No. 667,512. Patented Feb. 5, 1901.

C. H. FIELD.

GEAR CUTTING ENGINE.

(Application filed July 14, 1900.)

(No Model.) 2 Sheets—Sheet 1.

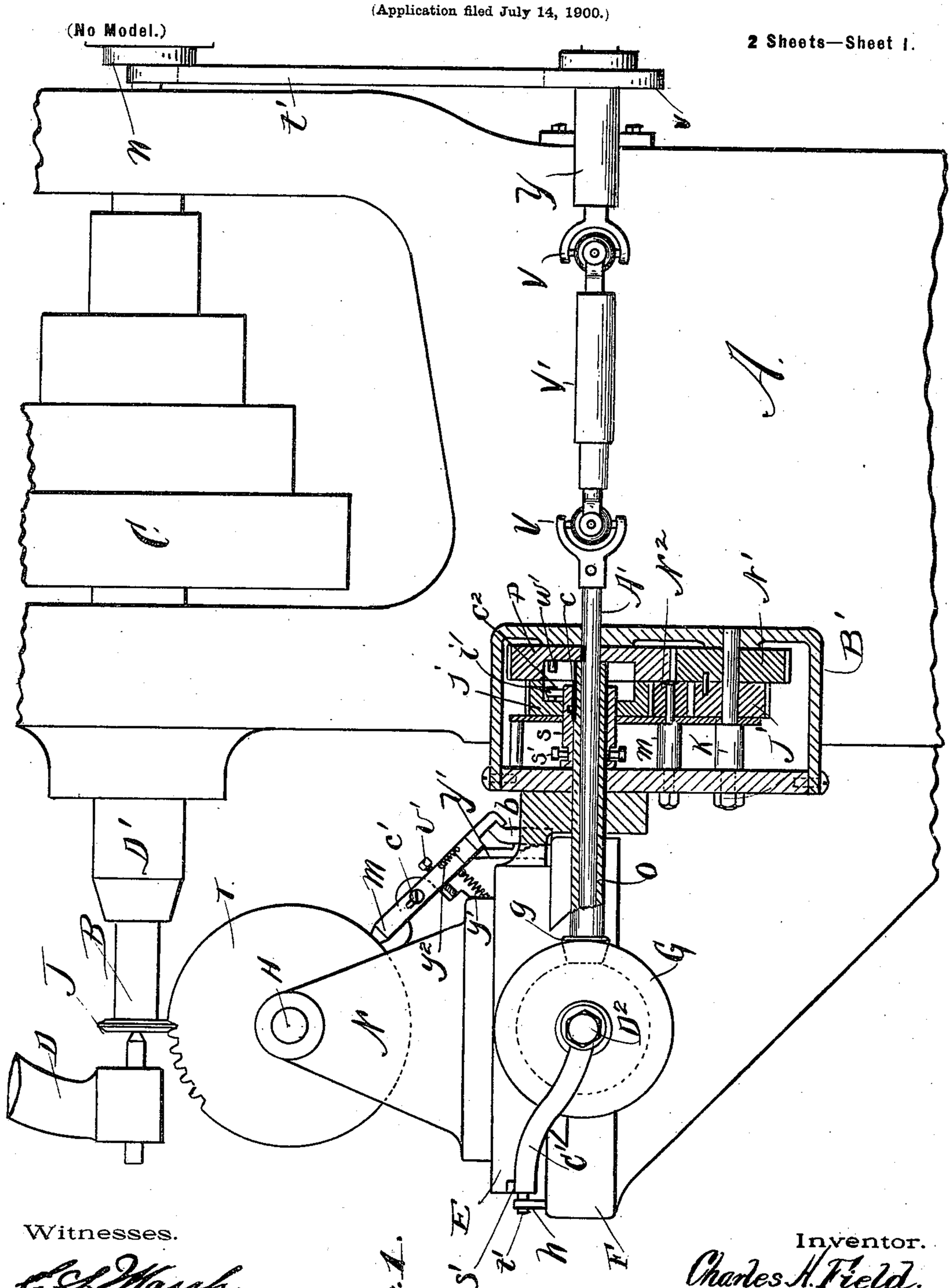

Fig. 1.

Witnesses.

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Fig. 2.

