This invention relates in general to a grinding and polishing machine, and more particularly to the class of such machine used for grinding and polishing gems or semi-precious stones, and the like.

There are many constructions of lapidary machines known in the art, for grinding gems. However, most of these machines are of extremely complicated and expensive construction, and are not suitable either from a mechanical or economical standpoint for use by novices or the inexperienced.

Today, more and more people are taking up the lapidary art as a hobby, and those machines that are available for novice gem grinders are generally not very accurate, and do not provide a machine that can be expeditiously utilized to accurately grind the facets on a gem, so as to assure a fine quality finished product.

The present invention provides a grinding machine which, while relatively uncomplicated in construction and relatively economical to produce, results in a machine wherein a gem can be very accurately and finely ground and/or polished, so that the facets can be accurately and effectively located on the gem, and a machine that can be easily operated by someone who is not necessarily completely experienced in the gem grinding field, to provide a professional looking end product even for amateurs and novices.

Accordingly, an object of the invention is to provide a novel lapidary machine for grinding or polishing gems or the like.

Another object of the invention is to provide a novel lapidary grinding machine for grinding or polishing gem facets, in which the machine is relatively economical in construction, relatively simple to operate, but which is extremely accurate, for providing a professional touch to the grinding of such gems, and especially by amateurs in the lapidary art.

Another object of the invention is to provide a novel lapidary machine for grinding gem facets, which will greatly increase the accuracy and minimize the errors involved in providing the facets on a gem, and which has a plurality of movements for providing for expeditiously and accurately adjusting the gem holding head of the machine with respect to the lap wheel.

A still further and more specific object of the invention resides in the provision of means whereby the gem supporting head may be swung upwardly from operative position to permit readjusting and providing inspection of the gem, and the convenient interchange of laps, without changing the setting of the head, and when the head is lowered back down, means will automatically stop the head in whatever setting it had been placed previously, thereby insuring that the spacing and angularity of the facets on the gem will not be disturbed by such movement of the head.

Other objects and advantages of the invention will be apparent from the following description taken in conjunction with the accompanying drawings, wherein:

FIG. 1 is a side elevational, partially broken view of a gem grinding machine embodying the instant invention; in dot-dash lines there is partially shown a raised or pivoted position of the head of the machine;

FIG. 2 is a fragmentary elevational view, generally similar to that of FIG. 1, but taken from the opposite side of the machine as compared to that of FIG. 1;

FIG. 3 is a top plan view of the indexing wheel for the machine;

FIG. 4 is a fragmentary, top plan view of the machine of FIG. 1;

FIG. 5 is a fragmentary, partially exploded view of the machine of FIGS. 1 to 4;

FIG. 6 is an enlarged, side elevational view of a jig fixture, which may be utilized for accurately transferring a stone from one dop to another, in the grinding of a gem;

FIG. 7 is a top plan view of the fixture of FIG. 6.

Referring now again to the drawings, the grinding machine broadly comprises a table or base 10, which may include leg portions 10a, and on which is rotatably mounted a lap wheel 12 of conventional type, together with a movable post or column 14, having an articulated arm 16 projecting generally laterally outwardly therefrom, and movably supporting a head 18 thereon. Head 18 is adapted to hold a gem for grinding or polishing on the wheel 12.

The base 10 is preferably portable, and may be made of any suitable material, such as for instance, aluminum, which would contribute to the lightness and mobility of the device. The lap wheel 12 may have a splash pan 20 associated therewith, and in the conventional manner, with the pan being open on its upper side, to provide access between the head 18 and the lap wheel 12.

The standard or post 14 may comprise a base portion 22 which in the embodiment illustrated has a threaded shank element 24 projecting downwardly from the flat underside 22a of the base portion, and passing through a slot 26 in the table 10, and there may be provided a clamping threaded wing nut 28 or other like fastener device, acting with the shank 24, for detachably locking the post 14 in any selected position with respect to the table 10, thereby providing for selective longitudinal movement of the post 14 on the table and providing for adjusting the position of the grinding head 18 with respect to the lap wheel.

