(No Model.)

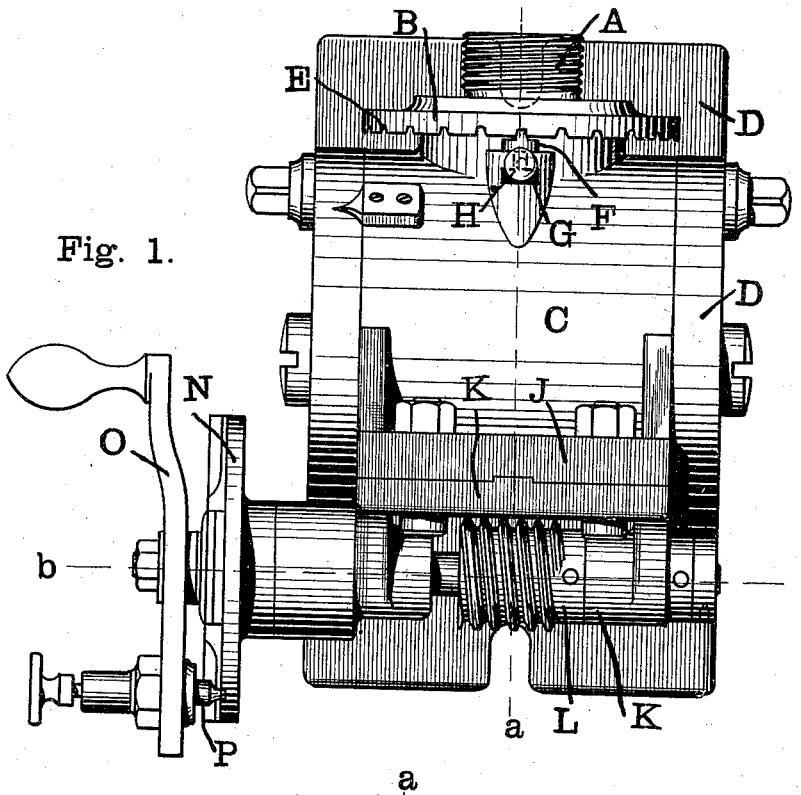
2 Sheets—Sheet 1.

A. H. BRAINARD.

DIVIDING ENGINE.

No. 343,980. Patented June 22, 1886.

Fig. 1.



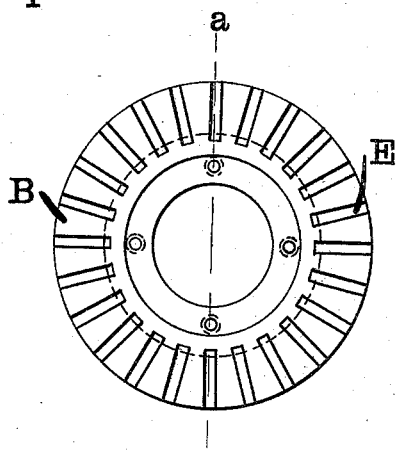


Fig. 2.

WITNESSES:
W. A. Seward
W. Sp. Baker.

Amos H. Brainard
INVENTOR
by James N. See
ATTORNEY

N. PETERS, Photo-Lithographer, Washington, D. C.

(No Model.)

2 Sheets—Sheet 2.

A. H. BRAINARD.

DIVIDING ENGINE.

No. 343,980. Patented June 22, 1886.