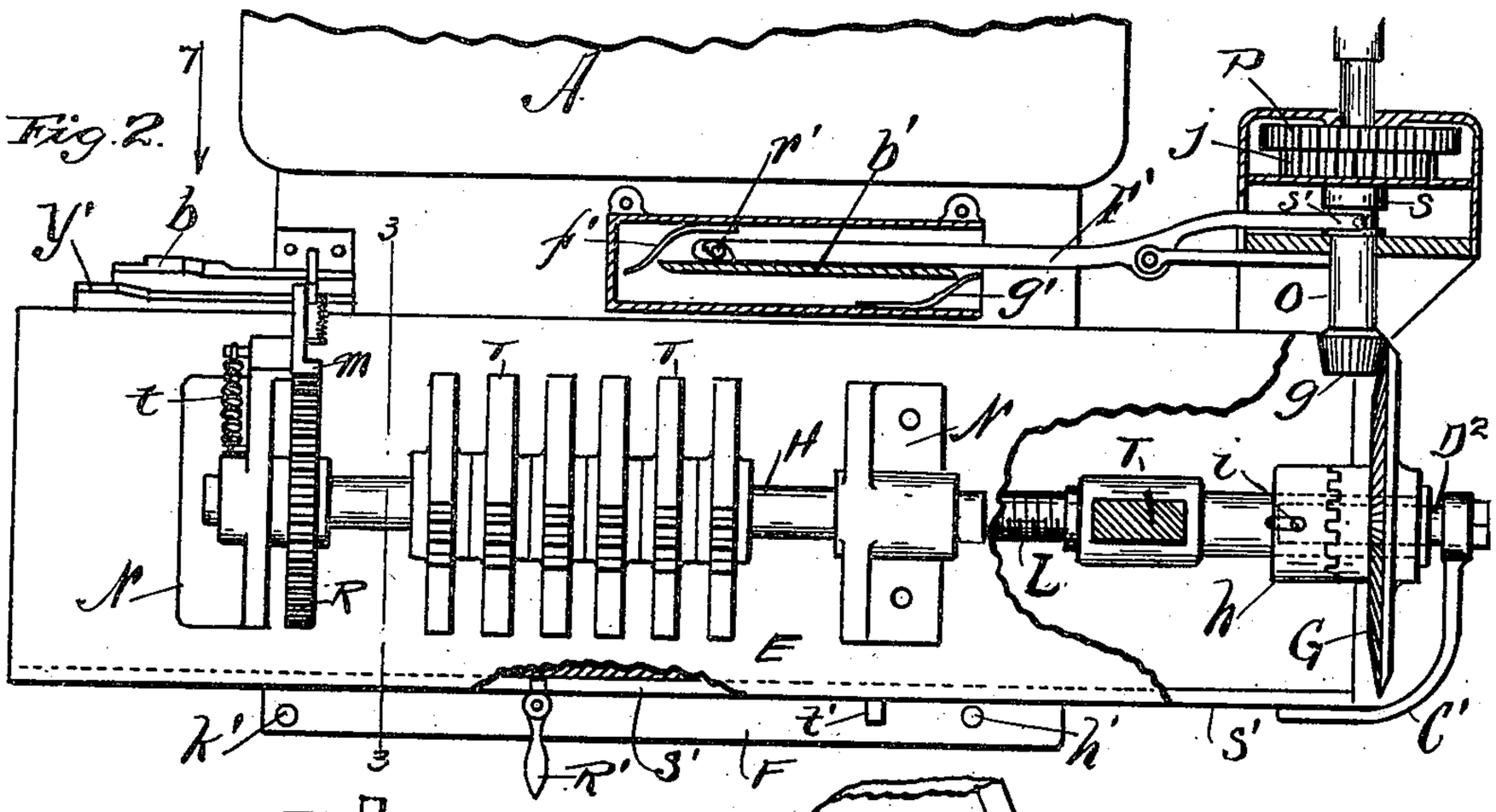


Fig. 5.