The post 14 projects upwardly from its base portion 22, and may support a sleeve 30 thereon, which sleeve is movable both lengthwise and rotatably, with respect to the post 14. A locking means, such as a thumb screw 32, may be provided on sleeve 30 for locking the sleeve in any selected position with respect to the post 14 and especially against rotatable movement with respect thereto.

The sleeve 30 is preferably supported on a vernier 34, which may comprise a base section 34a, held in selected position on the post 14 by means of thumb screw 34b, and an internally threaded rotatably movable, fine adjustment portion 36, which coacts with the externally threaded base section 34a, to raise or lower the sleeve 30 with respect to the post, and thus obtain a fine adjustment of the level of the sleeve 30 on the post. The exterior surface of the vernier portion 36 may be vertically lined or slotted, as shown, and there may be provided a spring locking member 40 which coacts in a confronting slot in the vernier surface, and resists rotation of the vernier portion 36, thereby assuring that upon rotation of the sleeve 30 on the post, such rotation will not cause rotation of the vernier portion 36.

Projecting laterally inwardly toward the lap wheel 12 and from sleeve 30 is aforesaid arm member 16, which is pivoted as at 42, thereby dividing the arm into an inner section 44 and an outer section 45. It will be noted that an end of section 44 is received in a slot 46 (FIG. 4) in sleeve 30 and is secured to the sleeve by any suitable means such as brazing, welding, fasteners, or the like, which provides a highly effective and high strength connection between the arm 16 and the sleeve 30.

Outer arm section 45 adjacent its inner end, includes an upwardly facing slot 47 therein, which is adapted
for receiving in abutting coaction, a stud 50 projecting generally laterally of inner arm section 44, for holding the arm sections 44, 45 in generally aligned condition. There may also be provided an electrical contact 52 on outer arm section 45, but in electrically insulating fashion, which is adapted for coaction or engagement stud 50 upon movement of such stud into the lowermost portion of the slot 47, to energize, a signal light 54 or some other signal means, for indicating that the arm sections 44, 45 are in generally aligned condition. In other words electrical contact 52 may comprise a conductive member such as a screw extending through an insulated holder 56 in threaded coaction therewith and with the screw having a pointed tip adapted for engagement with stud 50 to complete the circuit 58 when outer arm section 45 is disposed in linear alignment with the inner arm section 44.

Secured to the outer end of the outer arm section 45 is a substantially semi-circular, segmental plate 60 carry-in on its face generally adjacent its curved edge, graduations 62a of the type of a protractor.

Pivoted adjacent the outer end of outer arm section 45 is the grinding or polishing head 18. Head 17 may comprise a barrel portion 61 having an opening or passageway 62 extending axially therethrough, and with a boss 64 (FIGS. 1, 4) extending laterally from the barrel 61 and with such boss having a threaded shank portion 66 extending through an opening in the outer arm section 45, and coating with a threaded thumb nut 68, for locking the head 18 in any selected rotative position with respect to outer arm section 45. A pointer 69 extending upwardly from the boss 64 and disposed in alignment with the axis of the barrel 61, coacts with the aforementioned numerical designations on the protractor plate 60 to indicate the angular position of the head 18 with respect to the supporting arm 16.

