(No Model.) 4 Sheets—Sheet 1.

F. HOLZ & G. A. MUELLER.

UNIVERSAL HEAD FOR MILLING MACHINES.

No. 333,631. Patented Jan. 5, 1886.

Fig. 1.

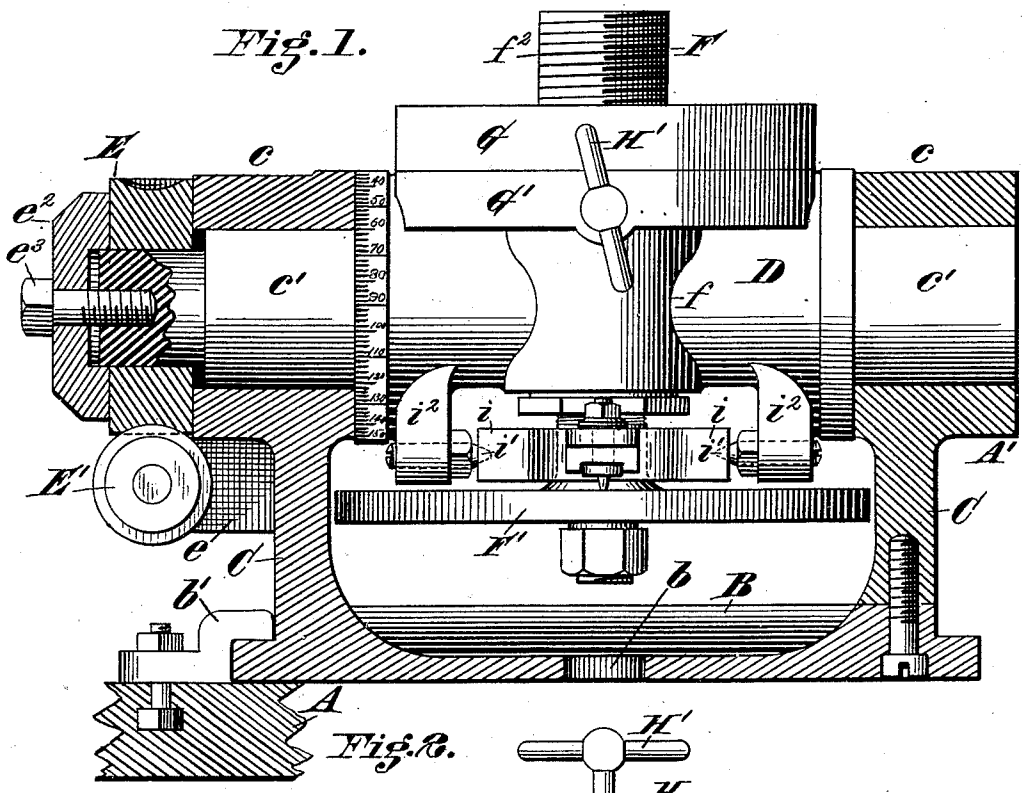
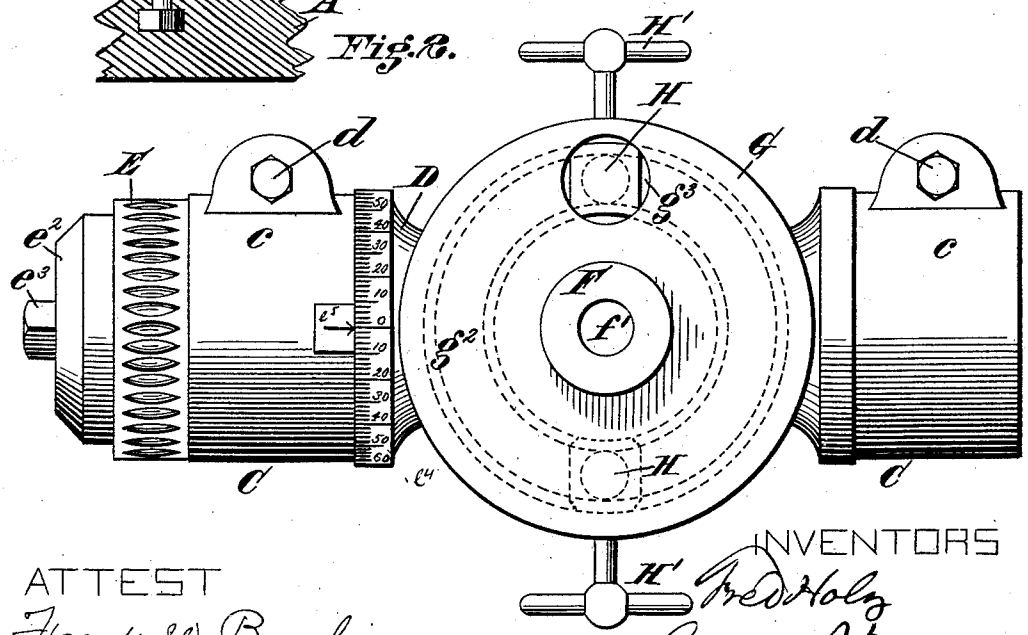


Fig. 2.



