A. VOCELLE.

CYLINDER LAPPING MACHINE.

APPLICATION FILED OCT. 5, 1916.

1,246,191.

Patented Nov. 13, 1917.

4 SHEETS—SHEET 1.

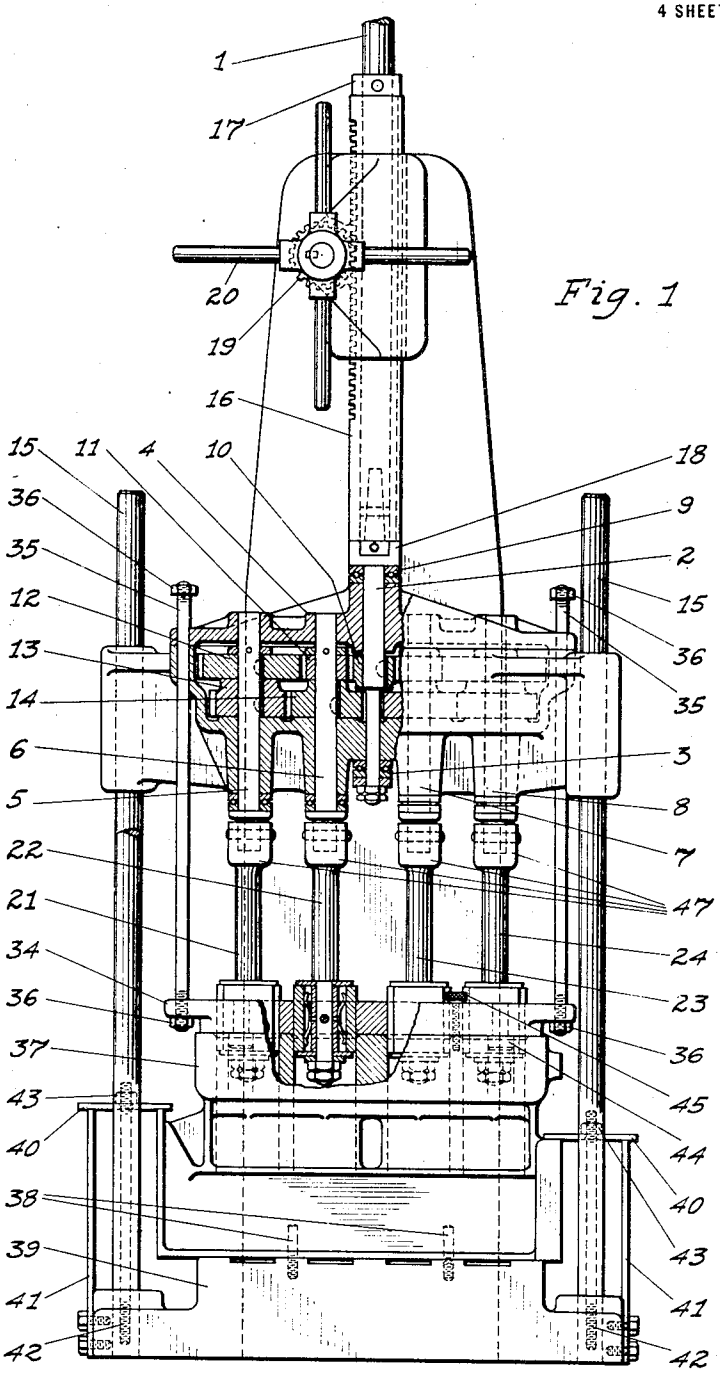

Fig. 1

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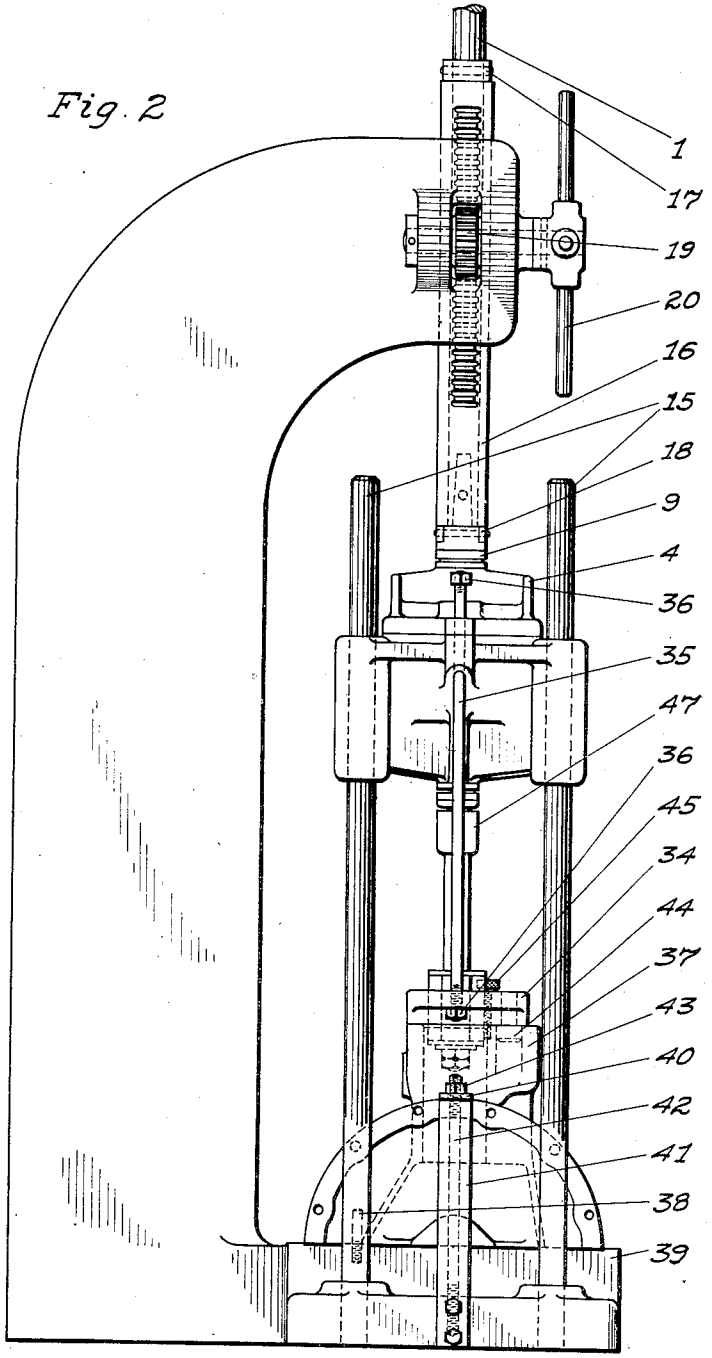
4 SHEETS—SHEET 2.

Fig. 2



