3 Sheets--Sheet 1.

J. A. PEER.

Gear Cutting-Machines.

No. 153,370. Patented July 21, 1874.

Fig. 1.

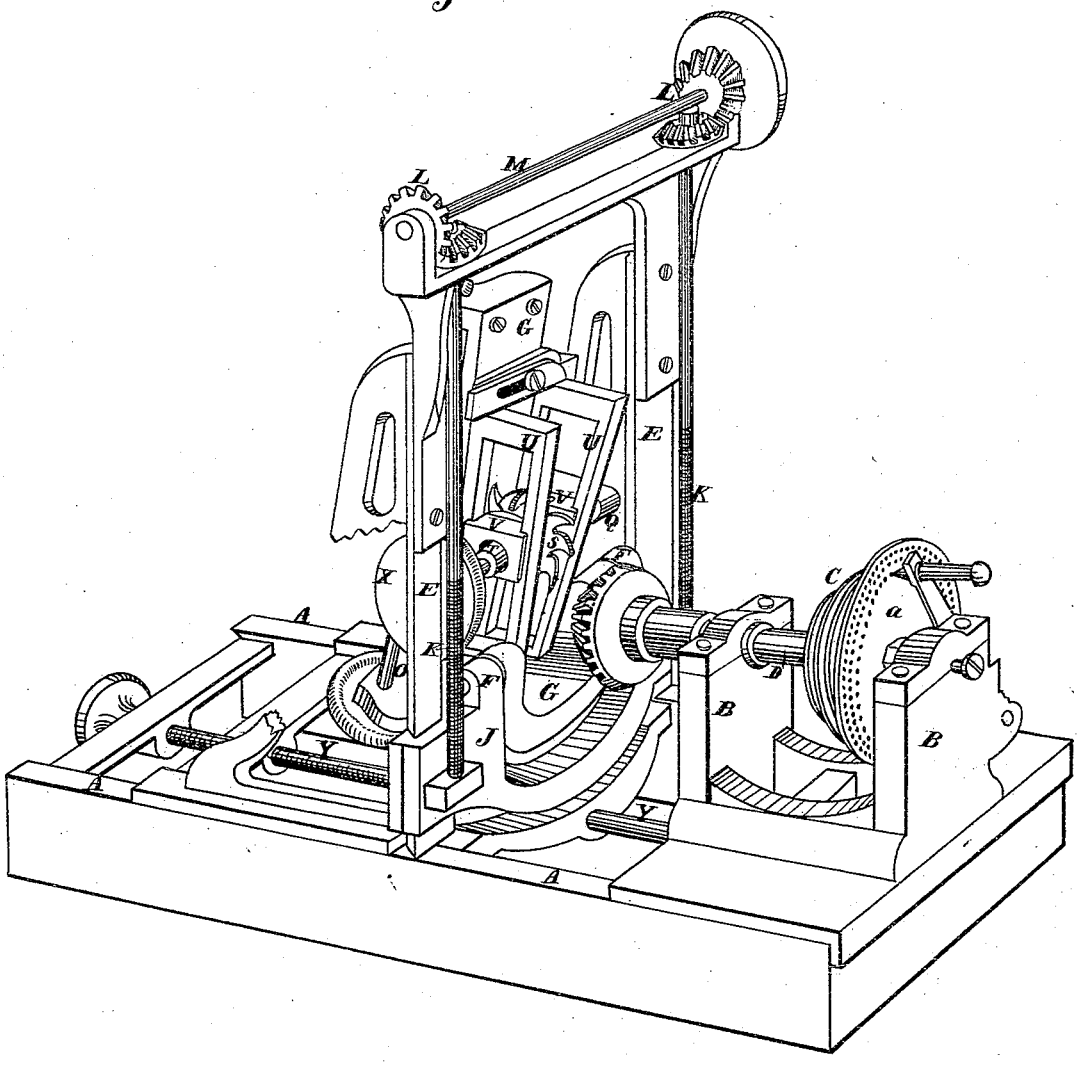

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Fig. 2.