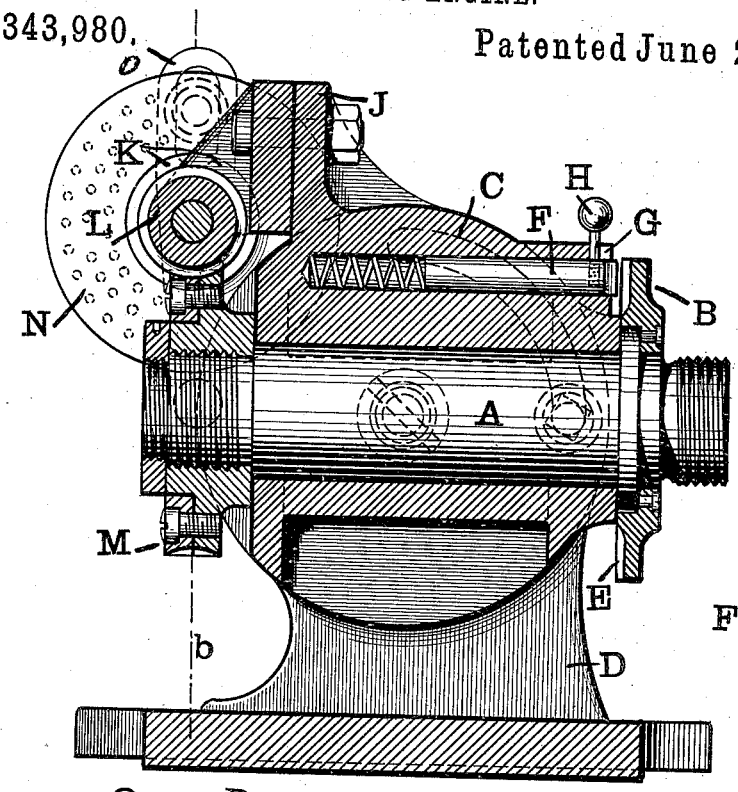


Fig. 3.

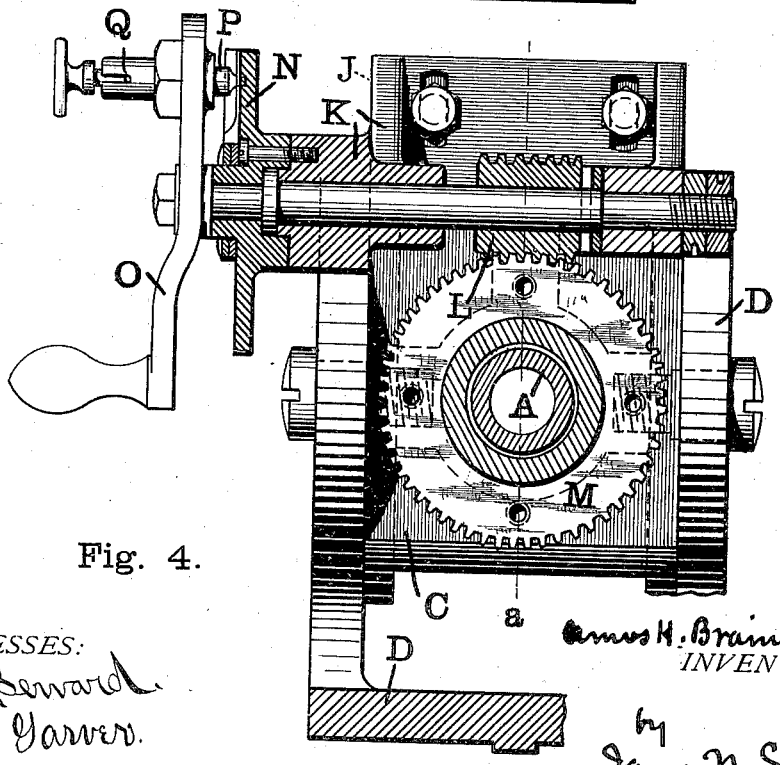


Fig. 4.

WITNESSES:
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UNITED STATES PATENT OFFICE.

AMOS H. BRAINARD, OF HYDE PARK, MASSACHUSETTS.

DIVIDING-ENGINE.

SPECIFICATION forming part of Letters Patent No. 343,980, dated June 22, 1886.

Application filed September 13, 1884. Serial No. 143,019. (No model.)

To all whom it may concern:

Be it known that I, AMOS H. BRAINARD, of Hyde Park, Norfolk county, Massachusetts, have invented certain new and useful Improvements in Centers or Heads for Milling-Machines, &c., of which the following is a specification.

This invention pertains to improvements in centers or heads for use in connection with milling-machines and other machine-tools, such centers or heads being employed in holding the work while it is operated upon, and in dividing the work after the manner of a dividing-engine.

The improvements will be readily understood from the following description, taken in connection with the accompanying drawings, in which Figure 1 is a plan of a head for use with milling-machines, &c., illustrating my improvements; Fig. 2, a rear elevation of the primary index-plate; Fig. 3, a vertical longitudinal section of the device upon line *a*, and Fig. 4 a vertical transverse section of the device on line *b*.

