No. 614,247. Patented Nov. 15, 1898.

E. T. GOODHEW & H. GOLDSMITH.

GRINDING MACHINE.

(Application filed Aug. 27, 1897.)

(No Model.) 3 Sheets—Sheet 1.

Fig. 1.

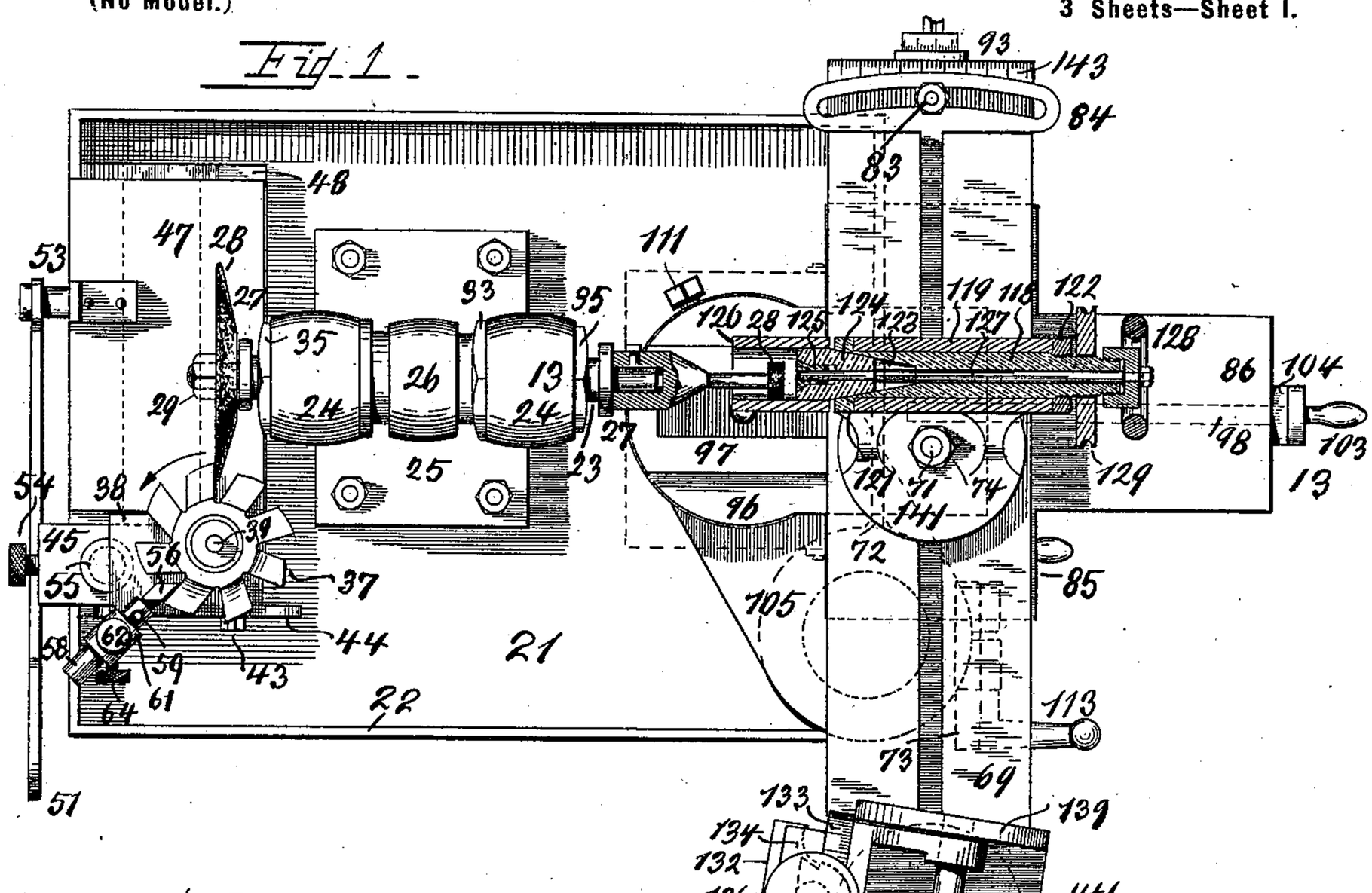


Fig. 3.