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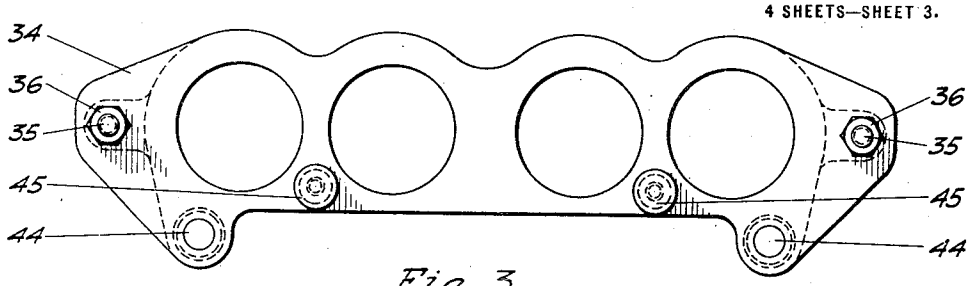


Fig. 3

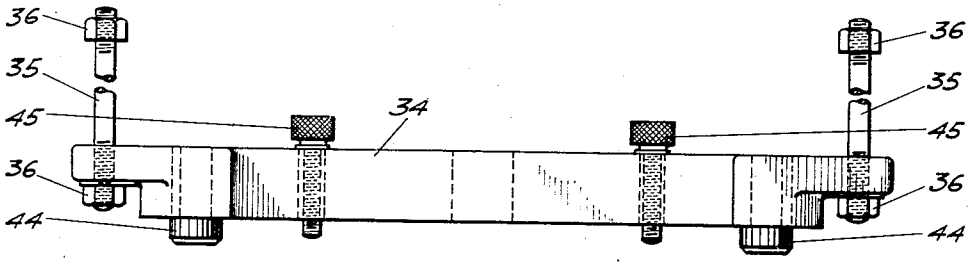
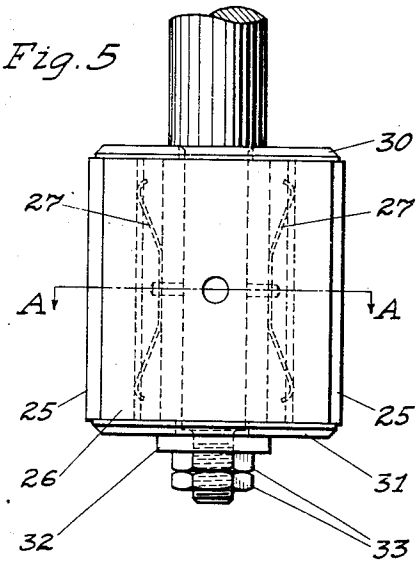


Fig. 4

Fig. 5



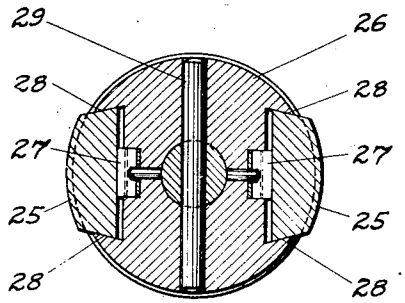


Fig. 6

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4 SHEETS—SHEET 4.