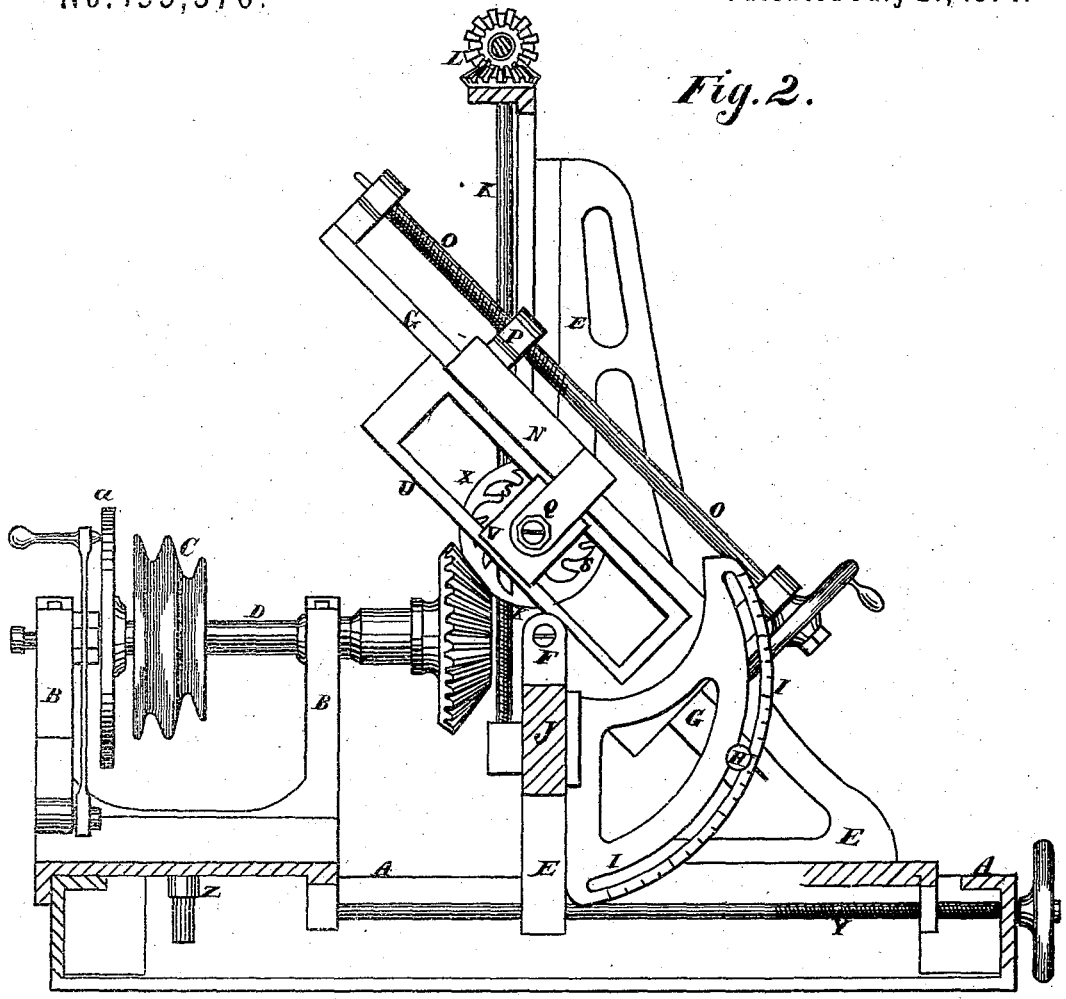

Fig. 3.