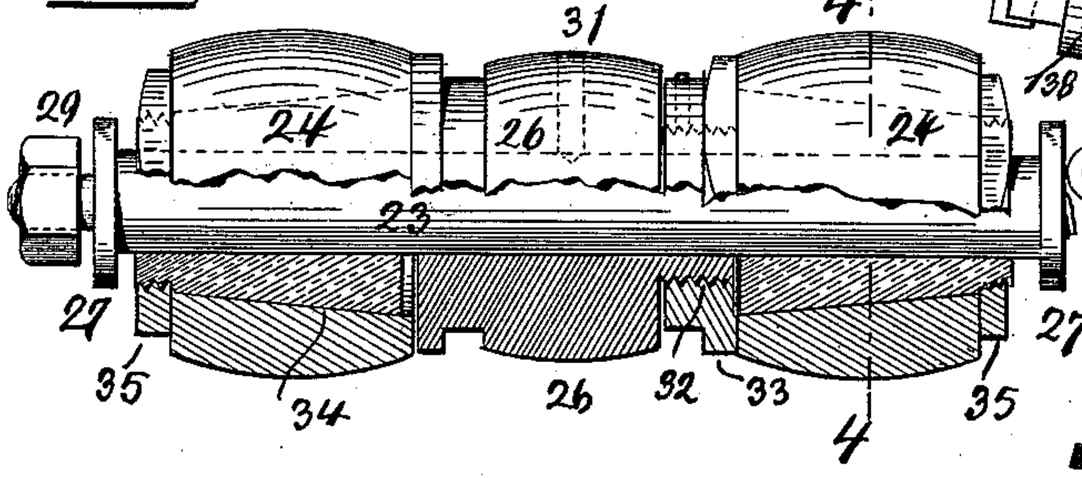


Fig. 4.

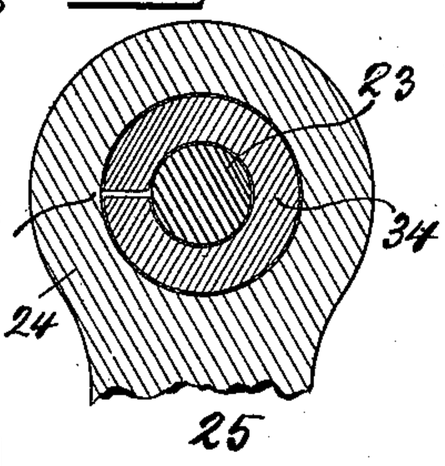
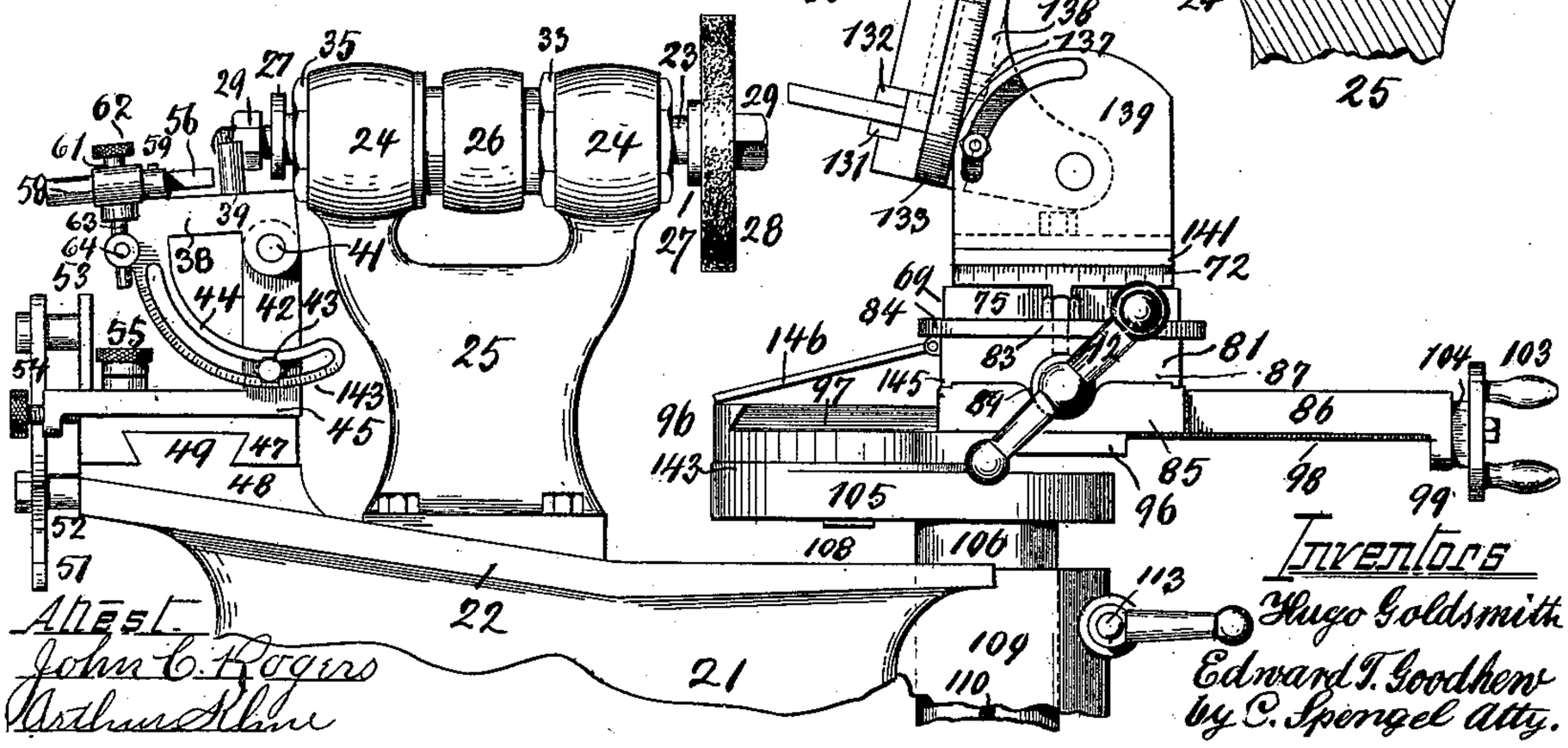


Fig. 2.