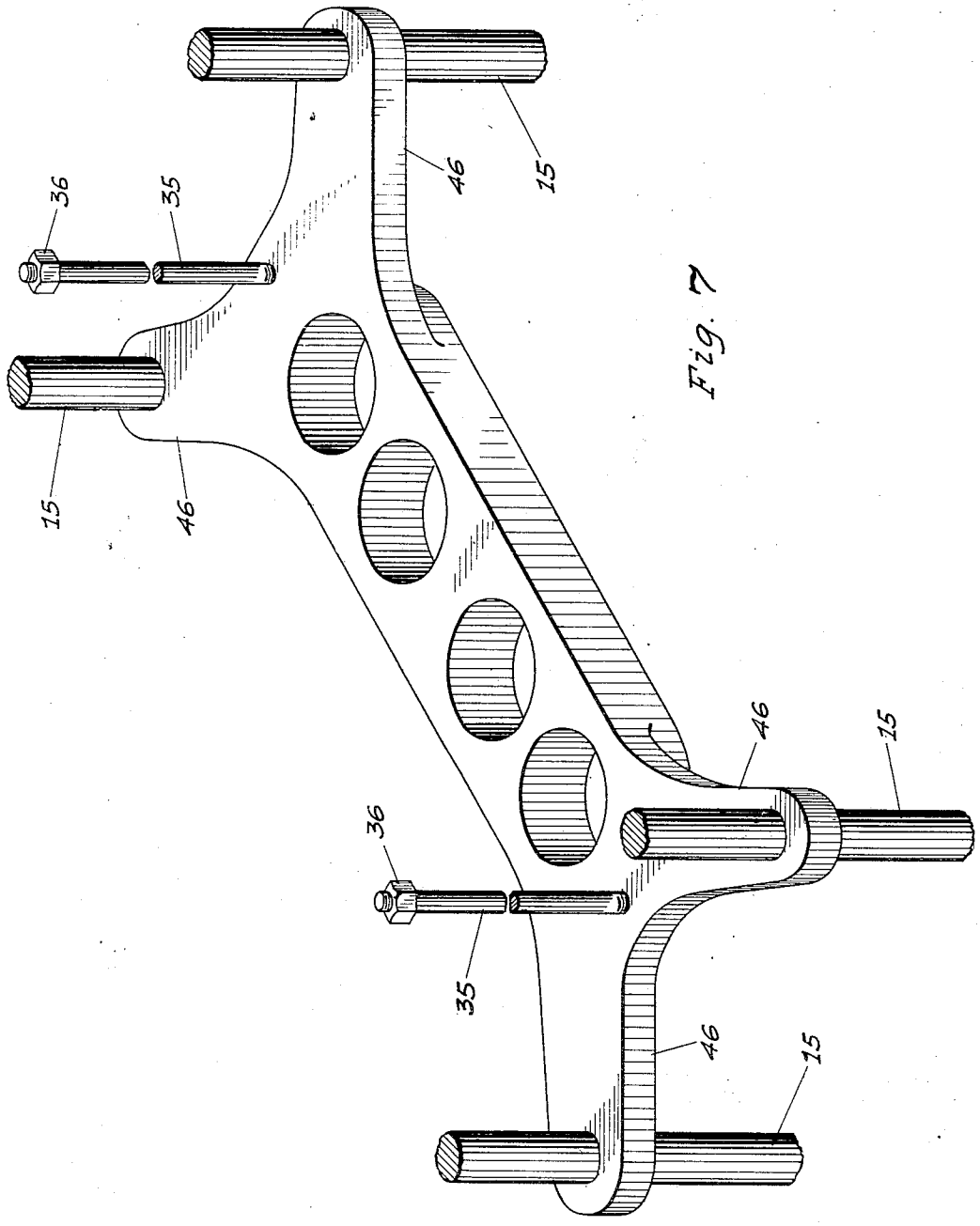

Fig. 7

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UNITED STATES PATENT OFFICE.