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Fig. 3.

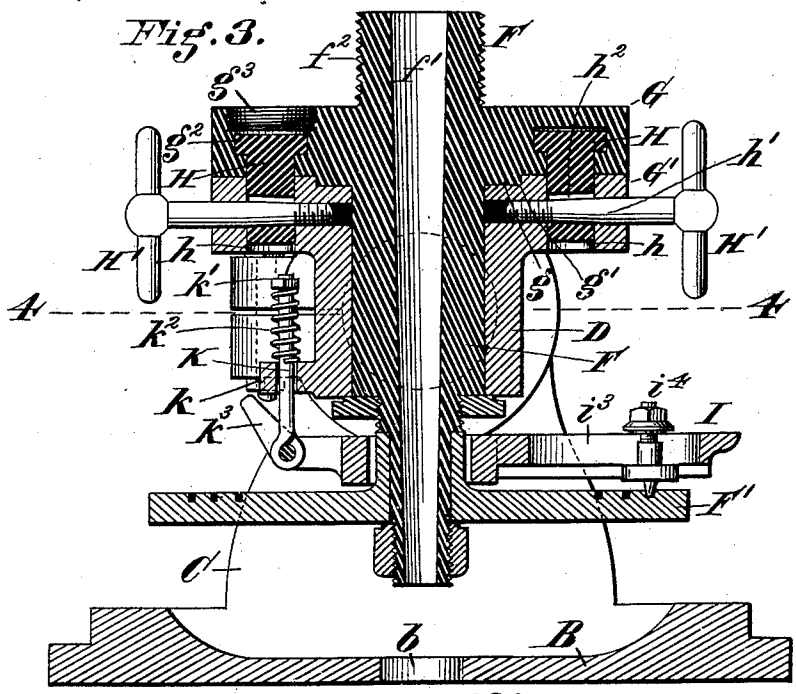
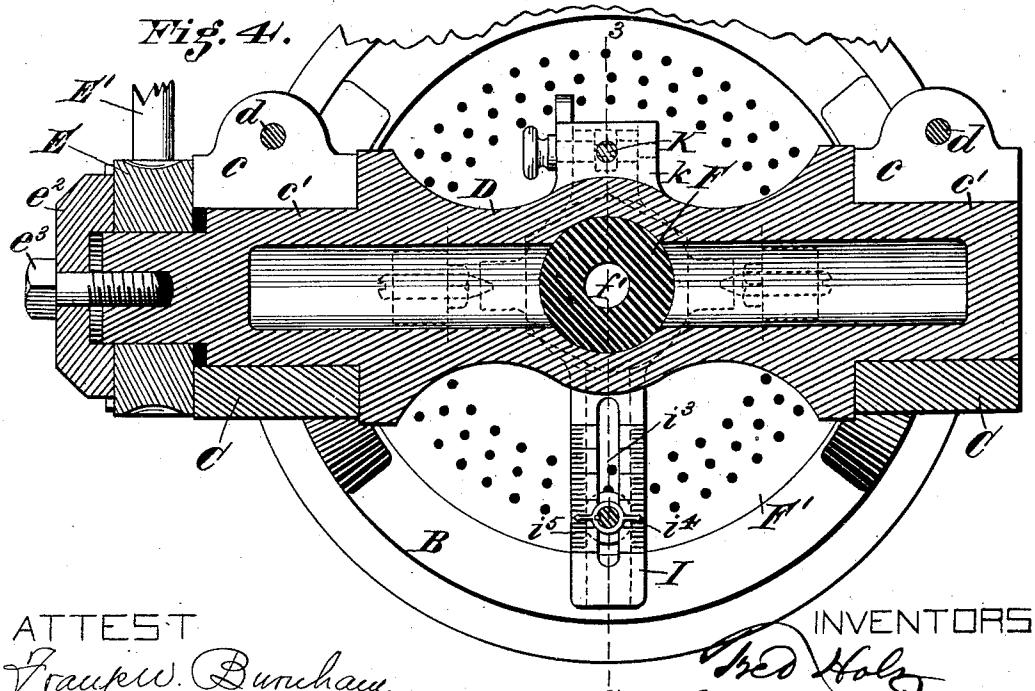


Fig. 4.