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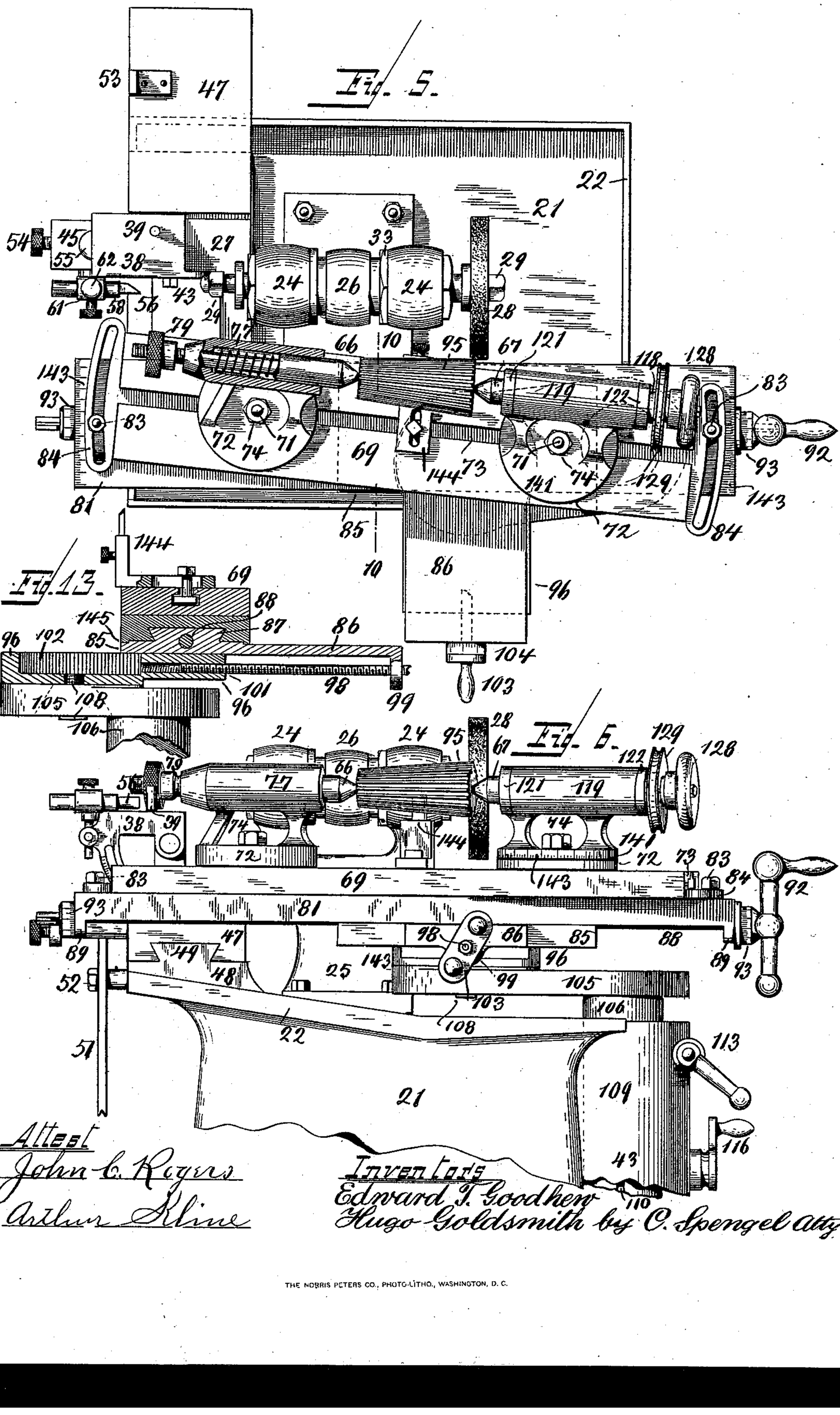
(No Model.) 3 Sheets—Sheet 2.

Fig. 5.