ADOLPH VOCELLE, OF DETROIT, MICHIGAN, ASSIGNOR TO DODGE BROTHERS, OF DETROIT, MICHIGAN, A CORPORATION OF MICHIGAN.

CYLINDER-LAPPING MACHINE.

1,246,191. Specification of Letters Patent. Patented Nov. 13, 1917.

Application filed October 5, 1916. Serial No. 123,804.

To all whom it may concern:

Be it known that I, ADOLPH VOCELLE, a citizen of the United States, residing at Detroit, Michigan, have invented certain new and useful Improvements in Cylinder-Lapping Machines, of which the following is a clear, full, and exact description.

This invention relates to a device for lapping the internal surfaces of the walls of cylinders such as are used for explosive or other types of engines.

One of the objects of this invention is to provide a means for perfecting the internal surface of a cylinder by lapping it with an abrasive material after it has been bored out by a tool having a cutting edge. Another object is to provide a device for quickly and cheaply lapping the internal surface of a cylinder, so arranged that the lapping elements may be easily and quickly inserted into the bore of the cylinder. These being among the objects of the present invention, the same consists of certain features of construction and combination of parts to be hereinafter described and then claimed with reference to the accompanying drawings which illustrate a suitable embodiment of the invention having the above and other objects in view.

In machining the internal surfaces of cylinders for explosive or other types of engines it has been found that any process which involves the use of a tool having a cutting edge is likely to produce a surface which contains small areas raised above the main portion of the surface and which would rapidly wear off in use, thus increasing the diameter of the cylinder and making the piston a loose fit shortly after being placed in service. The present invention relates to means for quickly and cheaply removing the "high spots" left in a cylinder wall by the preceding operations, this being accomplished by lapping the cylinder walls with blocks of abrasive material conforming in shape to the cylindrical surface and pressed against it by spring pressure while moved in various directions over the surface. The means employed for performing these operations will be described in conjunction with the drawings in which—

Figure 1 is a front elevation partly in section of a cylinder lapping machine embodying the present invention.

Fig. 2 is a side elevation of the same machine.

Fig. 3 is a plan view of the guide plate indicated by the numeral 34 in Figs. 1 and 2.

Fig. 4 is a front elevation of the guide plate.

Fig. 5 is an elevation of the holder for carrying the abrasive elements.

Fig. 6 is a sectional view taken on the line A A of Fig. 5.

Fig. 7 is a perspective view showing a modified form of guide plate.

Referring to Figs. 1 and 2, the revolving spindle (1) drives the lapping elements by means of a suitable mechanism to be hereinafter described and is itself driven by means not shown in the drawings but similar to those used for the same purpose in the ordinary types of drill presses. To the spindle (1) is connected an extension (2) by means of a taper socket and a cross pin or key, as shown in the drawings, or by other suitable form of connection. This extension (2) carries at its lower end an anti-friction bearing (3) which supports the housing (4) carrying a plurality of secondary spindles (5, 6, 7 and 8) for driving the lapping elements. A second anti-friction bearing (9) is also provided at the upper side of the housing so that thrust in either direction between the housing and the spindle (1) is taken care of. For driving the secondary spindles (5 and 6) a train of gears (10, 11, 12, 13 and 14) is provided, a similar train shown in dotted lines being provided for driving the secondary spindles (7 and 8). Gear (10) is rigidly fixed upon the extension (2) and gears (13 and 14) are rigidly fixed on the secondary spindles (5 and 6) respectively. Gear (11) meshing with gear (10) is free to turn on the secondary spindle (6) but is engaged with gear (12) which is rigidly fixed on secondary spindle (5). Gears (13 and 14) are of such size and are so located with reference to each other as to transmit motion from secondary spindle (5) to secondary spindle (6)

In operating the machine it is necessary to move the housing in the direction of the

axis of the spindle (1) in order to insert the abrasive elements into the cylinder, and to remove them when the operation is completed, as well as to move them from one end of the cylinder to the other while the lapping operation is progressing. The housing (4) is consequently arranged to slide on the parallel rods (15) which are rigidly supported by the main frame of the machine. Figs. 1 and 2 show one method by which this movement may be accomplished. The sleeve (16) surrounds the spindle (1) and supports it through the medium of the collars (17 and 18) fixed on the spindle and bearing against the ends of the sleeve (16). For moving the sleeve a pinion (19) engaged with a rack cut in the sleeve is provided. This pinion may be rotated by the hand wheel (20). In addition to means for moving the spindle by hand a power feed may also be provided as well as a suitable stop mechanism for retaining the spindle in any desired position.