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Fig. 5.

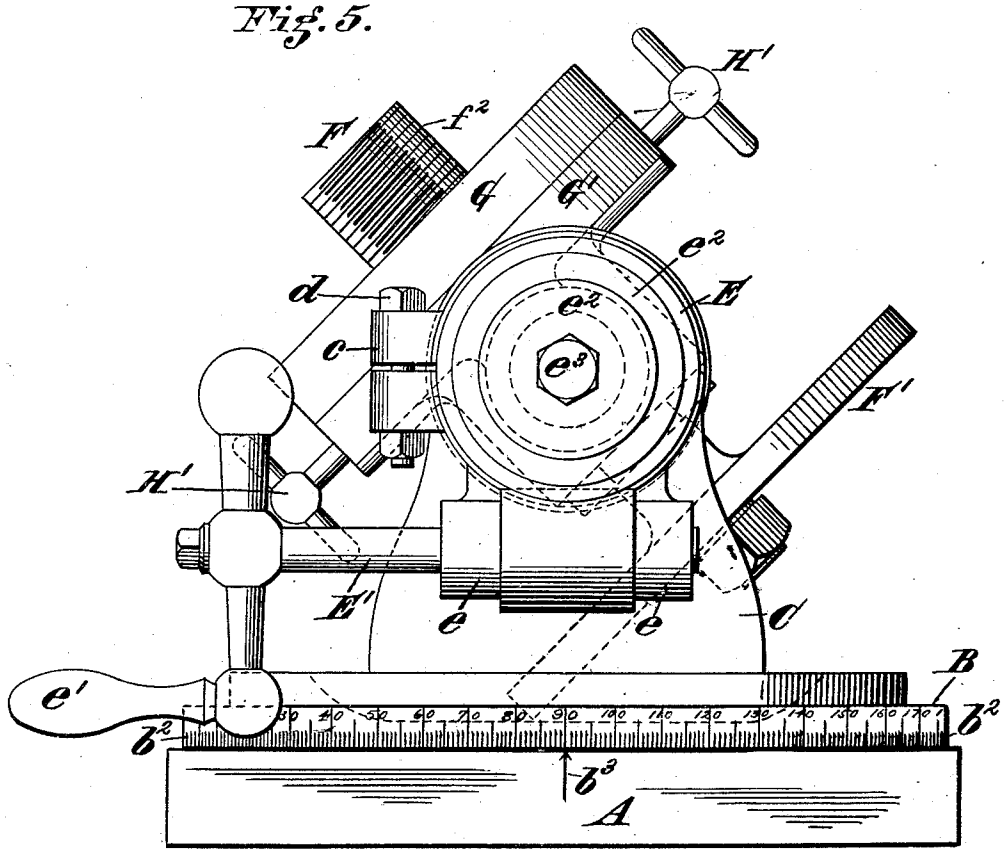
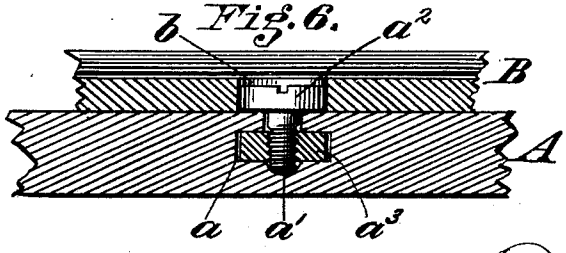


Fig. 6.



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Fig. 7.