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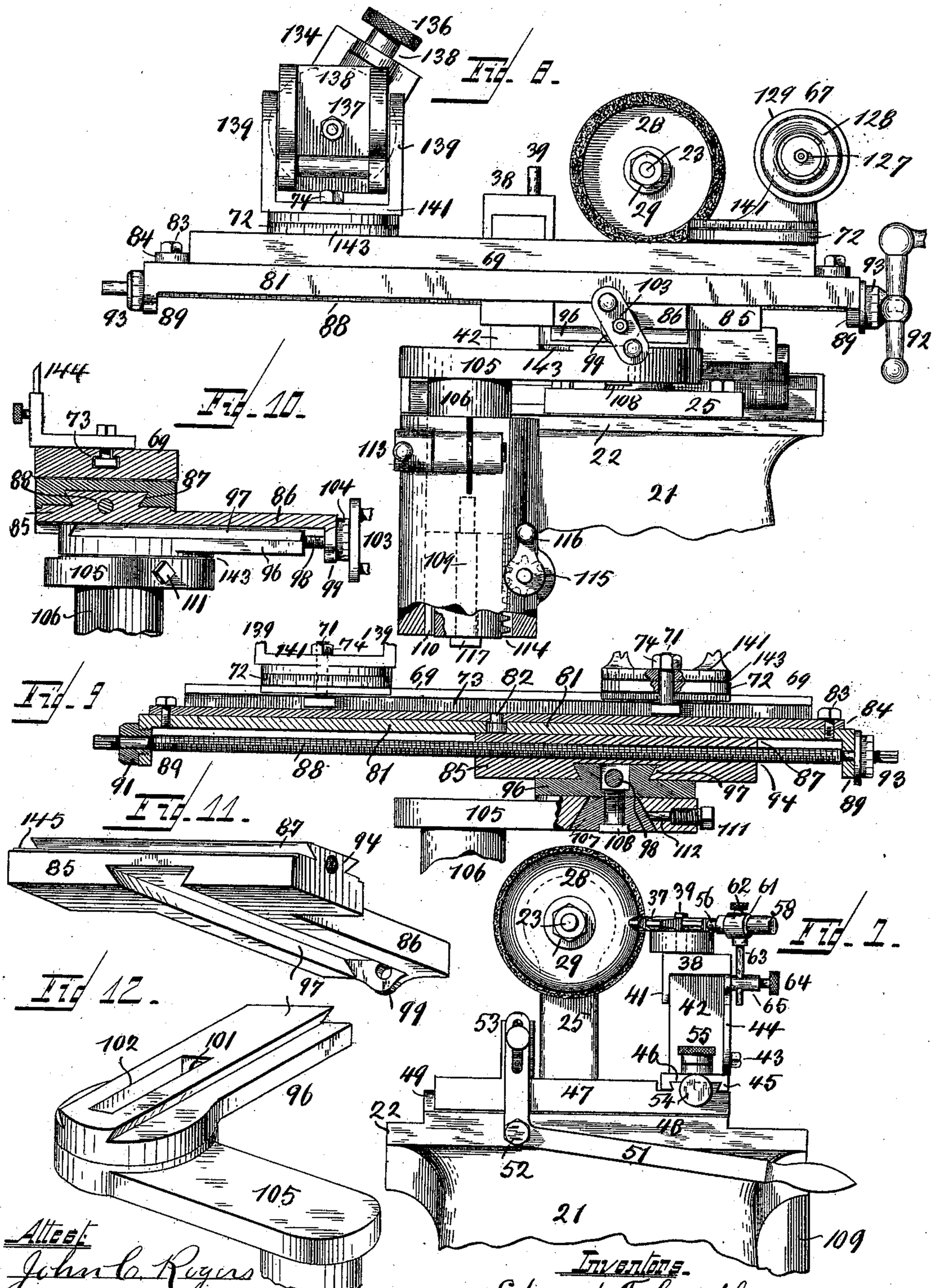
No. 614,247. Patented Nov. 15, 1898.

E. T. GOODHEW & H. GOLDSMITH.

GRINDING MACHINE.

(No Model.) (Application filed Aug. 27, 1897.)

3 Sheets—Sheet 3.



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UNITED STATES PATENT OFFICE.

EDWARD T. GOODHEW, OF COVINGTON, KENTUCKY, AND HUGO GOLDSMITH, OF CINCINNATI, OHIO.

GRINDING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 614,247, dated November 15, 1898.

Application filed August 27, 1897. Serial No. 649,763. (No model.)

To all whom it may concern:

Be it known that we, EDWARD T. GOODHEW, a resident of Covington, Kenton county, State of Kentucky, and HUGO GOLDSMITH, a resident of Cincinnati, Hamilton county, State of Ohio, citizens of the United States, have invented a certain new and Improved Grinding-Machine; and we do declare the following to be a clear, full, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, attention being called to the accompanying three sheets of drawings, with the reference-numerals marked thereon, which form a part of this specification.

This invention relates to a new and improved grinding-machine for grinding metallic surfaces, particularly such which occur in machine elements and in the cutters of machine-tools. In the first case the grinding is for the purpose of obtaining smooth and true surfaces, flat or round. In the other case it is for restoring cutting edges and points of such tools as are used in milling-machines, gear-cutters, lathes, planers, shapers, &c., also reamers, straight and tapering, mandrels, gages, &c. In each case—that is, for each particular class of work—suitable holding attachments capable of being adjustably and removably secured are to be provided.

The objects of our invention, attained by the construction shown, are particularly convenience in operation, which enables the attendant to perform all manipulations, feeding, &c., from one side without changing his position, and quick change and adjustment from one kind of work to another, which is done by reducing the handling of attachments to the lowest possible minimum and without requiring replacing or change of them except in extreme cases. The construction is such that the work is always in plain view of the operator without throwing any of the waste, chips, dust, or sparks upwardly into his eyes, and, finally, on cutting-tools it grinds against the cutting edge, preventing thereon the formation of wire-edges, which require subsequent removal by filing.