Upon the lower ends of the secondary spindles, extensions (21, 22, 23 and 24) are attached by means of flexible joints (47) of the form shown in the drawing or of any suitable construction which will transmit the rotary motion of the secondary spindles (5, 6, 7 and 8) to the extensions (21, 22, 23 and 24) and also permit of a slight disalinement between the secondary spindles and the extensions. Upon the lower ends of the extensions are carried holders in which blocks of abrasive material are inserted. These holders are shown in detail in Figs. 5 and 6, (25) being the blocks of abrasive material which are carried in dovetail grooves in the holder (26). Behind the blocks, flat springs (27) are provided which press the blocks outwardly, motion in this direction being limited by the inclined walls (28) of the grooves. In the drawing these walls are shown as inclined plain surfaces, but it is obvious that other forms of grooves adapted to limit the motion of the abrasive blocks may be used. The holder (26) is driven by the pin (29) which passes through the extension of the secondary spindle and is provided with removable plates (30 and 31) at its ends. For retaining the holder (26) and plates (30 and 31) in position upon the secondary spindle, a washer (32) and the lock nuts (33) are provided. This arrangement permits the plate (31) to be removed easily in case it is desired to insert new abrasive elements.

The guide plate (34) shown in Figs. 3 and 4 is provided with a plurality of holes of approximately the same diameter as the bore of the cylinders to be lapped and is suspended from the housing (4) by the rods (35). These rods are provided with nuts (36) and are of such a length that when the guide plate is hanging upon the rods (35) and the nuts (36) it will be in engagement with the abrasive elements. For locating the guide plate upon the top of the cylinder casting the pins (44) engaging with accurately located holes in the top of the casting may be used and screws (45) may also be provided for holding the guide plate against motion normal to the top of the cylinder.

In Figs. 1 and 2, (37) indicates a cylinder casting placed in position to be lapped. The casting may be located by means of the studs (38) fixed in the base (39) of the machine and engaged with accurately located holes in the bottom of the cylinder casting. For holding the cylinder casting down in position upon the base (39), the clamps (40) fulcrumed upon the uprights (41) and held in place by the rods (42) and nuts (43) are provided, or any other suitable arrangement for accurately locating the cylinder casting and holding it in place may be used.

In Fig. 7 a modification of the guide plate is shown in which the guide plate is suspended upon the rods (35) and nuts (36) as in the arrangement above described, but instead of being located by engagement with the cylinder casting is guided upon the rods (15) by suitably fitted holes in the arms (46).

In operating the machine the cylinder casting is first located and rigidly fastened in position by the means above described or by any other suitable method. The spindle (1) is then lowered and with it the housing (4) and all the other parts carried upon it. When the spindle is in its upper position with the abrasive blocks out of engagement with the cylinder casting the guide plate as above described will be hanging upon the rods (35), which are of such a length that the guide plate will be engaged with the abrasive blocks and will hold them against outward motion. At the same time the guide plate will project below the lower ends of the blocks so that as the spindle is lowered the guide plate may come in contact with the top of the cylinder casting before the abrasive blocks enter the bore. The downward motion may be stopped at this point and the guide plate accurately located upon the top of the cylinder casting by the means already described or by some other method. If the modification shown in Fig. 7 is used the guide plate will be accurately located by the rods (15) and no other means of locating it will be required. After the guide plate is in proper position upon the top of the cylinder casting a continuation of the downward movement of the spindle will cause the abrasive blocks to slide through the holes in the guide plate and to enter the cylinder casting, the holes in the guide plate being of a diameter equal to or smaller than the bore of the cylin-

der so that the abrasive blocks will readily enter the bore. After the abrasive blocks have passed out of engagement with the guide plate, power may be applied to the spindle (1) and a rotary motion given to the abrasive elements. While this motion is continuing the spindle may be raised and lowered by the means shown or by a power feed or other mechanism so that the entire internal surface of the cylinder may be acted upon by the abrasive material. In case it is desired during the lapping operation to operate the abrasive blocks while they are partly projecting above the top of the cylinder, as may be thought desirable to insure lapping the extreme upper part of the bore, the guide plate may be raised somewhat in the drawings, or the mechanism may be so arranged that the guide plate does not come in contact with the top of the cylinder but has its travel limited so that its lowest position is somewhat above the top of the cylinder casting.

In some of the claims the means for yieldingly pressing outward the abrasive elements is designated as a spring. It will be understood, however, that the term "spring" is intended to include not only resilient pressure means of the spring type, but also any means for producing a yielding as distinguished from a positive pressure.

It is obvious that the invention is susceptible of modification, as the various parts of the cylinder lapping machines may be differently constructed, and parts thereof omitted without departing from the scope and spirit of the invention.

