has a collar 32 secured thereon and in yielding and thrust engagement with the adjacent end of the head through an interposed spring washer 32a which permits limited outward yielding movements of the sleeve relative to the head 29. The outer enlarged end of the sleeve 31 is provided with a conical counterbore 33 extending to the form of the sleeve and being complementary to and adapted to form a seat for a valve head 34, the stem b of which is projected inwardly through the sleeve. The sleeve bore is of greater diameter than the valve stem so that the only point of contact of the sleeve with the valve is through the head of the valve seated in the conical sleeve end. The means illustrated for clamping a valve to the sleeve 31 includes, as best shown in Fig. 5, a gate member 34 engaging the outer enlarged end of the sleeve 31 hinged at one end to a plate 35 and having its other end releasable held to the sleeve by a hand screw 35. A clamping screw 35a is threaded centrally through the member 34 and is adapted to coat at its inner end with the valve head a to hold it to its seat. The screw 35a has its outer end bent in crank form to facilitate a turning thereof and also of the sleeve 31 and engaged valve when the valve is clamped therein.

The free end portion of the valve stem b projects beyond the inner end of the sleeve 31 and is supported in axially aligned relation to the sleeve by a member, in the present instance, in the nature of a disc (see Fig. 3), having a plurality of stem seating recesses 37 in spaced relation around its periphery and adapted to be moved into valve stem supporting relation when a turn of the disc. Valves of stems vary in diameter, but customarily are \( \frac{1}{4}, \frac{1}{2}, \frac{3}{4}, \frac{5}{8}, \frac{7}{8} \) or \( \frac{1}{2} \) inch in diameter, and the disc 38 is, therefore, preferably provided with five circular valve stem receiving recesses, having different diameters suited to such dimensions. The valve head having a stem of one of the prescribed sizes to be firmly seated in a disc recess which has been positioned in valve stem supporting relation. The disc 38 is rotatably mounted on a stub shaft 39 projecting from a bracket 33 rising from the inner portion of the plate 28. The disc is held in any adjusted position by engagement of a retainer 40 with a registering opening 41 in the disc. The pin 40 is mounted in the bracket 33. When a valve stem is held seated in a recess of the support 36, it is held therein by a lever 42 which is fulcrumed to the bearing bracket 39 at 43 and has one arm engagement of a retainer 40 on the valve stem, and its other arm serving as a handle. The collet contractile spring 44 engages the lever and normally retains it in holding engagement with the valve stem.

It is apparent from the foregoing that when a valve and its stem are properly mounted in the sleeve 31 and on the support 36, the valve is firmly held to its seat in the sleeve 31 coaxially therewith by the clamping screw 35a and when so clamped is permitted to have limited outward axial movements with the sleeve due to the interposing of the spring spacing member 32a between the sleeve collar 32 and the head 29. When the valve has been thus positioned in the holding means, its stem may be disposed in true radial relation to the grinding wheel or in slightly angled position shown in the relative positions whether or not it is desired to grind the stem end in flat or crowned form. A stem when mounted in the holding means may be moved into or out of engagement with the grinding surface of the grinding wheel by a turning of the hand wheel 21 which effects an adjustment of the table 10, and should the pressure of the stem end against the grinding wheel during such an adjustment be too heavy, the spring 32a will yield to permit an outward movement of the stem and its mounting means relative to the grinding wheel. When the valve stem end is to be ground to form a right angular bearing face, the valve stem is positioned with its axis in true radial relation to the grinding wheel, so that the wheel periphery has substantially a line contact with the stem end entirely across the latter axially of the wheel, and when the stem is thus engaged with the wheel a uniform grinding of its end is effected by a turning of the stem about its axis relative to the wheel. This turning may be effected by a supporting ring and turning the outer end of the sleeve 31.