In the following specification and particularly pointed out in the claims is found a full description of the invention, its operation, parts, and construction, which latter is also illustrated in the accompanying three sheets of drawings, in which—

Figure 1 shows a top view of the machine with the parts adjusted for grinding on the left side the teeth of a forming-cutter, such as is used in milling-machines or gear-cutters, and on the right side for surface-grinding, the object under work being the inner surface of a hollow cylindrical machine element. While it is not customary to use the machine in this way—that is, with both ends of the grinding-spindle engaged simultaneously—it may nevertheless be done and is so shown in the drawings to avoid unnecessary repeated illustrations of parts. Fig. 2 is a front elevation of Fig. 1 with the left end of the machine not used. The right end is about to be actively engaged and shows parts adjusted for grinding, for instance, the beveled edge of a die. Inclined cutting edges required in lathe and planer tools or their necessary clearance are also obtained in this manner. Fig. 3 shows an enlarged view, partly in longitudinal section, of the grinding-spindle and manner of its support, whereby wear of the parts is taken up to maintain it in perfectly true positions. Fig. 4 is a cross-section on line 4 4 of Fig. 3. Fig. 5 shows the machine in top view with the parts adjusted for grinding a taper-reamer at the right end of the grinding-spindle. The principle of this adjustment is applied to all tapering and circular work—as, for instance, taper-bearings of spindles, arbors, and mandrels, angular milling-cutters, rose-bits, &c. Fig. 6 is a front view of Fig. 5. Figs. 7 and 8 are end elevations of the machine, showing left and right ends, respectively, of the same and parts about in a position as shown in Figs. 1 and 2. Fig. 9 is a central longitudinal section of the work-supporting table with parts below it and in the position shown in Figs. 1, 2, and 8. Fig. 10 is a cross-section, on line 10 10 of Fig. 5, of the table and parts supporting it. Fig. 11 is a perspective view of the sliding base-frame supporting the table. Fig. 12 is a similar view of the pivotally-supported arms carrying it. Fig. 13 is a section on line 13 13 of Fig. 1.

The different parts of the machine are car-

ried by a frame 21, of which the upper part only, to which they are secured, is shown. The top or bed-plate of this frame is surrounded by a marginal guard 22 to confine the water used during grinding and cause the same to flow off through a general drain, thereby preventing it from splashing all over the floor. The details of this water-supply and its drain are not shown because being well known in machines of this kind.

The grinding-spindle 23 is supported in bearings 24, forming part of a standard 25, secured by its base to and rising from the top or bed-plate of the machine and driven by a pulley 26, mounted midway. Beyond the bearings are flanges 27, against which the interchangeable grinding-wheels 28, usually of emery, are seated, being held by nuts 29. The pulley is locked to the spindle by a set-screw 31 and has on one side an externally-threaded neck 32, upon which a nut 33 is mounted, which enables close adjustment of the pulley between bearings 24 and compensation for wear, so as to prevent longitudinal vibration of the spindle. Wear of the latter in its bearings is taken up by split boxes 34, which have an outside taper and line the bearings interiorly, beyond which they extend. This extended part is in each case screw-threaded and carries a nut 35, whereby the boxes are drawn outwardly as they wear, whereby their taper causes them to bear snugly around the spindle, the split 36, Fig. 4, permitting them to close to the required extent.

For grinding forming-cutters used in milling-machines and gear-cutters the left end of the grinding-spindle is used. By such cutters is meant circular cutters, the cutting edges of which must always be strictly preserved as to contour and shape by reason of the particular work they perform. These cutters, one of which is indicated at 37, are supported on a rest 38, on which they are held by a center-stud 39, to be received by their bore, and on which they may be rotated to present successively their teeth to the action of the grinding-wheel. This rest is pivotally secured at 41 to a post 42, which permits for it a tilting adjustment in a horizontal plane, (see Fig. 2,) in which the teeth are then ground at an angle if such is required for any certain purpose—as, for instance, when grinding stocking-cutters. The rest is held in this adjustment by a set-screw 43, seated in post 42 and passing through a slotted segmental bracket 44, forming part of the rest. Post 42 is carried on a sliding base 45, through which rest 38 receives an additional adjustment in a direction parallel to the grinding-spindle and across the face of the emery-wheel. This sliding base is held in place by a dovetailed connection 46 on its under side, one of the complementary parts of which is formed on the upper surface of a sliding bed-plate 47, by which all the described parts above it, including support 38, receive an adjustment at right angles to the adjustment last mentioned and to and from the face of the emery-wheel, which adjustment constitutes the feed motion. During this latter motion bed-plate 47 slides on a base 48, on which it is held by a dovetail connection 49, being manipulated by a lever 51, pivoted at 52 and connected at 53 to bed-plate 47.

54 is an adjusting-screw for moving base 45 on dovetail connection 46, by which it is held to bed-plate 47. 55 is a binding-screw carried by it, which when screwed against sliding bed-plate 47 locks it thereon in its adjusted position.