What I claim as new is:—

1. In a cylinder lapping machine, a block of abrasive material shaped to lap the interior wall of a cylinder, rotatable means for holding said block in lapping relation to the cylinder wall arranged to revolve said block about the axis of said cylinder, said means and said cylinder being arranged for free relative movement in the direction of said axis, means for continuously rotating said holding means, and means independent of the speed of rotation of the holding means for effecting a free relative reciprocation of said block and said cylinder while said block is revolving about the axis of said cylinder.

2. In a lapping machine a holder carrying a pair of opposed abrasive elements having abrading surfaces conforming in shape to the interior of a cylinder, and springs pressing said abrasive elements outwardly of said holder, said holder having a rotary motion about the axis of said cylinder and being freely movable in the direction of said axis, and means independent of the speed of rotation of said holder for freely reciprocating said holder while it is rotating.

3. In a cylinder lapping machine, an abrasive element shaped to operate upon the inside wall of the cylinder to be lapped and rotatable upon the axis of said cylinder, a support for said abrasive element freely movable to and fro in the line of the axis of the cylinder and adapted to carry said element throughout the length of said cylinder, means on said support for holding said element in lapping relation to the cylinder wall, means for continuously rotating said element upon said axis, and means for freely moving said support at will for the purpose aforesaid.

4. In a cylinder lapping machine, means presenting the cylinder to be lapped with its axis vertical, an abrasive element shaped to operate upon the inside wall of the cylinder, a vertically movable support from which said abrasive element is suspended to turn upon the axis of said cylinder, means on said support for holding said element in lapping relation to the cylinder wall, said support being mounted for free rectilinear movement to carry said element to and fro throughout the length of said cylinder in the axial line thereof, means for continuously rotating said element upon said axis, and means for freely moving said support at will for the purpose aforesaid.

5. In a cylinder lapping machine for multi-cylinder engines, the combination with an abrasive element for each cylinder, of means for supporting said elements for rotation coaxial with the axes of said cylinders, said means being arranged for free rectilinear movement to carry said elements throughout the length of the respective cylinders, means on said supporting means for holding said elements in lapping relation to the inside walls of the respective cylinders, means for continuously rotating said elements, and means acting on said supporting means and operable at will for freely reciprocating said elements in said cylinders while said elements are being rotated.

6. In a cylinder lapping machine for multi-cylinder engines, the combination with an abrasive element for each cylinder, of supports for said elements by which they are rotated and moved lengthwise of said cylinders to effect the abrading operation, said supports comprising a shaft for each element coaxial with the cylinder to be lapped, means on said shafts for holding said elements in lapping relation to the inside walls of the respective cylinders, means for effecting simultaneous rotation of said shafts, and means operable at will for freely moving said shafts simultaneously lengthwise of the axes of said cylinders while said shafts are rotating.

7. In a cylinder lapping machine for multi-cylinder engines, an abrasive element for each cylinder yieldingly pressed toward the

wall of the cylinder, supports for said abrasive elements comprising shafts with which said elements turn, and a common driving shaft for said elements, lengthwise of the axis of which said elements are movable to effect simultaneous movement thereof lengthwise of said cylinders.

8. In a cylinder lapping machine for multi-cylinder engines, an abrasive element for each cylinder yieldingly pressed toward the wall of said cylinder, and means for effecting the abrading movement of said elements in said cylinders, comprising vertically suspended and vertically movable rotatable shafts coaxial with said cylinders, means for effecting simultaneous rotation of said shafts, and means for effecting simultaneous vertical movement thereof.

9. In a cylinder lapping machine for multi-cylinder engines, the combination with an abrasive element for each cylinder, of means for rotating said elements in said cylinders, comprising shafts coaxial with the axes of said cylinders, and a common driving shaft for said shafts having its axis parallel to the axes of said shafts and along which axis said shafts are movable to effect reciprocation of said elements while they are being rotated.

10. In a cylinder lapping machine for multi-cylinder engines, a support for a block of cylinders to be lapped, an abrasive element for each cylinder, supports for said elements comprising a shaft rotatable with each element, a cross-head in which said shafts are rotatably mounted, and guides for said cross-head connected to said cylinder block support to guide said cross-head for coaxial movement of said shafts lengthwise of the cylinders.

11. In a cylinder lapping machine for multi-cylinder engines, the combination with a support for a block of cylinders to be lapped, of lapping means comprising a rotatable shaft coaxial with each cylinder, a cross-head in which said shafts are rotatably supported, guides for said cross-head for maintaining the coaxial relation of said shafts and said cylinder as said cross-head moves toward and away from said cylinders, means for reciprocating said cross-head, and means for continuously rotating said shafts while said cross-head is being reciprocated.