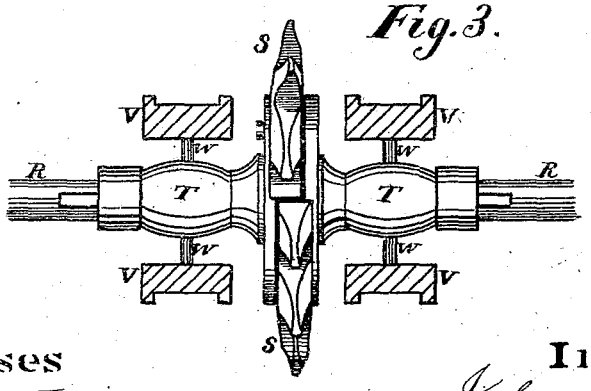

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Fig. 4.

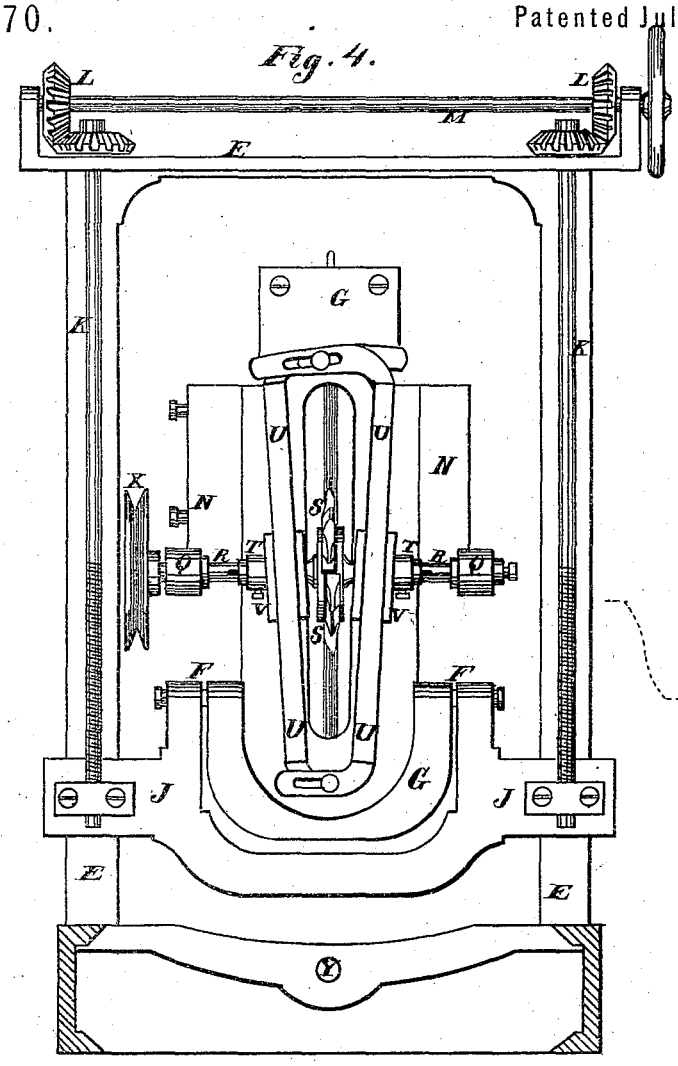


Fig. 5.

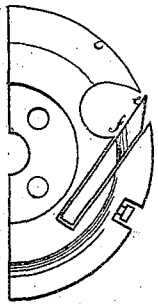


Fig. 6.

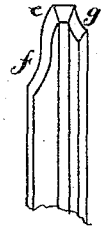


Fig. 7.

Fig. 8.