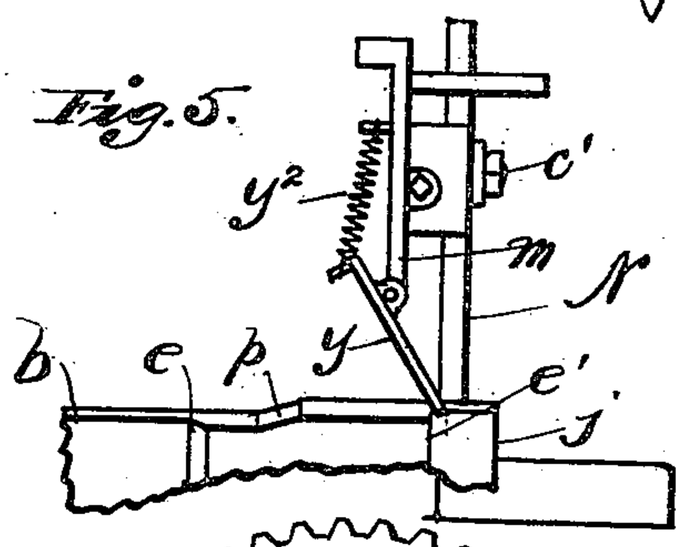
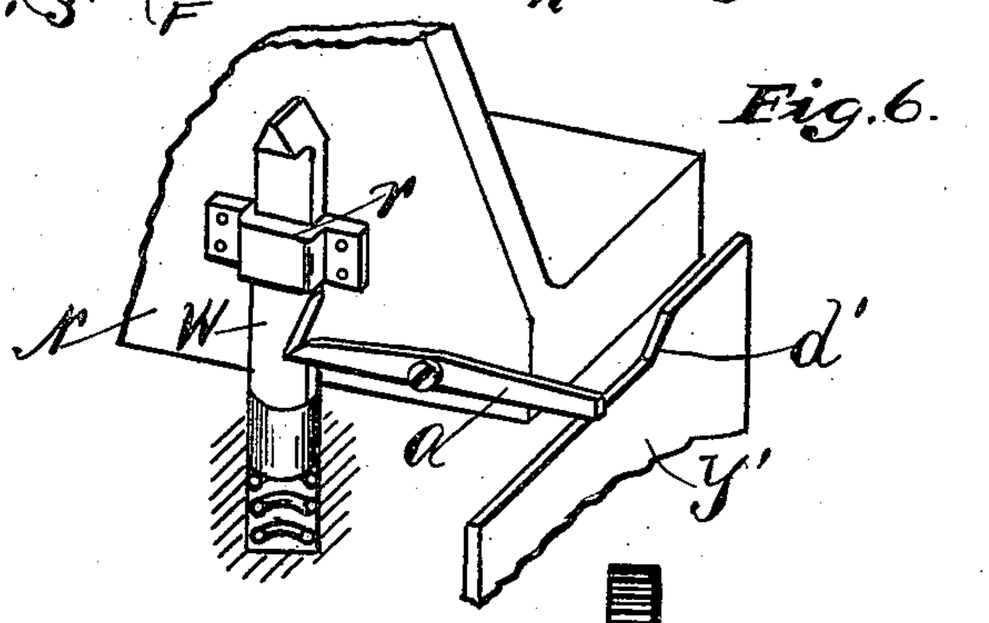


Fig. 6.