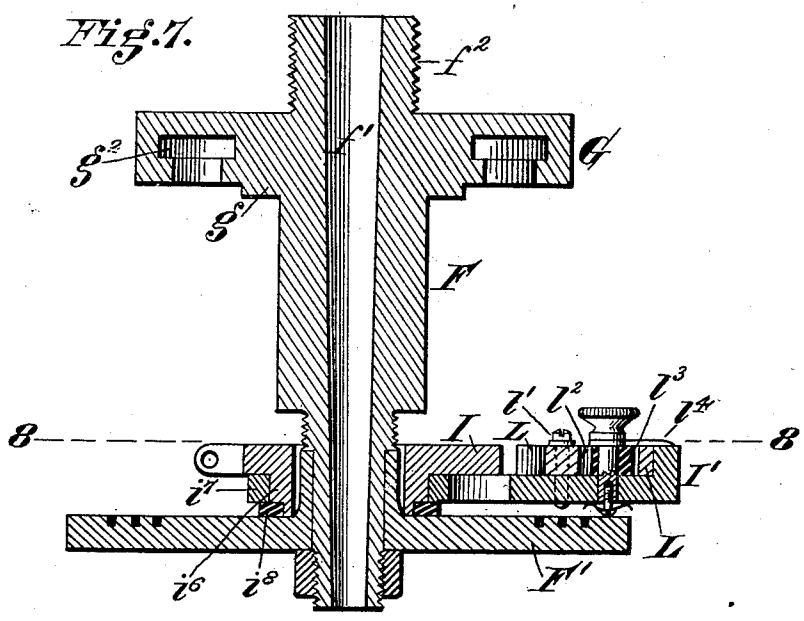
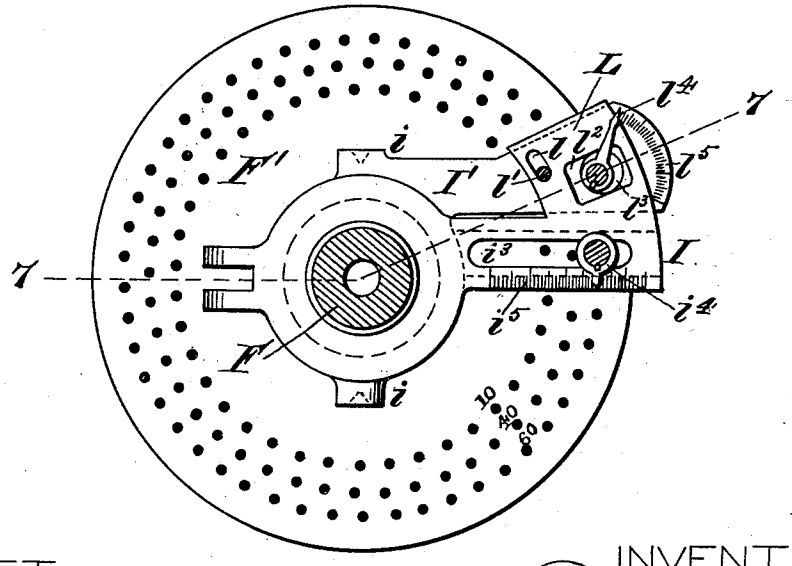


Fig. 8.



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UNITED STATES PATENT OFFICE.

FRED HOLZ AND GEORGE A. MUELLER, OF ANDERSON'S FERRY, ASSIGNORS TO THE CINCINNATI SCREW AND TAP COMPANY, OF CINCINNATI, OHIO.

UNIVERSAL HEAD FOR MILLING-MACHINES.

SPECIFICATION forming part of Letters Patent No. 333,631, dated January 5, 1886.

Application filed February 2, 1885. Serial No. 154,766. (No model.)

To all whom it may concern:

Be it known that we, FRED HOLZ and GEORGE A. MUELLER, both of Anderson's Ferry, in the county of Hamilton and State of Ohio, have invented certain new and useful Improvements in Universal Heads for Milling and Analogous Machines, of which the following is a specification.

Our invention has for its prime object to secure a greater universality and more perfect control in the presentation of the work held in the cutting or dividing head of a milling-machine; but its general features will be found applicable in shapers, planers, and other machines on which it may be desirable to cut work at an angle.

Its main points may be summarized in the statement that the mandrel or work-carrier is permitted, for the purposes of adjustment, first, rotation upon a pivot perpendicular to the supporting bed or carriage; second, rotation or oscillation upon a pivot at right angles to the first; and, third, a rotation upon its own axis, thus allowing the work an adjustment representing the resultant of any one or more of the others; also, that provision is made for a primary adjustment of the index-dial to determine the interval between the kerfs, and for a secondary adjustment subordinate to the first, and without disturbing the index-pin, for the purpose of a fresh cut in the same kerf, whereby, especially, the kerfs of bevel-wheels may be suitably converged from outer to inner end.

In the drawings, Figure 1 is a side elevation of our improved head, showing the base and journal-boxes in section. Fig. 2 is a top plan view. Fig. 3 is a vertical central section thereof through mandrel and index-plate. Fig. 4 is a top plan view on the line 4 4 of the preceding figure. Fig. 5 is an end elevation, showing the swinging member of the head partly turned on its transverse axis. Fig. 6 is an enlarged detail, in section, of the table and pivot-bolt for positioning the head thereon; and Figs. 7 and 8 are respectively a vertical section and a top plan view of mandrel, index-plate, and the differential apparatus whereby said plate is controlled to permit a second cut in the same kerf.