To permit an angular adjustment of the valve stem relative to the grinding wheel and in a plane substantially parallel to the grinding wheel axis, so as to place the end surface of the stem at an acute angle to the circumferential face of the grinding wheel and thus effect what may be termed a "crown" grinding of the stem end, the bracket plate 28 is mounted for limited horizontal rocking movement on the table 10. To accomplish this, the plate 28 has a pivot pin 50 projecting into a transversely disposed sur-

face groove 51 in the table 10 and the plate is provided in outwardly spaced relation to such pin with a revolving eccentric stud 52, which, in the present instance, is engageable in an extended end portion of the groove 51. The stud 52 is provided at the end of the stem 51 mounted in a vertical opening in said plate, being held therein, and also being locked in adjusted position, by a screw 54 engaging a circumferential recess in the shaft. The plate 28 is clamped in adjusted position to the table 10 by thumb screws 55, the stem portions of which extend through enlarged openings 56 in the plate.
and thread into the table. The openings 58 are of a size suitable to permit any desired lateral adjustment of the plate 28 when the clamping screws are loosened. A swinging adjustment of the plate 28 about its pivot 59 effects an angular slipping of the short axis of a valve carried by the plate relative to a radial line of the grinding wheel, so that the circumferential grinding face of the wheel, presuming it to be parallel to the wheel axis, will stand at a slight angle to a diametrical end plane of the stem, thus causing the lower end to be ground 59 substantially conical or crown form when the valve is rotated about its axis for such purpose. The portion of the valve stem end which is engaged by the grinding wheel during the grinding action is preferably less than the length of a radial line of such end, so that the ground end of the stem when finished will be of substantially truncated form, as illustrated by Fig. 6.

The purpose and importance of effecting a crown end grinding of a valve stem forms no part of the present invention and need not, therefore, be described. This feature is covered by a companion application.

A power drive for the valve carrying sleeve 31 is illustrated in Figs. 5 and 9 and may be substituted for the hand drive accomplished through gearing the outer end of the sleeve 31 and turning it in the head 29. The collar 32 on the inner end of the sleeve 31 is replaced by a spiral gear 62 that may be threaded on the sleeve and which is engaged by a drive pinion 63, the shaft 64 of which is journaled in a bearing plate 65 secured to the top of the bearing head 29. The axis of the shaft 64 is parallel to the axis of the chuck 12 and carries a pulley 66 which is connected by a belt 67 to a pulley 68 fixedly mounted on the end of a stem 69 adapted to be engaged within the chuck 12. It is thus apparent that the drive for the valve holding sleeve 31 is connected to the chuck 12 and through it with the drive means therefrom.

It is apparent that when a valve is properly mounted in the holding means of the plate 28 and the valve is rotated, either manually or mechanically, the valve stem b turns with the sleeve 31, which constitutes the driving element therefor, and on the support 35, and that the lever 42 merely acts to hold the valve stem to its seat on said support and not to prevent it from turning.

To facilitate the successive grinding of all of the valves of a set for which the proper length measurements have been obtained, as hereinafter described, and to obviate the initial adjustment of the machine for each valve, thus simplifying and minimizing the grinding expense for a valve set, the screw adjusting means 21, 22, for the table 10 is provided with a secondary adjusting feature, the purpose of which will later be more fully described. This secondary adjusting feature comprises, in the present instance, a slip adjustment for the fractional turning movements on the feed wheel 21, and is provided on its periphery with graduations corresponding to those on the dial of a length measuring gauge, as hereinafter described, which graduations are such as to register the feeding movements of the wheel 21 in thousandths of an inch. These graduations register with a fixed pointer the pertinent portion of the table 10, as indicated at 71 in Fig. 1.

