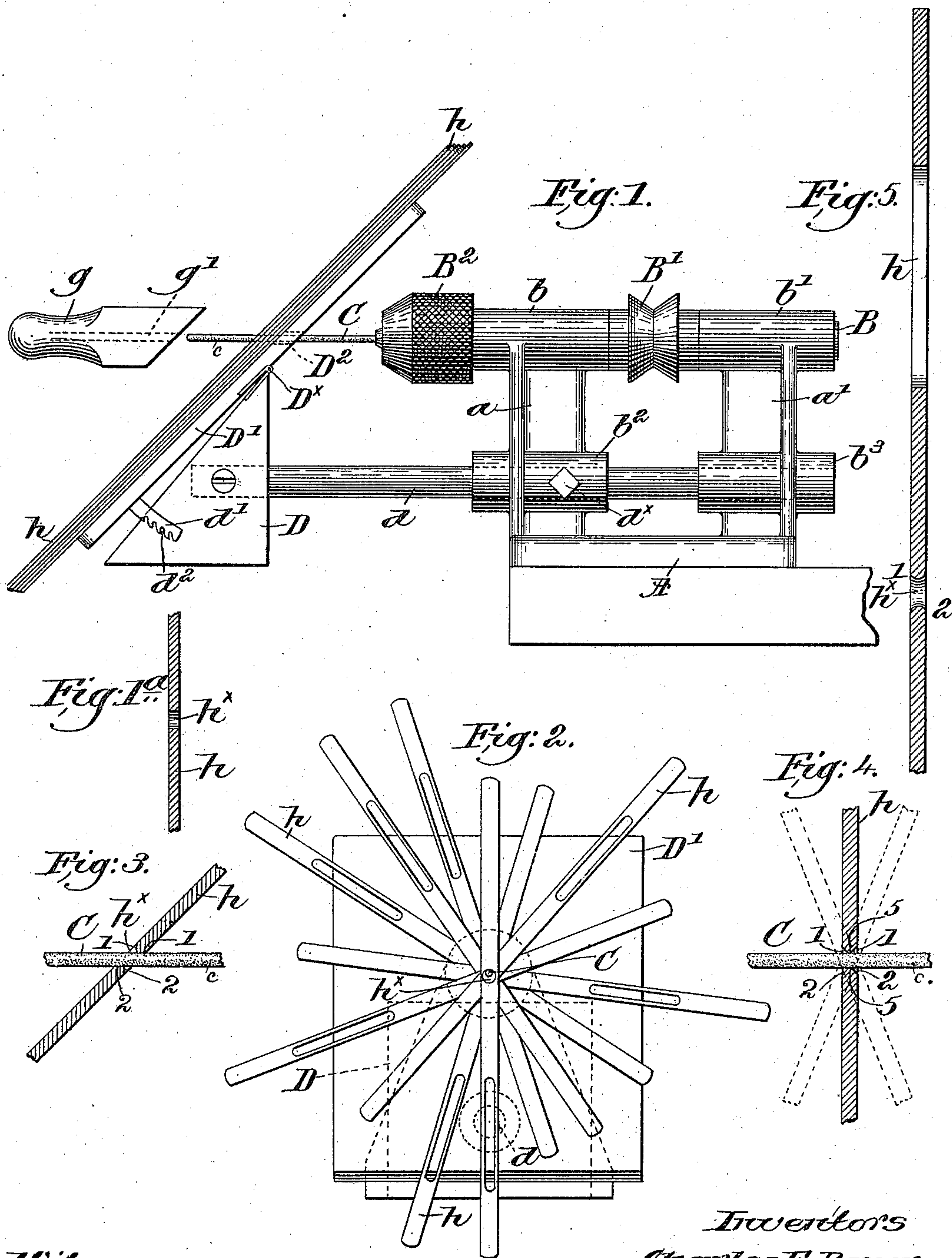


(No Model.)

C. F. ROPER & C. E. NUTTING.  
GRINDING APPARATUS.

No. 575,313.

Patented Jan. 12, 1897.



Witnesses:  
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# UNITED STATES PATENT OFFICE.

CHARLES F. ROPER AND CHARLES E. NUTTING, OF HOPEDALE, MASSACHUSETTS, ASSIGNORS TO THE HOPEDALE MACHINE SCREW COMPANY, OF SAME PLACE.

## GRINDING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 575,313, dated January 12, 1897.

Application filed May 7, 1896. Serial No. 590,545. (No model.)

*To all whom it may concern:*

Be it known that we, CHARLES F. ROPER and CHARLES E. NUTTING, of Hopedale, county of Worcester, State of Massachusetts, have invented an Improvement in Grinding Apparatus, of which the following description, in connection with the accompanying drawings, is a specification, like letters and figures on the drawings representing like parts.

10 This invention has for its object the production of a convenient apparatus for rapidly and accurately grinding the warp-receiving eyes or holes in sheet-metal heddles or warp-detectors used in looms in connection with stop-motion mechanism, as, for instance, in 15 United States Patent No. 536,969, dated April 2, 1895, the heddles shown therein being composed of thin sheet-metal strips provided each with a warp-receiving eye and an elongated slot through which a supporting-bar is passed.

20 The warp-eyes are punched or drilled in the metal strip and a bur or rough edge is left which would catch or cut the warps, and in order to obviate this the eyes must be smoothed or rounded at their edges, and the apparatus forming the subject-matter of this present invention performs the work in a rapid and effective manner.