A represents a portion of the bed-plate or traversing table upon which the head is mounted. In this table is formed a longitudinal reversed T-slot, *a*, having at a suitable point a depression, *a'*, into which fits the lower end of a screw-bolt, a^2, secured against displacement by a nut, a^3, adapted to slide in the slot. The head of this bolt is received in a close-fitting cylindrical bore or aperture, *b*, in the superposed discoidal base B, thus being made to secure said base against lateral displacement so long as itself is firmly clamped in its position along the slot, and also to serve as a vertical pivot for the rotation of the cutter-head, of which this base forms a part, and as a guide for placing it in its proper position upon the table. Said discoidal base B is clamped to the bed-plate and held against rotation in the interval between any adjustment by any suitable means, preferably clamps *b'*, secured by means of bolts and nuts sliding in the just-mentioned longitudinal slot in said bed-plate. Around the perimeter of the base is inscribed a suitable scale, b^2, and on the bed-plate will be marked or affixed an arrow or pointer, b^3, for the purpose of these adjustments.

Two brackets or standards, C, rise from the bed-plate opposite each other and receive in split journal-boxes *c* the trunnions *c'* of a horizontal stock, D, which supports and forms a transverse axis for the mandrel or work-carrier and its immediate accessories, as will presently appear. These split journal-boxes are adjustable, by means of clamping-bolts or set-screws *d*, to take up wear, or, if found necessary, to grasp the trunnions frictionally and hold the stock in fixed position at any point of its oscillation or effective rotation. One of the trunnions is turned down to receive a worm-wheel, E, made fast thereto in the usual manner by means of an intermeshing worm-shaft, E', set in lateral bearings *e* from the adjacent bracket, and having at its outer end a crank or hand-hold, *e'*. This wheel, and consequently the stock and the mandrel car-

ried thereby, may be revolved when desired, but will be held firmly in position, as far as this axis is concerned, in the intervals between adjustment while a cut is being made, the peculiar form of gear being sufficient of itself, under all ordinary circumstances, to insure such locking. As an additional measure of security, however, more convenient than a resort to the split bearings already mentioned, a cap, e^2, is provided, so shaped as to embrace and be steadied by the end of the trunnion projecting beyond the worm-wheel, and to bear against the outer face of said wheel, which, instead of being rigidly keyed in place, will be allowed some lateral play along its key. A screw-bolt, e^3, is passed through the center of the cap and threaded into an axial socket in the end of the trunnion, so that by turning the bolt in the proper direction the wheel and opposing shoulder of the stock may be drawn toward each other and firmly clamped against the intermediate bearing-bracket. To insure precision in the adjustment upon this axis, a scale, e^4, is marked upon a rim of the stock, completely encircling it, or extending at least to the entire expected range of oscillation, and an appropriate pointer, e^5, is provided upon one of the brackets, advisably the one supporting the worm-shaft, as it is there most conveniently referred to, and alongside which bracket the scale will of course be located.

At right angles to the stock, and fitting into a bearing, f, in the center thereof, is the centering-spindle, mandrel, or work-carrier F, hereinafter, for convenience, invariably termed "mandrel," to one end of which is attached, by a key or otherwise, the index plate or dial F', perforated with concentric series of holes, or having equivalent gaging devices whereby it, with the attached mandrel, may be adjusted accurately through any predetermined portion of a revolution.

Centrally through the mandrel, from end to end, is a bore, f', tapering regularly toward the index-plate, at least for a considerable portion of its length, whereby chucks or arbors of different styles may be attached or work bolted on, and the end of the mandrel farthest from the index-plate, or at the larger diameter of the bore, is screw-threaded externally, as at f^2, for the reception of a face-plate or certain types of chucks not provided for by the bore.

Below the screw-threaded reach of the mandrel is a broad flange, G, integral with its body and resting upon a like flange, G', at the top of the central bearing of the oscillating stock. To strengthen the connection between the stock and the mandrel, the flange from the latter may be provided with a short and broad hub, g, fitting into a corresponding recess or seat, g', in the one from the oscillating stock. The flange G has at a short distance from its edge an annular T slot or channel, g^2, concentric with the axis, and closed above, except at one point, where there is an aperture, g^3, to admit the gibs or bolts H, which are headed to fit into the channel, and the shanks of which, passing through the pendent arm of said channel, enter close-fitting recesses h in the opposing flange beneath. Through this latter flange, and transversely of each recess therein, are passed cotters or lock-screws H', having smooth tapering stems h', and screw-threaded ends taking into the body of the stock at the inner side of said recesses. The shanks of the gibs have within the recesses transverse flaring apertures h^2, arranged for the passage of the cotters, yet so that the tapering parts thereof bear upon the lower side of the aperture and tend to draw the heads of the gibs forcibly down upon their seats, whereby the mandrel can be readily and firmly clamped to the stock and as readily loosened therefrom, and revolved with the index-plate when the latter is to be adjusted.