50 is simply a boss on slide 45 to increase the thickness of the metal thereat sufficiently to permit the necessary number of threads for reception of binding-screw 55. (See dotted lines in Figs. 2 and 7.)

There is also an adjustable spring-actuated stop 56, which is adjustably connected to rest 38, its object and function being to prevent uneven grinding of the cutting-teeth—that is, taking off more from one than the other. Fig. 1 shows the manner of use of this stop plainly. After the cutter to be ground has been placed on stud 39 and rest 38 is properly adjusted as to position the amount required to be ground off is determined. With the cutter then held in such position stop 56 is adjusted against any one of the other teeth nearest accessible, whereby a certain fixed relation is established between stop and grinding-wheel on the one side and all the rest of the teeth on the other side, with the ultimate effect that all of the latter are accessible and exposed to an equal extent to the action of the grinding-wheel. The manipulation is then simply as follows: The cutter-tooth is pressed with one hand against the grinding-wheel, while with the other, by means of lever 51, the sliding bed-plate 47, with the cutter, is slowly fed inwardly—that is, toward the grinding-wheel—until the base of the tooth is reached. Meanwhile stop 56 by being in contact with one of the other teeth prevents the emery-wheel from taking too much off of the tooth being ground. After one tooth has been finished the parts are quickly reversed by an opposite operation of lever 51, the cutter is turned in the direction of the arrow to the next tooth, the stop, being beveled, yielding readily, after which the side of the next tooth to be ground is held against the emery-wheel and fed inwardly, as described before.

As to details of construction, stop 56 is carried in a barrel 58, with a spring behind it, while a pin 59, extending into a groove of the former, prevents the spring from pushing it out entirely. For purposes of adjustment to or from the cutter to be ground barrel 58 is mounted in a sleeve 61, within which it is held by a set-screw 62. This sleeve is carried on a rod 63, held by a set-screw 64 on a stud 65, by which the whole is connected to rest 38, and on which it has a vertical

as well as a rotary adjustment, so that, as will be seen, stop 56 by reason of these various adjustments may be readily adjusted to meet one of the teeth of a cutter to be ground. All other work is done by the grinding-wheel at the right end of the grinding-spindle, being held, according to its nature, either by centers 66 and 67 or a vise 68. These holding devices may be used interchangeably and are adapted to be detachably connected to a table 69, being held thereto by a locking-bolt 71, passing through the base 72 of each device, and the head of which fits into an inverted-T groove 73, passing lengthwise through the table and open at its ends to permit such bolt-heads to pass in. When arrived in proper position, nuts 74 above bases 72 are tightened, thus holding the particular device in place. Feathers 75, projecting from the under side of base 72, fit into the upper part of groove 73, and thereby prevent the particular device from turning about its bolt 71 in case the latter should not be properly tightened. Center 66 consists simply of a center-point the shank of which is mounted within a barrel 77, with a spring behind it to obtain the necessary live pressure for holding the particular work in place between it and the other center-point 67. (See Fig. 5.) This shank is rearwardly extended beyond barrel 77, the projecting end being provided with a knob 79 for manipulation for the purpose of admitting and disengaging the work.

Table 69 rests on a bed-plate 81, on which it has an adjustment in a horizontal plane, swinging about a central pivot 82. It may be locked in its adjusted position by set-screws 83, passing through slots in flanges 84 at both of its ends and seated in bed-plate 81. The latter is supported on a base-frame consisting of two members 85 and 86, at right angles to each other, it being more particularly supported on member 85 on which it is held by a dovetail connection 87 in a manner to have a sliding adjustment thereon. This adjustment, which is in the direction of its length, constitutes one of the feed motions and is obtained by the operation of a feed-screw 88, mounted with its ends in flanges 89, depending from the ends of sliding bed 81, and between which said screw is longitudinally confined. In practice this confinement is obtained by reducing the thickness of the screw where it passes through these flanges, whereby shoulders are formed which prevent the thicker part of the screw from passing through. The necessary larger hole required at one end of the flanges to permit insertion of the screw during manufacture is closed up by a bushing 91. A crank-handle 92, which may be used at either end, and customary indexes and dials 93 are provided at each end. This feed-screw is seated in a threaded bore 94 of member 85 of the base-frame, and it is evident that by rotating screw 88 bed-plate 81, with table 69, may be moved longitudinally in either direction on said base-frame.