In the drawings, A indicates the spindle or arbor, as usually found in centers or heads for use with milling-machines and the like, the nose of this spindle being threaded and bored for the reception of chucks, shanks, &c.; B, an index-plate firmly secured to the spindle, shown in the example as being attached to its front end near the nose; C, the usual block in which the spindle is fitted to be revolved; D, the usual stock or housing in which the block is supported, and adjustable upon an axis at right angles to the axis of the spindle, the stock being adapted to be secured to the table of the milling-machine or the like; E, accurately-spaced index-notches in the rear face of the primary index-plate; F, a sliding spring-detent carried by the block, and fitted to engage, with its tooth-shaped forward end, the notches of the primary index-plate; G, a T-shaped slot in the bearing of this detent; H, a handle secured to the detent, and serving in moving the detent endwise free of engagement with its index-plate, this handle projecting upwardly from the detent through the slot previously mentioned; J, a rearwardly-facing bracket-seat formed at the rear upper portion of the block; K, a housing-bracket secured against the face of the bracket-seat by means of bolts engaging in slots, as clearly shown; L, a worm secured upon a shaft journaled in the housing-bracket; M, a worm-wheel secured upon the rear end of the spindle, and engaged by the worm when the housing-bracket is adjusted in its downward position for that purpose; N, a secondary index-plate, having the usual circle of holes, secured to the housing-bracket coaxially with the worm-shaft; O, a crank secured to the worm-shaft and adapted to serve for its rotation; P, a spring-detent carried by this crank, and adapted to have its pin engage in the holes of the secondary index-plates, this detent having the usual handle for withdrawing it, and being provided with the usual means for adjusting it radially in the crank, to correspond with a chosen circle of holes in its index-plate; and Q, a pin projecting radially from this detent, and engaging an open-ended slot in the bearing which supports the detent.

The primary index-plate B is preferably provided with that number of notches which is the multiple of the greatest number of small numbers. I prefer to provide this primary index-plate with twenty-four notches, that number being found to be the common multiple of the greatest number of very small numbers usually called for in operations with heads of the class to which this device pertains. The secondary index-plate N may be provided with as many different circles of holes, each circle, of course, having a different number of holes, as the intended capacity of the device may call for. Normally the detent F will be pushed outward by its spring into a position to engage any chosen one of the notches in the index-plate. This detent may be released to free the notches by means of its handle, and the handle may be turned sidewise into one of the branches of the T-slot G, so as to permanently hold the detent in a backward position out of engagement with its dial. The detent P is normally held by its spring into engagement with the chosen hole in the secondary index-plate. This detent may, by means of its handle, be withdrawn from engagement with the holes of its index-plate, and, after pulling the detent so far outward that the pin Q will leave the open end

of this slot, the detent may be turned a trifle, thus bringing the pin out of line with its slot and preventing the return of the detent, the detent thus being held free of engagement with its index-plate. The housing and bracket may be adjusted and bolted in a downward position, so that the worm engages the worm-gear, and in this position the turning of the crank serves to rotate the spindle. The housing-bracket may be adjusted so that the worm is free of engagement with the worm gear, thus permitting the spindle to be rotated independently of the worm, the rotation being effected by taking hold of the primary index-plate, or by the chuck, or work in hand which may be connected with the spindle. With the parts in the position last indicated, the division of the work for small numbers may be indexed upon the primary index-plate B. The worm may be adjusted into engagement with the worm-gear, and the detent P locked back out of action, and the crank O may then be employed in rotating the spindle, while the division of the work in hand is indexed upon the primary index-plate and the detent P released, so as to engage with the secondary index-plate. The spindle may then be rotated by means of the crank, and the division of the work in hand may be indexed upon the secondary index-plate. The primary index arrangement is seen to be of an essentially substantial character by reason of the fact that the index-plate is secured directly to the spindle, and the indexing effected without any moving mechanism intervening between the spindle and the index-plate. The primary indexing device is thus provided for accuracy and solidity of operation.

The direct method and means characteristic of the primary indexing cannot be carried very far, so far as high numbers of divisions or great range of divisions is concerned. The secondary index-plate permits, within the maximum limits determined by choice in the construction, of the use of a large number of circles of holes, each of which may be employed for divisions corresponding with its own number, or corresponding with divisors of its number, it being understood, of course, that the index effect is modified in arithmetical value by the number of teeth in the worm-gear. Any desired number of revolutions and fractions of revolutions may be given to the crank, and therefore an almost infinite variety of divisions may be secured by means of the secondary index. The secondary index, however, involves, first, a somewhat delicate construction of index point and holes; and, second, the intermediary of mechanism, the worm-gearing between the spindle, and the actual point of index; and, third, an essentially slow and careful mode of operation possessing great capacity for refinement, but involving corresponding opportunities for error.