So far as the functions of the parts thus far described are effected thereby, the pin which serves to lock the index-plate, and consequently the mandrel, against rotation while the work is under the cutters, and generally called the "index-pin," may be sustained in and adjustable along an arm or guide rigid in all directions with the stock and parallel with the face of the index-plate, such arm, of course, having the usual scale; but in order to get this index-pin at times out of the way and permit the mandrel to be rotated freely by hand, and incidentally also, for more convenient accomplishment of still another feature of our invention—the differential adjustment—we have adopted the following arrangement, which, together with the additional feature alluded to and next after to be described, will be found capable of quite extensive application in machines of this general type.

Referring, now, to Figs. 1, 3, and 4, a lever, I, termed, in view of its purpose, the "index-lever," is mounted, by means of ears i and pivot-pins i', in hangers i^2 from the oscillating stock, so as to be free to vibrate perpendicularly to the index-plate, over which it extends, but prevented from movement in any other plane, except with said stock. To permit such vibration the lever only loosely embraces the hub of the index-plate, which would otherwise hold it against any pivotal play at all. Adjustably mounted in a longitudinal slot, i^3, in the forward or longer arm of the index-lever, is the index-pin i^4, provided with the usual indicator or indicators to co-operate with the scale or scales i^5, arranged along the side of the slot, and having clamping-nuts to hold it at any point of the scale with which it may have been registered. To the rear end of the index-lever is pivoted a link, K, playing through an eye in a lug, k, offset from the central bearing of the stock. At its upper or free end the link has a head or nut, k', and between this nut and the lug is seated an expansion-spring, k^2, coiled about the body of the link and tending constantly to draw up the

rear end of the lever, and thereby depress the other end to keep the index-pin in engagement with the index-plate. Thus the index-pin may be disengaged by lifting the front end of the lever, and the plate and mandrel turned to register the next perforation of the series, to which the pin has been set, with said pin, when the spring, acting on the rear end of the lever, will carry the pin into said perforation and again lock the plate.

In order that the index-lever may be latched out of engagement with the plate, a detent, k^3, is pivoted at its rear end conveniently by the same pin, serving as a pivot for the link, and this detent, when turned up to abut against the under side of the lug through which the link plays, will hold the corresponding end of the lever depressed, while the front end is conversely raised, leaving the plate and mandrel free to be turned any distance by hand, or permitting the index-pin to be adjusted without trouble.

Now, as to the differential adjustment. In bevel-wheels the kerf should converge from the outer to the inner edge of the working-face; but it is undesirable and almost impracticable to release the index-pin from the index-plate between each regular onward adjustment and move it from the series of perforations which determine the spacing of the cuts to another series, as would be necessary in order to get this slight differential movement with the ordinary mechanism. Therefore we have devised means, as we are now about to describe, whereby the fixed arm, if used, or the index-lever, if that should be adopted, may be moved laterally with precision a slight distance after the primary cuts are made and again locked fast, whereby the under pin may be used in connection with the same series of perforations over again, and secondary or supplemental cuts will be made alongside of and in the same kerfs previously cut.

As it is evident from the foregoing description of the index-lever in what manner the rigid index-arm may be used, so, also, a description of the differential device as applied to this lever will be sufficient to explain its use with the rigid arm. Instead of forming the lever I with its pivot-ears in a single piece, as in the foregoing construction, we form it with a hub, i^6, loosely embracing the hub of the index-plate, as before, and fit closely to this hub a collar, i^7, from a supplementary arm or lever, I′, securing this collar and arm to the primary lever by means of a rim or metallic washer, i^8, fastened to the hub of said primary lever, as shown in Fig. 7 in cross-section. From the collar project the pivot-ears i, which connect the lever with the stock, and the whole construction is in this manner so snugly secured together that it will vibrate as a single lever toward or away from the index-plate, while permitting the index-arm of the lever to play laterally upon the supplementary or pivot arm, or within the bearing formed by the collar of the latter.

A wing-piece, L, from the main arm, and described upon an arc concentric with the axis of lateral movement thereof, enters a similarly-curved way or seat passing through the supplementary arm near its outer end, and by means of a slot, l, and clamping-screw l', may be securely held thereto to prevent any play between the arms. A second slot, l^2, in the swing receives an eccentric, l^3, having a thumb-piece and a pointer, l^4, and upon the extreme end of this supplemental arm is a suitable graduated scale, l^5, with which the pointer co-operates.