For grinding tapering surfaces or tapering tools—like, for instance, a taper-reamer, as shown at 95 in Figs. 5 and 6—table 69 is adjusted on bed-plate 81 to the proper angle so as to bring the surfaces to be ground into a line parallel with the feed motion, in which position it is held by locking-screws 83. For all other work table 69 is in a coincident position with the bed-plate below, as shown in Fig. 1. For moving the table with the work to or from the grinding-spindle—that is, at right angles to the feed motion just described—an arm 96 is provided, upon which the base-frame by its member 86 is mounted, being held thereto also by a dovetail connection 97, operation being by an adjusting and feed screw 98, longitudinally confined by one of its ends in a flange 99 at the overhanging end of member 86. This screw is mounted in a threaded bore 101 of arm 96, part of which is cored out, as shown at 102, since it is unnecessary that the screw pass through the solid metal of the entire length of said arm. This screw is also provided with the customary operating-handle 103 and dial and indexes 104. Arm 96 is pivotally connected to another arm 105, projecting from a post 106, the connection being by a tapering plug 107, held by a screw 108 to arm 96, thus furnishing a substantial bearing. Post 106 is pivotally supported in a bearing 109, projecting from frame 21. It will now be seen that by means of these two pivotally-connected arms 96 and 105, which form an articulated bracket, the work-supporting feed-table may be quickly swung to any position either in front of the face or opposite the end of the grinding-wheel, as shown, respectively, in Figs. 5 or 1. The bracket-arms may be locked rigid in position by a locking-screw 111, pushing a locking-key 112 against plug 107, and by a clamping-screw 113, tightening the upper split part of bearing 109 against post 106. The closer and final adjustment is then had by operating either one of handles 92 or 103. Under conditions as illustrated in Fig. 5 handle 103 would be used for such purpose, while handle 92 would be used for feeding. As shown in Fig. 1 handle 92 would be used for the final close adjustment and handle 103 for feeding.

If when in the adjusted position shown in Fig. 5 certain parts (center 66) come too close toward the left end of the grinding-spindle, the grinding-wheel thereat is detached and support 38 moved out of the way. If the limit of this latter adjustment by lever 51 is exhausted, the same is disconnected either at its end or at its fulcrum, which permits the parts to be moved still farther back.

For vertical adjustment of the work-post 106, which carries all parts, is raised or lowered in its bearing by means of a rack 114 and pinion 115, operated by a handle 116. To permit such without interfering with rotation of the post, the lower part of the same, which carries the rack, is independent from the up-

per as to rotation, but connected thereto for vertical movement by a screw 117. To counteract any tendency of the lower part to rotate by reason of frictional contact with the upper part, a groove and key may be provided between such lower part and the adjacent part of bearing 109, as shown at 110, Fig. 8.

In grinding certain kinds of work it becomes necessary that it be rotated at the same time while being ground to preserve a true cylindrical outline or bring certain projecting parts, like cutting edges, all within a true circular line. Again, certain work must be supported otherwise than being held between centers. For such purposes the frame supporting center 67 is constructed to meet all these requirements.

To obtain rotation, a mandrel 118 is mounted in barrel 119, being held therein by a flange 121 at one end and a nut 122 at the other. One of its ends—the one nearest the grinding-wheel—has an outwardly-flaring socket 123 to receive the tapering shank of center-point 67 or of whatever special work-holding device is used.

In Fig. 1 an expansion-bushing 124 is being used, which is a bushing with a tapering end fitted into socket 123 and lengthwise split on a radial line reaching to the center. It is also counterbored from its outer end to receive a tapering plug 125, which when drawn inwardly spreads this split bushing and holds firmly the object 126 to be ground. This plug is moved in or out by a rod 127, rigidly connected to and manipulated by a hand-wheel 128, which is mounted on mandrel 118 by a screw connection. If the particular object is too large for the expansion-bushing 124, intermediate bushings or washers may be employed. A chuck similar to a lathe-chuck may also be used here, its attachment readily suggesting itself. Whenever rotation is now required for any of the special work-holding devices, such is readily obtained by means of a belt-pulley 129, mounted on mandrel 118. Connection may be made by a belt from the same counter-shaft which drives the grinding-spindle. To obtain the adjustment of this whole center with reference to the grinding-spindles and as shown in Fig. 1, base 72 is in two parts, the upper one, 141, turning on the lower one, which latter rests on table 69, the two being locked by the same screw 71. In the position shown adjustment as to the amount to be ground away is obtained by manipulating handle 92, while the feed motion proceeds from handle 103. There is also a vise 68 provided, fitted and held onto table 69 in the same manner as described before for the centers. Whenever it is required, the bases of centers 66 and 67 may be loosened and slid to one end of table 69 to make room for the vise, and only in extreme cases—for instance, with a long piece of work in operation requiring an extended feed motion—may it become necessary to remove one of the centers entirely. In such case the same is endwise moved out of groove 73 and the vise is moved in in the same manner. In Figs. 1 and 8 it is shown inactive, while in Fig. 2 it is about ready to be adjusted up against the grinding-wheel. Either one of handles 92 or 103 may be assumed as being used for feeding. In addition to the general adjustment which it shares with table 69 it has three independent adjustments, due to its own construction, any or all of which may be interchangeably combined to provide six kinds of compound adjustments, with hardly any limit as to any specific positions within the limits of the general adjustments. The lower jaw 131 is stationary with reference to the upper one 132, being connected to a seat projecting from a back 133. The upper jaw 132 is connected to the lower end of a slide 134, held in place on back 133 by a dovetailed connection. It is manipulated by a screw 135 and hand-wheel 136. Back 133 is pivotally mounted on a central locking-screw 137, seated in a swinging frame 138, on which latter back 133, with the vise-jaws, may be adjusted and locked in any position. Frame 138 is pivotally connected to and between standards 139, rising from a base 141, pivotally supported above the general face 72 of the devices. It will thus be seen that the vise-jaws may be laterally adjusted on back 133 to any angle. This adjustment may be combined with another adjustment in a plane at right angles to the plane within which the first adjustment lies, and is done by swinging frame 138. To either one of these adjustments or to them combined may be added the third kind of adjustment, which is by turning the whole base in a horizontal plane on the base. The different uses of the vise readily suggest themselves, but are principally for surface-grinding and grinding lathe and planer tools. Customary scales and indexes 143 are provided in addition to those mentioned and wherever necessary and on all parts having adjustments—as, for instance, at the ends of table 69 and on bed-plate 81 for the angular adjustments of the former on the latter, on the rotary bases supporting centers 67 and vise 68, on the backs and swinging frame of the latter, on the segmental bracket supporting rest 38, on the bosses and hubs between arms 96 and 105 for the operation of handle 116 to raise and lower post 106, &c.