Experience has shown that in the ordinary work of milling-machines, &c., pieces which are to have but few divisions are generally subject to heavier cutting operations in the machine than those which are to have higher number of divisions. Thus in the production of an ordinary reamer the cutting part of the reamer will have, say, twenty flutes, and these flutes will be produced by light cutting operations, while the head or the shank of the reamer will have four flat sides produced by four heavy and generally two very heavy cuts. It will thus be seen that in the production of such a reamer the primary indexing might not pass the range of accuracy desired in dividing for the flute, while the secondary index would be exceedingly slow in working out the divisions of the head of the reamer, and at the same time would have its delicate mechanism subjected to the strains of heavy milling cuts. In the production of such work by means of my improvements I employ the primary indexing mechanism for the coarser divisions, heavier cuts, and speedy dividing operation, and the secondary indexing mechanism for the finer divisions, more delicate cuts, and the essentially more deliberate dividing operation, thus causing the two indexing mechanisms to coact by consecutive steps to yield solidity, accuracy, and speed of operation and durability of device.

Again, I may take a piece of work whose flutes require to be deeply cut and accurately divided. The accuracy of dividing mechanism involves a peculiar delicacy of structure, and also involves a careful protection from rough usage, while a substantial and strong dividing apparatus adapted for continued rough usage involves a freedom from delicacy. Such a piece of work as has been last mentioned would therefore be inaccurately done if the dividing mechanism were of heavy, substantial, and unprotected character, and slowly done if done with delicate dividing mechanism, and at the same time the delicate dividing mechanism will become injured during the heavy operation.

In my improved apparatus I may do the heavy cutting of the flutes while the work is under the control of the primary index. This index, though substantial, may still, from frequent use or from indelicate original construction, be not accurate enough for the purpose in hand; but it will be sufficiently accurate for the preliminary heavy cutting, and will not become injured by the severe use. The secondary indexing mechanism can then be made to control the division while the finishing cuts are being made, thus ultimately yielding in heavy work the accuracy due to delicate indexing mechanism without impressing injurious strains upon that delicate mechanism.

In the device as illustrated the block C is clamped, in the usual manner, between the usual jaws of the stock B, the object being to enable the block with the spindle, &c., to be set horizontally or vertically, or at any intermediate angle. The block is supported on the usual axial screws, having a bearing in the sides of the stock, and the adjustment is made secure

by the usual screws tapped into the block through segmental slots in the sides of the stock, as indicated in dotted line in Fig. 3.

The degree of angular adjustment of the stock in the block may be indicated by the usual pointer secured to the block, as seen in Fig. 1, it being the intention that this pointer shall point to various indexing marks or graduations which may be placed upon one of the side pieces of the stock.

I claim as my invention—

1. In centers or heads for milling-machines or the like, the combination of a rotary spindle and its stock or support, a primary index-plate secured to the spindle, a detent engaging said index-plate, and provided with means for locking it out of such engagement, a rotary shaft connected to such spindle by gearing, a secondary detent connected with said shaft, and provided with means for locking it out of action, and a secondary index-plate adapted to be engaged by said secondary detent, substantially as and for the purpose set forth.

2. In centers or heads for milling-machines or the like, the combination of a rotary spindle, a stock or support for the same, a primary index-plate secured to said spindle, a primary detent fitted to engage such index plate, and provided with means for locking it out of such engagement, a worm-gear fast upon the spindle, a worm-shaft having a worm engaging such worm-gear, and provided with a secondary detent, a secondary index-plate arranged to be engaged by said secondary detent, a housing supporting said worm-shaft and secondary index-plate, and bolts engaging in slots or analogous devices for securing said housing to the spindle supported in a position corresponding to the engaged or disengaged position of the worm-gearing, substantially as and for the purpose set forth.

3. In centers or heads for milling-machines or the like, the combination of a rotary spindle and its stock or support, primary index-plate B, secured to the spindle, and provided with facial index-notches, sliding primary detent F, disposed parallel to the spindle and provided with means for locking it out of engagement with its index-plate, a worm-gear fast upon the spindle, bracket-seat J, housing K, adjustably secured to the bracket-seat, worm L, engaging the worm-gear and having its shaft carried by said housing, crank O, secured to the worm-shaft and provided with secondary detent P, and secondary index-plate N, supported by the housing, substantially as and for the purpose set forth.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, on this 10th day of September, A. D. 1884.

AMOS H. BRAINARD.

Witnesses:
EDMUND DAVIS,
A. H. HOLWAY.