12. In a cylinder lapping machine for multi-cylinder engines, an abrasive element for each cylinder yieldingly pressed toward the wall of said cylinder, means for supporting said elements for rotation coaxial with the axes of said cylinders, a cross-head in which said supporting means are mounted, guides for said cross-head, and means for supporting said cylinders in coaxial relation to the respective supporting means carried by said cross-head.

13. In a cylinder lapping machine for multi-cylinder engines, the combination with an abrasive element for each cylinder, supports for said elements comprising a shaft coaxial with each cylinder, a cross-head in which said shafts are rotatably mounted, guides for said cross-head, and a common driving shaft for said aforementioned shafts movable with said cross-head to reciprocate said abrasive elements in said cylinders.

14. In a cylinder lapping machine for multi-cylinder engines, the combination with an abrasive element for each cylinder, supports for said elements comprising a vertically suspended shaft coaxial with each cylinder, a vertically movable cross-head by which said shafts are supported with provision for rotation about their respective axes, and a common driving shaft for said aforementioned shafts, said cross-head being supported by said driving shaft.

15. In a cylinder lapping machine for multi-cylinder engines, the combination with an abrasive element for each cylinder, supports for said elements comprising a vertically suspended shaft coaxial with each cylinder, a vertically movable cross-head by which said shafts are supported with provision for rotation about their respective axes, a common driving shaft for said aforementioned shafts, said cross-head being supported by said driving shaft, and means for effecting vertical movement of said driving shaft to effect simultaneous reciprocation of said elements in said cylinders.

16. In a cylinder lapping machine for multi-cylinder engines, a support for a block of cylinders to be lapped, lapping means comprising a shaft coaxial with each cylinder, a cross-head supporting said shafts, guides for said cross-head to maintain the coaxial relation of said shafts and said cylinders as said cross-head is moved toward and away from said support, and a common driving shaft for said aforementioned shafts arranged to support said cross-head and movable therewith.

17. In a cylinder lapping machine for multi-cylinder engines, a support for a block of cylinders to be lapped, lapping means comprising a shaft coaxial with each cylinder, a cross-head supporting said shafts, guides for said cross-head to maintain the coaxial relation of said shafts and said cylinders as said cross-head is moved toward and away from said support, a common driving shaft for said aforementioned shafts arranged to support said cross-head and movable therewith, and means acting on said driving shaft for effecting a reciprocating movement of said cross-head and said lapping means.

18. In a cylinder lapping machine for multi-cylinder engines, a support for a block of cylinders to be lapped, lapping means

comprising a shaft coaxial with each cylinder, a cross-head supporting said shafts, guides for said cross-head to maintain the coaxial relation of said shafts and said cylinders as said cross-head is moved toward and away from said support, and a guide for guiding said lapping means into said cylinders having a lost motion connection with said cross-head.

19. In a lapping machine a holder carrying a pair of opposed abrasive elements having abrading surfaces conforming in shape to the interior of a cylinder, springs pressing said abrasive elements outwardly of said holder, said holder having a rotary motion about its axis and also a reciprocatory motion in the direction of its axis, and a guide plate provided with a cylindrical hole adapted to receive said abrasive elements and hold them against the action of said springs.

20. In a lapping machine a holder carrying a pair of opposed abrasive elements having abrading surfaces conforming in shape to the interior of a cylinder, springs pressing said abrasive elements outwardly of said holder, said holder having a rotary motion about its axis and also a reciprocatory motion in the direction of its axis, a guide plate provided with a cylindrical hole adapted to receive said abrasive elements and hold them against the action of said springs, and means for moving said guide plate in conjunction with said holder during a portion of the reciprocatory motion of said holder.

21. In a cylinder lapping machine, abrasive elements, a holder in which said abrasive elements are yieldingly pressed outwardly, and means for limiting the outward movement of said elements in said holder, when said holder is out of the cylinder to be lapped, adapted to guide said elements into said cylinder.

22. In a cylinder lapping machine, opposed abrasive elements yieldingly pressed apart, and means for limiting the separating movement of said abrasive elements when out of the cylinder to be lapped, arranged to guide said elements into said cylinder.

23. In a cylinder lapping machine, abrasive elements, a holder in which said abrasive elements are yieldingly pressed outwardly, and a guide for limiting the outward movement of said elements when out of the cylinder to be lapped and for guiding them into said cylinder, said elements being movable out of operative relation to said guide as they come within said cylinder.

24. In a cylinder lapping machine, opposed abrasive elements yieldingly pressed apart, a support for said elements by which they may be moved into and out of the cylinder to be lapped, means for limiting the separating movement of said elements when out of said cylinder, and means for supporting said limiting means in confining relation to said abrasive elements, said limiting means being relatively movable lengthwise of said abrasive elements out of confining relation thereto.