144 is an adjustable stop operating on the principle of stop 56, and is used, for instance, when work is done as shown in Figs. 5 and 6 to enable the operator to hold the particular edge to be ground in proper even contact with the grinding-wheel while he feeds the object across the latter. A rabbet 145 may be cut in the edges of member 85 of the sliding frame, as shown in the drawings, to obtain a dust-proof joint between the former and bed-plate 81. To protect the dovetail on the upper surface of arm 96, particularly when parts are in a position as shown in Figs. 1 and 2, a

hood 146 is provided, which by being hingedly secured to bed-plate 81 moves with the same and lies over the exposed parts. It adjusts itself and keeps grit, dust, and chips out. It is only shown in dotted lines in Fig. 1.

The different possible adjustments and feed motions of the work due to the various adjustments of table 69 are in short as follows: Pivotal adjustment of it on bed-plate 81, as shown in Fig. 5; adjusting and feed motion of the two in one direction on members 85 of the base-frame; adjusting and feed motion of the three on arm 96; pivotal adjustment of all these parts—that is, table 69, bed-plate 81, base-frame 85 and 86, and arm 96—on arm 105; additional pivotal adjustment of these parts on post 106, and vertical adjustment of all the previously-mentioned parts within bearing 109.

Having described our invention, we claim as new—

1. In a grinding-machine, the combination of a grinding-spindle and a work-holding table which has a swinging adjustment in a horizontal plane to or from the former and to a position at any angle thereto, being supported for such purpose on two pivots, adjustment being had by swinging on either one of them, or on the two, it having also two sliding adjustments at right angles to each other in any position of the pivotal adjustment.

2. In a grinding-machine, the combination of a grinding-spindle, a work-holding table 69 of rectangular shape, a bed-plate 81 of similar shape, a centrally-located pivot whereby it is connected to the latter so as to have a swinging motion thereon, which permits its adjustment to a position to be either parallel or to have an angular relation to the bed-plate, the two together being also capable of two adjustments at right angles to each other, two feed-screws at right angles to each other, whereby these adjustments are obtained and means to lock table 69 to bed-plate 81.

3. In a grinding-machine, the combination of a grinding-spindle a work-holding table and two arms each pivotally connected on which the table is pivotally supported in a manner to have an adjustment in a horizontal plane to or from the grinding-spindle to a position at any angle with reference to the latter.

4. In a grinding-machine, the combination of a work-supporting table, an arm 96 on which it is supported to have reciprocatory adjustment and on which it is held by a dovetailed connection and a hood 146 hingedly supported and adapted to automatically cover parts of the latter when they are exposed during adjustment.

5. In a grinding-machine, the combination of a grinding-spindle, and a work-holding table two pivots on which it is supported and whereby it becomes capable of a swinging adjustment in a horizontal plane to or from the grinding-spindle and to a position at any angle thereto, a general frame which contains a bearing for one of the pivots, and means to provide for a vertical adjustment of such pivot.

6. In a grinding-machine, the combination of a frame 21, a standard 25 mounted thereon and supporting a grinding-spindle, a lateral bearing 109 on the frame, a post 106 supported thereby, the connection being such as to permit such post to rotate, means to give it vertical adjustment in its bearing and a work-holding table carried by the post.

7. In a grinding-machine, the combination of a grinding-spindle, a work-holding table, an arm 96 on which it is supported in a manner to have pivotal adjustment, the support being mediated by an interposed base-frame 85, 86, to which each is connected, the connection being by grooves and dovetail and as to one arranged at right angles with reference to the connection of the other whereby the work-holding table is supported with two adjustments at right angles to each other.

8. In a grinding-machine, the combination of a grinding-spindle, a work-holding table, an arm 96 on which it is carried and which is pivotally connected, the connection being by a tapering plug 107, rigidly connected to arm 96 and received by a correspondingly-shaped socket and means for locking plug 107 against rotation thereby holding arm 106 in its adjusted position.

In testimony whereof we hereunto affix our signatures in presence of two witnesses.

EDWARD T. GOODHEW.
HUGO GOLDSMITH.

Witnesses:
C. SPENGEL,
ARTHUR KLINE.