So long as a cut is being made, or so long as the machine is being used upon work that does not require the first kerf made by the cutters to be widened, either uniformly along its whole length, as where a spur-wheel is being cut, and the cutter is too small or convergingly, as in the above-mentioned instance of bevel-wheels, the two sections of the lever will be firmly clamped together, as just explained, and the index-pin will be elevated and the index-plate moved to bring the next succeeding perforation beneath that pin after each completed cut; but when the nature of the work or of the cutter demands a second cut in the same kerf the index-pin may be left stationary in engagement with the index-plate when the original or opening kerf is finished, and the clamping-screw in the wing-piece be loosened and the eccentric moved until its pointer indicates the proper degree for the additional side cut, this movement pushing the main index-arm laterally, and with it the index-plate, the proper distance. Then the two sections will be reclamped together and the side cut made, and this being completed the clamping-screw will be again loosened, the eccentric returned to zero, bringing the index-plate back to its normal position, the clamping-screw turned to lock the sections together, the lever elevated, and the index-plate shifted until the pin matches and engages with the next succeeding perforation of the series, when a fresh cut may be made.

Instead of adjusting for the secondary cut after each several kerf is given its primary cut, as above described, the series of kerfs may successively be given their primary cut and the adjustment then made to give each in succession its secondary cut. The latter course will generally be found more convenient.

To briefly recapitulate: By the freedom of revolution secured to the mandrel upon its transverse axis—that is, upon the bearings of the supporting-stock—we are enabled to cut to a bevel of any desired angle upon either face of the work held, or cut upon its periphery at will, without detaching it from and resetting it in the mandrel. The capacity of rotating the base-plate upon the table, carrying with it the stock on an axis transverse to the axis of the latter, permits the mandrel to be

so set that the work will be cut at any desired angle of obliquity—as, for instance, in cutting skew-gear. These two movements give a practically universal adjustment for securing the starting-cut, and the rotation of the mandrel on its own longitudinal axis affords the progressive feed from that point to complete the work. This universality of adjustment, in addition to above merits, obviously dispenses with the necessity of using right and left tools.

We claim—

1. The combination, substantially as hereinbefore set forth, of the circular base-plate, the slotted table or bed-plate, the pivotal bolt for the base-plate, having a nut sliding in the slot in the bed-plate, the brackets rising from the base-plate, the stock having trunnions journaled in said brackets, the work-carrier or mandrel supported in said stock and transversely thereof, the clamp for the base-plate, and a clamp for the trunnions of the stock.

2. The combination, substantially as herein before set forth, of the base-plate, the stock, the mandrel or work-carrier supported transversely of said stock, the index-plate secured to the outer end of the mandrel, the index-lever pivoted to hangers from the stock, and the adjustable index-pin carried by said lever, the rod secured to the rear end of the index-lever and passing through an eye in an offset from said stock, and the spring interposed between the rod and said offset to hold the index-lever down toward the plate.

3. The combination, substantially as hereinbefore set forth, of the base-plate, the stock journaled in brackets rising from the latter, the mandrel or work-carrier supported transversely of said stock and borne therewith in its adjustments, the index-plate secured to the outer end of the mandrel, the index-lever pivoted to hangers from the stock, and the adjustable index-pin carried by said lever, the rod secured to the rear end of the index-lever and passing through an eye in an offset from said stock, the spring interposed between the rod and said offset to hold the index-lever down toward the plate, and means for locking the index-lever in a raised position away from the plate.

4. The combination, substantially as hereinbefore set forth, with the mandrel and the stock in which it is supported, of the index-plate secured to the outer end of the mandrel, the index-lever pivoted to ears or hangers from said stock, the index-pin adjustable along the lever to lock the index-plate, the rod pivoted to the rear end of said index-lever and passing through an eye in an offset from said stock, the spring interposed between the rod and the offset to hold the lever down toward the index-plate, and the latch or dog, also pivoted to the heel of said lever and arranged to be turned up and latched against the adjacent side of the offset to hold the index-lever away from the index-plate.

5. The combination, substantially as hereinbefore set forth, of the mandrel formed with a flange, its supporting-stock correspondingly flanged, the gibs or keys sliding in an annular T-slot in the first-mentioned flange and projecting into apertures in the opposite flange, and the tapering screws or cotters passing through apertures in said keys and threading into the stock whereby the mandrel may be locked firmly to said stock and prevented from axial rotation.

6. The combination, substantially as hereinbefore set forth, of the supporting-base, the stock journaled in brackets from said base, so as to be capable of a complete rotation, means for locking said stock against rotation in any given adjustment, the mandrel carried transversely of said stock and partaking of its adjustments, and capable of an independent rotation on its own axis, and means for locking said mandrel to the stock to prevent said independent rotation.