A chuck 72 including a stem section 73, and which chuck 72 is of split sleeve construction as indicated at 74, is provided. Stem 73 extends through the passageway 62 in the barrel 61, and may have a threaded end on which is fixed an indexing gear or wheel 76, as by means of nut 76a. The chuck portion 72 has a symmetrically sloping circumferentially extending aligning cam surface 80, which coacts with complementary surface 82 on the barrel, for aligning the chuck 72 with respect to the barrel and limiting the rearward movement of the chuck with respect to the barrel. An internally threaded collar 83 is adapted for threaded clamping coaction with external threads 83a on the chuck 72. A spring element 84 which may be of the flat spiral construction illustrated, coacts between the barrel and an abutment 84a on the chuck stem, to resiliently urge surfaces 80, 82 into engagement. It will be seen, in other words, that the chuck 72 and associated wheel 76 have limited axial movement with respect to the barrel. Openings 85, 85a may be provided in the barrel 61 and stem 73 respectively, which openings when in aligned conditions are adapted to receive a rod or the like to provide a means for locking the stem 73 against rotation in the barrel.

The barrel may be of the stepped or recessed construction illustrated at 86, and a split sleeve 87 coacts therewith in encircling relation, with a threaded member 88 being provided, for tightening the split sleeve 87 in frictionally gripping relation on the barrel member. The split sleeve 87 supports a pivotal finger 89 in a mount 89a, which finger is adapted for coaction with the notches 91 in the indexing wheel 76, to selectively lock the wheel and thus the attached chuck 72, in whatever rotative position desired. The finger 89 is pivotally mounted at 90 to the mounting portion 89a and there may be provided a compression spring member 92 for resisting pivoting of finger 89, in a mount 94, for holding the pivotal finger 89 out of coacting relation with the indexing wheel 76. Locking member 94 may comprise a bent wire movable transversely of mounting portion 89a and having an enlarged hook portion 94a which is adapted to engage the finger 89 and hold the latter in the phantom position illustrated in FIG. 5.

Referring to FIG. 3, it will be noted that indexing wheel 76 has 64 notches, in the embodiment illustrated, cut on its periphery, thereby providing for the grinding of a considerable number of facets on a gem, and in a very accurate and precise manner.

An important feature of the instant invention is that the distance between the head 18 where the stone is held for grinding and the pivotal axis 66 of the head, is relatively short as compared to prior art arrangements, and the distance between said pivotal axis 66 and the means 60a on the segmental protractor plate which indicates the angularity of the head 18, is relatively long, as compared to prior art arrangements. Accordingly, any human error in setting the angularity of the head 18 is minimized, and thus extremely accurate grinding of a gem can be accomplished. A length of approximately 3½ inches for the chuck and associated stem 73 has been found to be a satisfactory arrangement, with the pivotal axis 66 of the head being located in the compression illustrated in FIGS. 3 and 4, with the designations 60a on the plate 60 and the outer end of the chuck 72. The chuck recess 95 may have a pin 95a extending therethrough. The dop stick 96 has a notch 96a in the rearward end thereof, which notch preferably defines an approximate 60° angle, for coaction with the pin 95a which is adapted for receipt in notch 96a, and thus firmly fixing the rotative position of the dop stick with respect to the chuck 72.

If it is desired to adjust a facet being ground on the grinding machine different from the position of the chuck stem as provided by the 64 notches in the indexing wheel, or in other words if it is desired to "split" one of the 64 possible rotative and fixed positions of the chuck 72, then the locking finger 89 can be moved or pivoted out of locking coaction with the corresponding notch in the indexing wheel 76 and the locking means 88 may be loosened, thus permitting movement of the split sleeve and associated locking finger with respect to adjacent notches of the wheel 76, thereby providing for dividing the space between adjacent notches, into very accurate proportions, for "splitting" the distance between the facets being ground on a gem. Thereupon the tightening screw 88 can be tightened, and the indexing wheel turned to the desired notch, thereby turning the chuck through the desired angle.

Such an arrangement provides for the selective changing of the positional relationship between the locking finger 89 and the index wheel 76, and more particularly for the "splitting" of the angles defined or indicated by wheel 76.