In practice, it is customary to provide a clearance of approximately .013 of an inch between the end of the valve stem and the associated tappet rod when the valve head is properly seated and the tappet rod is fully retracted. To determine the length of a valve stem for any particular valve seat, a length gauge G, such as in Fig. 12, is employed, and any gauge suitable for the purpose may be used. The gauge illustrated comprises a head 80 carrying a gauge index unit 81 with its revolveingly and index finger 82 connected through suitable intermediate gearing with a rack bar 83. The upward movement of the rack bar is resisted by a spring 84, as shown in Fig. 13. The head 80 is provided at its lower end with a stop shoulder 85 having a surface complemental to and adapted to bear against the associated valve seat of a cylinder block in the manner of a valve. A gauge rod 86 is reciprocably mounted in an opening provided centrally through the lower neck portion of the head and bears at its upper end 87 against the lower end of the rack bar 83. The rod 86 is slightly greater in length than the distance between the race bar 88, when seated and extended, and the associated tappet 87 when the shoulder 85 is on the valve seat, so that by forcing the shoulder down onto said seat, with the rod 86 seated on the tappet, the rack bar 83 will be caused to move upward and effect a gauge index shift, the index finger 82 then engaging the dial face, as shown in Fig. 12, where the indicated reading is "12," meaning .012 of an inch, the graduations being in thousandths. The valve for the gauged seat is then marked "12," or a suitable notation to that effect made in a manner to be identified with the particular valve seat, before any of the valves are ground.

In the use of the machine in connection with the grinding of valve stems to proper length, the gauge G is first placed in a valve seat opening to measure the distance between the valve seat and tappet and to indicate on its dial a fraction of such distance in thousandths of an inch. The reading on the gauge shown in Fig. 12 is "12." This reading is marked on the valve for the valve opening measured, or is otherwise suitably noted in identifying relation to the valve, and the measuring of the remaining valve openings of the cylinder block and the noting of the gauge readings for the respective valves and openings is then effected in the same manner, preferably before starting the grinding of the valve. The valves are then taken to the grinding machine and the initial setting of the machine for all of the valves of the set is determined by the gauge reading noted with respect to the first valve to be ground. To effect the proper initial adjustment, the gauge is applied to the machine by inserting the gauge rod 86 through the valve holding sleeve 31 until the gauge shoulder 85 seats against the conical seating surface 33 of the sleeve in the same manner that a valve head seats thereagainst. The feed wheel 21 is then turned to move the table 10 and parts carried thereby rearward until the end of the gauge rod 86 engages the rear periphery of the feed wheel 8. When such engagement takes place, the feeding movement is continued until the gauge rod 86 has been moved outward, during a continued seating of the shoulder 85 against
the sleeve, a sufficient distance to actuate the
gauge of the measuring instrument to indicate a
reading of .012 of an inch. The slip gauge ring
5
the sleeve thereto, to place the ring graduation which
indicates "012," in register with the associated sta-
tionary index mark on the machine. This con-
stitutes the initial setting of the machine for the
entire set of valves. The gauge is now removed
10
and the valve, identified by the "12" notation, is
properly mounted in the sleeve 31 and on the
support 38, as best indicated in Fig. 2, with its
head in stop engagement with the sleeve face
33, and the outer end of the stem is then ground
to the extent permitted by the gauge setting of
the machine. If the desired clearance is .013
15
meaning thirteen thousandths of an inch, the
feed wheel, together with the gauge ring 70 fric-
tionally engaged therewith, is turned during the
grinding until the graduation mark "25" (12 plus
15) on the gauge ring has been turned into regis-
20
ter with the stationary index point 71, thus
further reducing the length of the valve stem
the extent of the desired clearance. If the mark-
ing for the next valve to be ground is say "15,"
the feed wheel 21 is turned to place the gauge
25
marking ring on the gauge ring into register with
the stationary mark "71," and, as the grinding
of the valve continues, the feed wheel is slowly
turned to add the desired .013 clearance, which
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in this case would be determined when the feed
wheel had been turned to place the "20" gradu-
aton mark in register with the index point. It is
apparent that the grinding of a number of valves
35
may be accomplished by only one use of the gauge
G in connection with the grinding machine to ob-
tain an initial setting thereof, after which the
machine may be adjusted in accordance with
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the readings noted in connection with different
valves without again placing the gauge in the
machine, and that considerable time and labor
required in the grinding of valve stems to the
desired length for the engine in which they are
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used is saved.