7. The combination, substantially as hereinbefore set forth, of the supporting-base pivoted to the bed-plate, so as to be adjustable about an axis perpendicular to its own plane, the clamp or clamps whereby said base is locked to the bed-plate and prevented from rotation, the stock journaled in brackets from said bed-plate and locked in any given adjustment about its own axis by a suitable clamping device, the mandrel transverse of and rotating in said stock and partaking of its adjustments, and a clamping device for locking said mandrel to the stock.

8. The combination, substantially as hereinbefore set forth, of the supporting-base, the stock journaled in brackets from said base, the worm-wheel keyed to one end of the stock, the worm-shaft engaging with said wheel, whereby the stock may be adjusted about its own axis, the mandrel journaled in the bearing afforded by said stock, and transversely thereof, and a clamp or clamps to lock said mandrel to the stock in any given axial adjustment of the mandrel.

9. The combination, substantially as hereinbefore set forth, of the supporting-base, the stock journaled in brackets rising therefrom, the worm wheel splined to one end of the stock, outside of the trunnion at that end, the worm-shaft engaging with said wheel to adjust the stock, the cap bridging the end of the stock and resting upon the exterior face of the worm-wheel, and the set-screw passing through said cap and entering the end of the stock, whereby said stock and worm-wheel may be drawn forcibly against the bearing at that end and clamped against displacement.

10. The combination, substantially as hereinbefore set forth, of the supporting-base, the stock journaled in brackets rising therefrom, the split bearing and clamping-screw, the worm-wheel and worm-shaft, the cap, and set-screw.

11. The combination, substantially as here-

inbefore set forth, of the supporting-base having a central bore therethrough, the bed-plate with its longitudinal T-slot and recess, the nut sliding in said recess, and the cylindrically-headed screw passing through the bore in the base and through said nut and taking into the recess to afford a pivot-pin for the base.

12. The combination, substantially as hereinbefore set forth, of the supporting-base having an axial bore, the bed plate or table having a T-slot and recess, the nut sliding in said recess, as described, the cylindrically-headed screw passing through said bore and nut, and a clamp or keeper for the base-plate having a headed screw-bolt also sliding in said slot.

13. The combination, substantially as hereinbefore set forth, with a mandrel or work-carrier, of an index-plate supported upon the outer end thereof, an index-pin to lock the plate and mandrel against rotation in their supporting-stock, and controlling mechanism interposed between said stock and pin, whereby the index-plate, index-pin, and mandrel may be together temporarily displaced from their normal adjustment and then restored thereto, in order that in the interval a second cut may be made alongside the primary cut.

14. The combination, substantially as hereinbefore set forth, with the mandrel and the stock in which it is supported, of an index-plate mounted upon the outer end of the mandrel, a sectional index-arm secured to the stock in such manner that one section is held against lateral movement thereby, an index-pin adjustable along the other section, to lock into the perforations of the index-plate to hold it and the mandrel against movement, and an adjustable connection between said latter section of the arm and the other, whereby the section carrying the index-pin may be moved laterally and then restored to the original adjustment, for the purpose explained.

15. The combination, substantially as hereinbefore set forth, with the mandrel and its supporting-stock, of the index-plate secured to the outer end of the mandrel, the index-arm composed of the sections I I′, lying alongside each other and steadied by a collar upon one closely embracing a hub upon the other axially of the mandrel, a connection between the section I′ and the stock, whereby said section is positively prevented from lateral movement, the index-pin adjustable along the section I, the segmental wing from the latter section passing laterally across the other, and the eccentric pivoted to the section I′ and engaging with said wing to move the index-pin and its carrier laterally, and therewith the index-plate.

16. The combination, substantially as hereinbefore set forth, of the mandrel and its supporting-stock, the index-plate attached to the outer end of the mandrel, the index-lever composed of the sections I and I′, the latter of which is pivoted to ears from the supporting-stock and embraces a hub upon the other by means of an annular collar, said hub surrounding the end of the mandrel, the index-pin adjustable along the section I, the curved wing L, extending laterally from said section and across the other, the eccentric pivoted upon the latter section and taking into a slot in the wing, and a clamping-screw to lock the two sections together.

17. The combination, substantially as hereinbefore set forth, of the arm or section I, the arm or section I′, the index-pin i^4, the wing L, the eccentric l^3, taking into a slot in said wing, the pointer l^4, attached to said eccentric, the scale l^5, the stock, the mandrel, and the index-plate.

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