To facilitate the transfer of a rough cut gem or stone from one dop to another, there may be provided the V-block jig or fixture 100, which V-block may have a pivotal lever 102 pivoted as at 104 to the block, and having a threaded abutment member 106 extending through one end of the block, to urge such pivotal lever member 102 into coaction with the slot in the associated dop. Such dop can be held in desired position in the V-groove 106 in the block by means of screws 116 extending downwardly through associated brackets 116a. The dop stick to which the partially cut stone is adapted to be transferred can be provided with a suitable guide or way, or for that matter, the conventional manner so that a partially ground gem can be adhered to the dop stick. Such dop stick has an end slot 96a, as aforementioned, which is received in coacting relation with pin 118 extending upwardly into the V-slot of the fixture, and which coacts with the aforementioned sloping walls of the V-slot in the dop stick, to accurately align the two dop sticks. Thus the gem can
be readily transferred from one dop to another without any error occurring during such transfer operation. The dop head is generally vertical plane and with respect to said arm, means for locking said head in selected angled condition with respect to said arm, and said arm being articulated and comprising an inner section and an outer section, said outer section supporting said head and being swingable in a generally vertical plane and with respect to said inner section, and means for limiting at least the downward movement of said outer section with respect to said inner section of said arm.

2. A machine in accordance with claim 1 wherein said pivotal mounting means for said head is located approximately centrally thereof in laterally projecting relation to one side thereof.

3. A machine in accordance with claim 1 wherein said arm is secured to a collar, said support comprising a vertical post on which said collar is slidably vertically as well as being rotatably mounted, and means for locking said collar in selected position on said post.

4. A machine in accordance with claim 1 wherein said head comprises a chuck including an elongated, axially oriented shank, a barrel having a passageway extending therethrough and receiving therein said shank, said barrel being pivotal on said arm for said vertical plane movement of said head, means on said barrel adapted for cooperation with means on said arm for indicating the vertical plane angularity of said head with respect to the arm, an indexing wheel secured to said shank exteriorly of said barrel, and being adapted for turning to rotate said chuck and associated shank with respect to said barrel, means providing for axial movement of said chuck and shank in said passageway in at least one axial direction, cam means engaging with the last mentioned means and aligning said chuck and shank in said barrel passageway, and means for detachably locking said index wheel against rotation.

5. In a machine for grinding precious or semi-precious stones comprising, a base having a lap wheel rotatably mounted thereon, a standard movably supported on the base for movement toward and away from said lap wheel, a sleeve mounted on said standard and adapted for movement vertically thereof for selectively adjusting the elevation of the sleeve with respect to the base, an arm projecting laterally from said sleeve, and an elongated head mounted on said arm, said head including means for holding a gem thereon, means pivotally mounting said head on said arm for swinging movement of said head in a generally vertical plane and with respect to said arm, means on said head for rotating said gem holding means about an axis disposed in said plane, means for indicating the vertical plane angularity of said head with respect to said arm, means for locking said head in selected vertical plane angled condition with respect to said arm, said arm being articulated and including an inner section coupled to said sleeve and an outer section pivotal on said inner section for movement in a generally vertical plane and mounting said head thereon, means for limiting the downward swinging movement of the outer arm section with respect to the inner arm section while providing for the upward swinging movement of said outer arm section with respect to said inner arm section, and said pivotal mounting means being disposed intermediate said gem holding means and said indicating means.

6. A machine in accordance with claim 5, wherein said head comprises a barrel pivotally mounted on said arm, said gem holding means including a chuck, said chuck having a stem extending through a passageway in said barrel and projecting outwardly thereof, said means for rotating said gem holding means comprising an index wheel secured to the projecting end of said stem, a split sleeve mounted on said barrel, means for tightening a split sleeve on said barrel for rigidly securing said sleeve to said barrel, a locking finger movably mounted on said split sleeve, said locking finger adapted to coact in locking relation with said means on said index wheel, for locking
the stem and associated chuck against rotation with respect to the barrel.

7. A machine in accordance with claim 6, wherein the chuck recess which is adapted to receive therein a dop stick in clamped relation includes an abutment extending transversely through the chuck recess in spaced relation to defining surfaces of the chuck recess, said abutment being adapted for coaction with a V-shaped slot in the associated dop stick to position the dop stick with respect to the chuck and chuck stem.