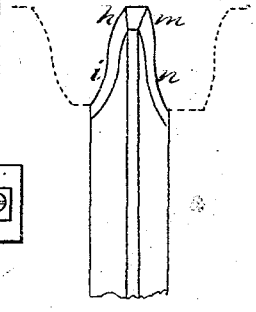
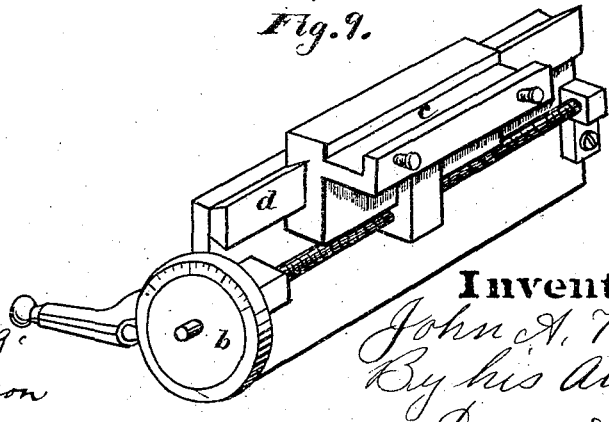


Fig. 9.



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UNITED STATES PATENT OFFICE.

JOHN A. PEER, OF SAN FRANCISCO, CALIFORNIA.

IMPROVEMENT IN GEAR-CUTTING MACHINES.

Specification forming part of Letters Patent No. **153,370**, dated July 21, 1874; application filed April 13, 1874.

To all whom it may concern:

Be it known that I, JOHN A. PEER, of San Francisco city and county, State of California, have invented an Improved Machine for Cutting Gears; and I do hereby declare the following description and accompanying drawings are sufficient to enable any person skilled in the art or science to which it most nearly appertains to make and use my said invention without further invention or experiment.

My invention relates to a machine for cutting gears of all sorts, whether bevel, spur, crown, mortise, face, or spiral, and also rack-bars, either in metal or in wood, for pattern purposes; and it consists in a novel construction and arrangement of adjustable cutters and guides, whereby all classes of gears can be cut at one operation by the same machine, and many different sizes of gears can be cut with but few sizes of cutters, thus giving the proper draft to the pattern-gear for molding purposes. Each cog is cut with one adjustment, which also cuts out the wedge-shaped space between the teeth at the same time. All of its lines are thus cut radiating to the center with one operation of the cutter. The work or gear to be cut is chucked in the lathe, turned up, bored out, and cut without removing it from its center, upon which it is turned, using one pitch-line to complete the tooth or cog. It also consists in so constructing the different parts that they can be mounted upon an ordinary lathe-bed, and the usual head-block and pulleys can be used with slight additions.

Referring to the accompanying drawings for a more complete explanation of my invention, Figure 1, Sheet 1, is a perspective view of my machine. Fig. 2, Sheet 2, is a longitudinal section. Fig. 3, Sheet 2, is an enlarged view of the cutters, with their shafts, sleeves, and boxes. Fig. 4, Sheet 3, is a front view of the swinging frame and the cutters. Figs. 5, 6, 7, 8, Sheet 3, are enlarged views of the cutter. Fig. 9, Sheet 3, is a view of the clamp for rack-bars.

A A are the ways of a lathe-bed. B is the head-block frame supporting the pulleys C upon the spindle or arbor D. The dividing or spacing plate *a* for the teeth of the gears may be placed within the frame B, close to the pulleys, when a machine is to be newly built; but if applied to an old lathe, this dividing or gage plate may be secured to the end of the spindle, where it projects through the head-block frame. The frame E, which carries all the operating mechanism, is fitted to slide upon the ways A of the lathe, so as to adjust its position longitudinally, this being done by means of a longitudinal screw, *y*. Within this frame, and supported by the boxes F F upon the vertically-sliding frame J, is the swinging frame G, which can be set at any desired angle to cut any bevel or spur gear. A set-screw, H, passes through the curved guiding-slot in the segment I, secured to the frame J, and enters the swinging frame G, so that by setting the screw up tight it can be made to secure the frame at any desired angle.

In the case of miter-gears it will be manifest that the center of motion of this swinging frame G must be in the same horizontal plane with the center of the arbor D and of the gear to be cut. If a spur-gear or rack-bar is to be cut, the frame G must be elevated sufficiently to allow the cutter to swing horizontally above the gear or bar to be cut, and other degrees of bevel will require a proportionate variation of the angle of the frame G.