30 Figure 1 in side elevation represents a grinding apparatus embodying our invention with a series of the heddle-blanks in position to be ground. Fig. 1<sup>a</sup> shows the blank with its straight unfinished eye. Fig. 2 is a left-hand end view of the apparatus shown in Fig. 1. Fig. 3 is an enlarged detail, partly in section, of one of the blanks, showing the manner of shaping the opposite edges of the warp-eye. Fig. 4 is a similar view showing the final step in the grinding, and Fig. 5 is a longitudinal sectional view, enlarged, of a heddle 40 with the finished warp-eye.

Referring to Fig. 1, we have shown a base A, provided with arms  $a a'$ , having bearings  $b b'$  for a shaft B, provided, as herein shown, 45 with a suitable pulley B' to receive a belt driven from a suitable source of power, (not shown,) whereby the shaft is rotated.

50 A chuck B<sup>2</sup>, of any suitable or usual construction, is mounted on the front end of the shaft B to receive therein the grinding-spindle C.

The grinding-spindle shown is composed of a long slender body, preferably of wood, of great length relative to its diameter and coated with emery  $c$  or other suitable abrasive material, the diameter of the grinder 55 being sufficiently small to enter readily the warp-eyes of the heddles or warp-detectors to be ground.

We have herein shown the arms  $a a'$  as provided with hubs  $b^2 b^3$  to receive a rod  $d$ , held in adjusted position by a suitable set-screw  $d^x$ , said rod at its outer end carrying the work-support. This work-support, as shown, 60 comprises, essentially, a stand D and a work-rest D', (shown as hinged at D<sup>x</sup> to the stand D and adapted to be adjusted and held in any desired angular position by a suitable adjusting device, herein shown as a notched segment  $d'$  on one member, to be engaged by a 70 pin  $d^2$  on the other.)

The work-rest D' has an opening D<sup>2</sup> above its pivotal point, the hinge D<sup>x</sup>, through which the grinding-spindle C is extended, as clearly shown in Fig. 1, and by pivoting the said 75 work-rest it is possible to place and hold it at any desired angle relatively to the grinding-spindle.

In operation the attendant takes a number of heddle-blanks  $h$ , having unfinished 80 punched or drilled warp-eyes  $h^x$ , (see Fig. 1<sup>a</sup>,) and strings them loosely on the grinding-spindle, permitting the pile of blanks to lie on the work-rest D', as in Fig. 1. The operator then preferably applies to the outer end 85 of the grinding-spindle a suitable guard or presser (shown as a block or handpiece) having an opening for the spindle and preferably an inclined face, the operator by the said guard or presser regulating the position and 90 speed of rotation of series of blanks on the work-rest about the spindle, for during the rotation of the spindle in grinding off the square-punched or ragged unfinished corners of the eyes the heddle-blanks are revolved at 95 a greater or less speed about the spindle and they dispose themselves in different radial positions thereabout, as in Fig. 2, and in their rotation, owing to their inclined position, the unfinished square corners at both sides of 100 the heddle-blanks are ground down somewhat, leaving beveled portions 1 and 2 (see



Figs. 3 and 4) leading from each side of the heddle into the eye-opening. The warp-eyes having been ground to present the oppositely-beveled edges described the blanks are strung  
 5 upon a grinding-spindle, the work-support having been pushed back or omitted, and the sharper corners of the edge 5, (see Fig. 4,) left at the intersection of the bevels 1 and 2, are ground down, the operator, as the blanks  
 10 rotate in this second grinding operation, touching them lightly from time to time to swing them out of a vertical plane or back and forth, as shown by dotted lines, Fig. 4, to thus effect the gradual rounding off of the  
 15 entire inner walls of the warp-eyes, finally bringing them into substantially the form shown in Fig. 5. The eyes thus finished present smooth outwardly-flaring rounded walls which offer no obstruction to the free passage  
 20 of the warp-threads and will not catch or tear them.

By adjusting the work-rest D' any desired angle, as at 1 and 2, may be given to the walls of the warp-eyes, and the entire work-support  
 25 may be moved toward or away from the chuck B<sup>2</sup>, as desired.

Having fully described our invention, what we claim, and desire to secure by Letters Patent, is—

30 1. In an apparatus of the class described, a rotatable holder, a long cylindrical grinding-spindle mounted therein, an adjustable work-rest in front of said spindle, and means to adjust the angle of said rest relative to the  
 35 spindle, substantially as described.

2. In an apparatus of the class described,

a rotatable grinding-spindle having a length greatly in excess of its diameter, an adjustable inclined work-rest located transversely to and having an opening for said spindle, and means to adjust the angle of the said work-rest relative to the spindle, substantially as described.

3. In an apparatus of the class described, a rotatable grinding-spindle having a length 45 greatly in excess of its diameter, and an inclined work-support located transversely to and having an opening for said spindle, substantially as described.

4. In an apparatus of the class described, 50 a rotatable grinding-spindle, a work-support having an opening through which the spindle is extended, and a manually-controlled guide or presser for the free or outer end of the grinding-spindle, substantially as described. 55

5. In an apparatus of the class described, a rotatable grinding-spindle, an inclined work-support having an opening through which the spindle is extended, and a manually-controlled guide or presser for the free or outer 60 end of the grinding-spindle, the inner end of the guide being beveled correspondingly to the work-support, substantially as described.

In testimony whereof we have signed our names to this specification in the presence of 65 two subscribing witnesses.

CHARLES F. ROPER.  
 CHARLES E. NUTTING.

Witnesses:

FRANK J. DUTCHER,  
 GEORGE E. STIMPSON.