8. A machine in accordance with claim 7, wherein said chuck stem is provided with a circumferential divergent cam surface adapted for coaction with a corresponding cam surface on said barrel, to limit movement of the chuck stem with respect to the barrel in one axial direction, and means coacting between said barrel and said stem to urge said cam surfaces into engagement.

9. A machine in accordance with claim 6, including means for releasably holding said finger out of coacting relationship with said index wheel.

10. A transfer fixture adapted for use with the machine of claim 7, wherein said fixture comprises a block having a V-slot construction and having means thereon for clamping a dop stick in opposing aligned relation to another dop stick, with the dop sticks being received in the V-slot construction in said block, vertically extending, pivotal means for urging one of the dop sticks toward the other of the dop sticks upon loosening of one of said clamping means, and means on said block for fixing the rotary positions of the dop sticks with respect to said block and with respect to one another, the last mentioned means comprising a vertical pin projecting into said V-slot construction and a vertically extending V-slot disposed in the outer end of said of said dop sticks, said vertical pin coacting in camming coaction with the V-slot in the respective dop stick, and said urging means coacting with the V-slot in its respective dop stick.

11. A machine for grinding precious or semi-precious stones comprising a base having a lap wheel rotatably mounted thereon, a vertical post movably supported on said base for selective linear movement toward and away from said lap wheel, a sleeve mounted on said post for vertical and rotatable movement with respect thereto, a vernier for fine adjustment of the vertical position of said sleeve on said post, means on said sleeve for locking it in selected condition on said post, an articulated arm projecting outwardly from said sleeve, said arm comprising an outer section, and an inner section pivoted at one end thereof to said outer section and secured at the other end thereof to said sleeve, means for limiting the articulated movement of said arm in at least one direction, said limiting means comprising a stud projecting laterally from said inner arm section and an open ended slot in said outer arm section adapted to receive said stud therein in abutting holding relation, a head mounted on said outer arm section, said head comprising a barrel pivoted to said outer arm section for movement in a generally vertical plane, a chuck having a rearwardly extending stem rotatably mounted in said barrel, said stem projecting outwardly of said barrel, an index wheel having a plurality of notches on its periphery secured to the projecting end of said stem, a split sleeve mounted on the barrel and movable circumferentially thereof, means for tightening said split sleeve on said barrel for rigidly securing said sleeve to said barrel, a locking finger pivotally mounted on said split sleeve, said locking finger being adapted to coact with a selected notch on said index wheel for detachably locking said chuck and stem in predetermined rotative position with respect to said barrel, indicia on said wheel for indicating the relative rotative position of said chuck with respect to said barrel, other indicia on said arm for indicating the angularity of said head with respect to said arm, means on said barrel adapted for coaction with the last mentioned indicia for so indicating the position of said head with respect to said arm, means for locking said head in selected angled condition with respect to said arm, and said barrel pivoting means being disposed approximately halfway between said chuck and said other indicia.

12. A machine in accordance with claim 11 including means providing for relative axial movement between said barrel and said chuck, and resilient means opposing said axial movement.

13. In a machine for grinding stone-like items, such as precious or semi-precious gems, comprising a movable support, an arm projecting generally laterally outwardly from said support, said arm comprising an inner section mounted on the support and an outer section pivoted to said inner section for movement in a generally vertical plane and with respect to said inner section, a head pivoted to said outer section for movement in a generally vertical plane and with respect to said outer section, said head including means for holding a stone thereon, means for locking said head in selected angled condition with respect to said outer section of said arm, and means for limiting at least the downward movement of said outer section with respect to said inner arm section, said limiting means comprising a stud projecting generally laterally from one of said arm sections, and the other of said arm sections having an open ended slot adapted to receive said stud therein in abutting holding relation.

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