The inclination is effected, as above described, by turning the frame G in its journal-boxes F. These boxes are situated upon a slide or guide, J, which is moved up and down upon the frame E by the screws K and miter-gears L, operated simultaneously by the shaft M in a similar manner to the device for raising and lowering the head upon a planer. Upon the swinging frame G is a slide, N, which is moved up and down by a screw, O, passing through a nut, P, upon the slide, and operated by a hand-wheel, as shown. The boxes Q are mounted upon the slide, and in these the shaft or arbor R of the cutter turns.

The cutter S is of peculiar construction, and is made by turning it up so that one side is of the exact shape desired for the teeth of the proposed gear, as shown in Figs. 5 and 6. This cutter is then cut in two across its center, and the two halves are reversed upon the shaft R, being suitably secured by flanges or otherwise.

Fig. 5 shows the construction of a cutter to

be used for making patterns and wood gears, and Fig. 7 shows cutters for metal work; but in each case the principle of turning up one side and then reversing upon the shaft, in order to secure absolute accuracy in both sides of the cut, is preserved.

In order to finish the tooth with one cut and one adjustment, giving it the proper taper in a bevel-gear, or the necessary draft, (if it be a wooden pattern of a spur-gear,) the two halves of the cutters must be made so as to approach each other as they pass across the face of the gear—that is, beginning at the outer edge of the face of a bevel-gear, the space between the teeth must be of a certain width, and at the inner edge of the face it must be narrower, depending in every case upon the particular size and bevel of the gear, and the number of teeth to be cut in it.

Heretofore solid cutters have been used, and three adjustments have been necessary to make the cut, and give it and the tooth the proper taper.

In my present construction I employ the divided cutter, as before described, and the two parts are each mounted upon a sleeve, T, which is fitted to the shaft R, and a pin in the sleeve passes through a slot in the shaft, this slot being made of a sufficient length to allow the sleeve to slide a short distance along the shaft, which at the same time causes it and its cutter to rotate by acting on the pin. Two guides or ways, U, are adjustably secured to the frame G, and these guides can be brought together or separated at the top or bottom, so as to stand at any desired angle with each other. A sliding box, V, is fitted to move up and down upon each guide, and through this box the shaft R passes, so that the sleeve T lies within the opening in the box. The sleeve is made with a swell in its center, as shown, and two pins or trunnions, W, serve as pivots about which the sleeve has motion in the box, and this allows the guides U to be inclined to each other while the shaft R passes straight through the box V. These pins also insure a longitudinal movement of the sleeve upon the shaft as the boxes move up or down upon the inclined guides when the latter stand at an angle. By this means the gradual approach or separation of the cutters is produced as they pass across the face of the gear to be cut. Power is applied to drive the cutter-shaft by means of the pulley X at one end.

The operation of my machine will be as follows: The metal blank from which the gear is to be cut is chucked and bored, and turned by means of the pulleys C and arbor D of the head-block, as in the case of any lathe. The frame E with its cutters is then moved up to the proper position by means of the screw Y, the gear-blank meanwhile remaining in its position just as it was finished. The frame G is then turned about its journals F until it stands at the proper angle, (depending upon the bevel to be cut,) so that when the slide N is moved up and down it will carry the cutters over the face of the gear. The guides U are then set so as to have the proper inclination to each other, and the boxes V, which slide on these guides, and through which the cutter-shaft R passes, will then be caused to approach each other, when the slide N, which carries the cutter-shaft, is moved downward by its feeding apparatus. As the cutters are secured by flanges to the sleeves T, and these sleeves are moved along the shaft R by the movement of the boxes V to which they are pivoted, it is manifest that if the cutters are set so as to make a cut of a certain width at the outside of the face of the gear they will be moved toward each other as the slide N moves downward on the frame G, making a tapering cut, and thus the cut will be finished upon one pitch-line and at one operation.