25. In a cylinder lapping machine, opposed abrasive elements yieldingly pressed apart, a support for said elements by which they may be carried into and out of the cylinder to be lapped, means for limiting separating movement of said elements when out of said cylinder, constructed to guide them into the cylinder, and means for automatically moving said limiting means out of guiding relation to the cylinder when said abrasive elements are withdrawn from the cylinder.

26. In a cylinder lapping machine, abrasive elements, a holder in which said abrasive elements are yieldingly pressed outwardly, a guide for limiting the outward movement of said elements when out of the cylinder to be lapped and for guiding them into said cylinder, said elements being movable out of operative relation to said guide as they come within said cylinder, and lost motion connections between said holder and said guide to bring about the relative movements of the guide and the holder automatically.

27. In a cylinder lapping machine, abrasive elements, a holder in which said abrasive elements are yieldingly pressed outwardly, a guide for limiting the outward movement of said elements and for guiding them into the cylinder to be lapped, and connections between said guide and said holder permitting relative movement of said guide and holder when said holder moves into the cylinder but retaining said guide in confining relation to said elements when said holder is withdrawn from the cylinder.

28. In a cylinder lapping machine for multi-cylinder engines, opposed abrasive elements for each cylinder yieldingly pressed apart, supports for said sets of abrasive elements arranged to carry said elements simultaneously into and out of the respective cylinders, a guide for limiting the separating movement of said elements when out of the cylinders, arranged to guide said elements into the cylinders, and lost motion connections between said guide and said supports for withdrawing said guide from the cylinders when the abrasive elements are withdrawn, said connections operating to withdraw said guide when it is in confining relation to said elements.

29. In a cylinder lapping machine, a plurality of revolving holders having their axes parallel, abrasive elements carried by said holders and yieldingly pressed normally outwardly of said holders, a movable cross-head by which said revolving holders are carried, a guide for limiting the out-

ward movement of the said abrasive elements when out of the cylinders and for guiding said elements into the cylinders to be lapped, and lost motion connections between said guide and said cross-head whereby said elements may move out of operative relation to said guide during the lapping operation whereby said guide is moved out of guiding relation to said cylinders when said elements are withdrawn from said cylinders.

30. In a cylinder lapping machine for multi-cylinder engines, an abrading tool for each cylinder comprising an abrasive element yieldingly pressed toward the wall of said cylinder, rotatable shafts coaxial with said cylinders upon which said tools are carried, a guide having tool receiving openings coaxial with said cylinders, means for effecting simultaneous rotation of said shafts, and means for effecting simultaneous movement of said shafts in the lines of the axes of said cylinders.

31. In a cylinder lapping machine for multi-cylinder engines, an abrading tool for each cylinder comprising an abrasive element yieldingly pressed toward the wall of said cylinder, rotatable shafts coaxial with the respective cylinders for carrying said tools, means for simultaneously rotating said shafts, and means independently guided and connected to said shafts for effecting rectilinear reciprocation of said shafts along their axes while they are rotating.

32. In a cylinder lapping machine for multi-cylinder engines, the combination with an abrasive element yieldingly pressed toward the wall of each cylinder, of supports for said elements by which they are rotated and moved lengthwise of said cylinders to effect the abrading operation, said supports comprising a shaft for each cylinder coaxial with the cylinder and arranged to reciprocate along its axis, means on said shafts for holding said elements in lapping relation to the inside walls of the respective cylinders, means for simultaneously rotating said shafts, means for reciprocating said shafts simultaneously lengthwise of the axes of said cylinders, and means for guiding said abrasive elements into said cylinders at the beginning of the lapping operation.

33. In a cylinder lapping machine, a cylinder support, an abrading tool movable into and out of the cylinder and comprising an abrasive element yieldingly pressed toward the wall of said cylinder when in operative position within the cylinder, a rotatable shaft upon which said tool is carried, and a guide having a tool receiving opening coaxial with said cylinder and adapted to receive said tool when it is withdrawn from said cylinder.

34. In a cylinder lapping machine, an abrading tool movable into and out of the cylinder and comprising an abrasive element yieldingly pressed toward the wall of said cylinder when in operative position within the cylinder, a guide for receiving said tool when it is withdrawn from said cylinder, means for rotating said tool and means for reciprocating it within said cylinder along the axis thereof, and means for effecting a relative movement of approach and withdrawal of said guide and said cylinder.

Signed at Detroit, Mich., this 21st day of September, 1916.

ADOLPH VOCELLE.

Witnesses:
ALFRED H. KNIGHT,
M. C. BURNSIDE.