During a stem end grinding operation, the
valve may be rotated about its stem axis by a
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manual turning of the carrying sleeve 31 or me-
chanically by connecting such sleeve with a power
source, as shown in Figs. 8 and 9. Also, that the
machine means for the valve may be adjusted
to dispose the valve stem axis in true radial rela-
tion to the grinding wheel to effect a flat grind-
ing of the stem end or that it may be adjusted
50
so as to effect a grinding of its stem end in a
plane which is at right angles with the grinding
face of the wheel, whereby to cause a crowned
grinding of the stem end when the stem is ro-
tated during the grinding action. It is also ap-
55
parent that the spring washer member 32a acts
to normally retain the valve holding sleeve 31
at the limit of its inward movement and is adapt-
ed to permit limited outward movement of
the sleeve and valve in the event a valve stem, dur-
ing an adjusting movement, is brought against
60
the grinding wheel with too great a pressure.

We wish it understood that our invention is not
limited to any specific construction, arrangement
of the parts, as it is capable of numerous modifi-
cations and changes without departing from
65
the spirit of the claims.

Having thus described our invention, what
we claim as new, and desire to secure by United
States Letters Patent is:
1. In a valve grinding machine, means for hold-
70
ing a valve during an end grinding of its stem,
said means comprising a mount, a sleeve rotat-
ably carried by the mount and forming a seat
at one end for the valve head and adapted to
have the feed wheel 21, relative thereto, and
75
a support for the end of the valve opposed
to its head to hold the stem in coaxial relation
to the sleeve, said support having a plurality of
seats therein for valve stems of different diam-
eters and adjustable to place any seat in stem
supporting position.

2. In a valve grinding machine, means for
holding a valve during an end grinding of its
79
stem comprising a reciprocable movable table,
a bracket plate carried by said table for pivotal
adjustment relative thereto, a sleeve rotatably
10
carried by said plate for rotation about its axis
and having a valve head seat, means for yeld-
ingly holding a valve and said sleeve with the valve
stem projecting through and beyond the sleeve,
and a valve stem support carried by said plate
and cooperating with said sleeve to hold a valve
stem in coaxial relation to the sleeve and per-
mitting turning of the valve with the sleeve.

3. In a valve grinding machine, means for
holding a valve during an end grinding of its
stem, said means including a member against
which a valve head may seat, means for holding
a valve to its seat in said member, a separate co-
operating support for the valve stem having a
plurality of seats for receiving stems of different
diameters and being adjustable to place any seat
in stem supporting position, and means for re-
leasing the valve and valve stem to hold it to
its seat in said support.

4. In a valve grinding machine, means for
holding a valve during an end grinding of its stem,
said means including an adjustable mount, a
sleeve rotatably mounted therein for rotation
about its longitudinal axis and having a valve
head seat at one end, said sleeve being mounted
for limited axial movements relative to the
mount, means yeldingly holding the sleeve at
one end of its said axial movement, and means
cooperating with the sleeve to hold a valve to
its seat therein with its stem projecting there-
through and beyond its opposite end.

5. In a valve grinding machine, means for
holding a valve during an end grinding of said
stem, said means including a member against
which a valve head may seat, means for holding
a valve to its seat in said member, a sleeve
cooperating support for the valve stem having
a plurality of seats for receiving stems of differ-
dent diameters and being adjustable to place any
seat in stem supporting position.

6. In a valve grinding machine, means for
holding a valve during an end grinding of its
stem, said means including an adjustable mount,
88
a sleeve carried by the mount for rotation about
its longitudinal axis during a grinding operation
and having shouldered coaction with the mount
to limit any axial movement of the sleeve rela-
tive thereto during grinding, a support for the
89
valve stem, said sleeve having a valve head seat
at one end, means cooperating with the sleeve
to hold a valve to its seat therein with its stem
projecting longitudinally threethrough and beyond
its opposite end, and a support separate from the
sleeve and not rotatable therewith for holding the
valve stem in coaxial relation to the sleeve and permitting
turning of the valve with the sleeve.

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