It will be seen that any taper can be given to the cut and tooth by a simple adjustment of the ways or guides U. If a spur-gear is to be cut the blank will of course be turned with a face parallel with the axis. The sliding frame J, carrying the swinging frame G, will then be moved along the frame E by means of its screws K until the frame G can be turned so as to lie horizontally, when the cutters will be fed directly across the face and cut the teeth. In this case the guides U would be set parallel, as the teeth need no taper unless a pattern is being made, when the guides could be inclined just enough to give the pattern the proper draft for molding purposes in casting.

The head-block B can be turned to one side or the other on the lathe-bed, and a screw, Z, serves to secure it. By this means the gear-blank can be set at any angle for the purpose of cutting an inclined or spiral gear.

The spacing or dividing plate *a* is constructed as shown, and is not especially different from those hitherto employed for such purposes.

The sliding frame E can be removed from the lathe-bed and give place to the ordinary tail-block when the lathe is employed for turning, or it may simply be moved back toward the rear end of the bed.

When straight rack-bars are to be cut it will be found more convenient to remove the usual head-block and substitute for it the device shown at Fig. 9, which simply clamps the bar in place, and, by means of its spacing-plate *b*, feeds it along as it is cut. The bar is held in a groove in the clamp *c*, which moves transversely across the guide *d* in front of the cutter, and thus furnishes a convenient means of cutting rack-bars.

When it is necessary to cut large bevel-gears much more attention must be paid to the curves upon which the teeth are cut, as the depth of the outer end of the teeth is considerably greater than that of the inner end, and the pitch-line would therefore be tapering toward the center, about which the gear is described.

Figs. 6 and 7 show enlarged view of the cutters for this purpose. In Fig. 6 the curve *e* of the cutter will cut out the shape of the bottom of the tooth, while the curve *f* will form the

top, beginning at the outside; but as the cutter moves toward the inside it will be manifest that only the bottom of the tooth will be formed from its least depth. After the cut is finished, therefore, the cutter is reversed and the edge *g* is employed to complete the top of the tooth down to the pitch-line. In the form shown at Fig. 7 only the bottom of the tooth is finished by the curve *e*, the whole of the remainder being completed by the curve *g* at the second operation.

Fig. 8 shows another slight variation which may be used in cutting gear-wheels and pinions with one adjustment where unusual accuracy is needed, and consequently a slight difference is made between the shape of the teeth of the wheel and those of the pinion.

The curve *h i* shows the cutting-edge for the pinion, which must be made fuller at the base and lighter at the point than the teeth of the wheel. These latter are made by the cutting-edge *m n*, which, as will be seen by the dotted lines, are somewhat fuller at the top and thinner at the base.

Having thus described my invention, what I claim, and desire to secure by Letters Patent, is—

1. The divided cutter S, formed upon one pitch-line, and having its halves reversed upon the cutter-shaft for the purpose of making both sides of the cut exactly alike, substantially as herein described.

2. The sleeves T, in combination with the adjustable guides U, sliding boxes V, shaft R, and cutter S, substantially as and for the purpose set forth.

3. The head-block B, constructed as described, so as to be turned from side to side and held by the screw Z, or equivalent device, in combination with the adjustable cutter S, for the purpose of cutting spiral gear, substantially as herein described.

4. The combination, in a gear-cutting machine, of a rotary shaft journaled in a sliding frame, two sleeves capable of longitudinal motion on said shaft, and carrying on their adjacent ends the halves of a divided cutter, sliding boxes in which said sleeves are pivoted, and stationary adjustable guides for the boxes to traverse in, and thereby impart the proper movements to the halves of the cutter toward or from each other, all substantially as and for the purpose specified.

5. In combination with the frames J, G, and N, adjustable as described, the shaft R, sleeves T, cutter S, sliding boxes V, and guides U, operating in the manner and for the purpose specified.

In witness whereof I hereunto set my hand and seal.

JOHN ANTONE PEER. [L. S.]

Witnesses:

GEO. H. STONG,

C. M. RICHARDSON.