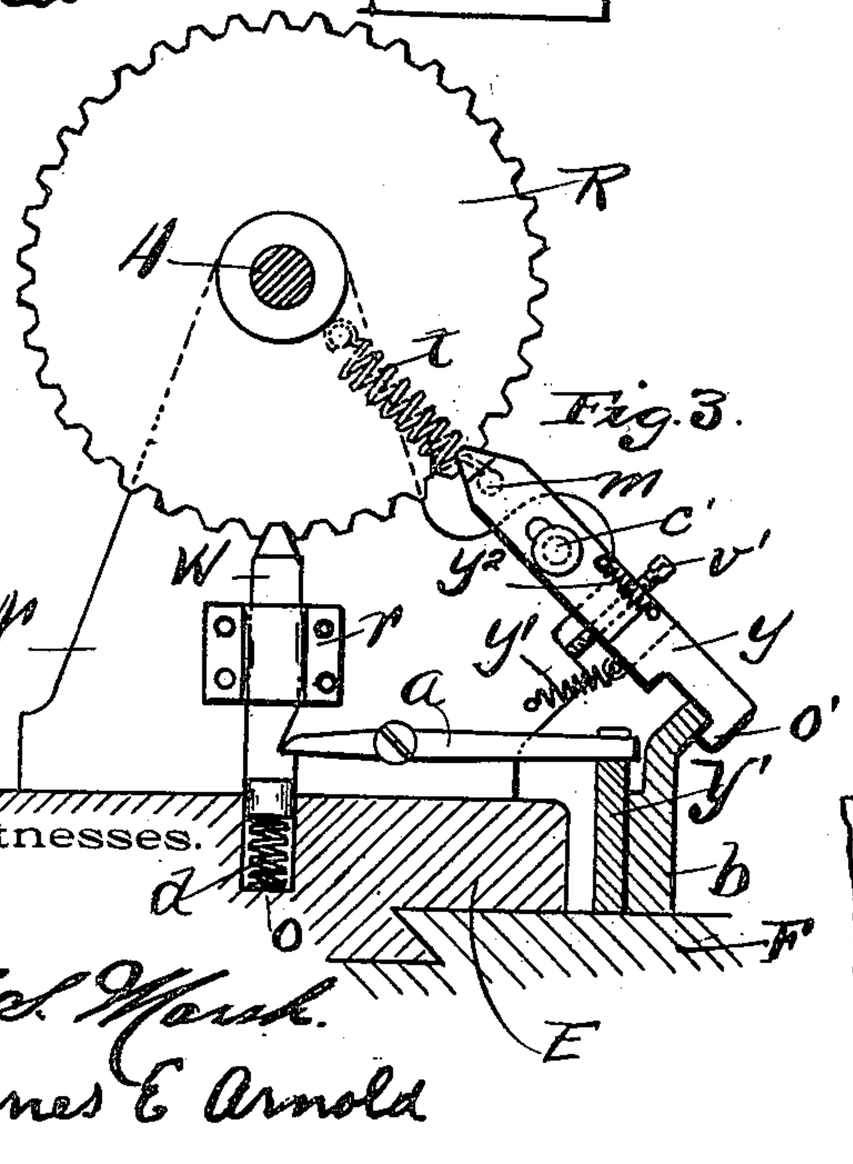


Fig. 3.

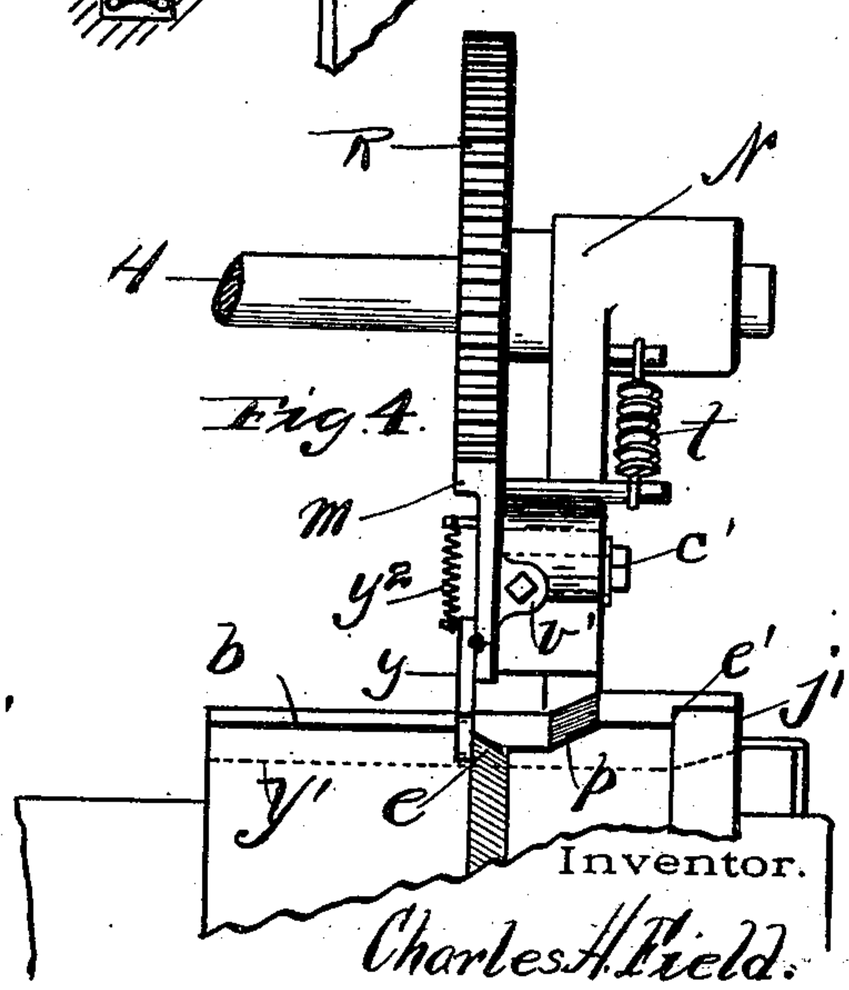


Fig. 4.

Witnesses.

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UNITED STATES PATENT OFFICE.

CHARLES H. FIELD, OF PROVIDENCE, RHODE ISLAND.

GEAR-CUTTING ENGINE.

SPECIFICATION forming part of Letters Patent No. 667,512, dated February 5, 1901.

Application filed July 14, 1900. Serial No. 23,636. (No model.)

To all whom it may concern:

Be it known that I, CHARLES H. FIELD, a resident of Providence, in the county of Providence and State of Rhode Island, have invented certain new and useful Improvements in Gear-Cutting Engines; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

This invention consists of certain improvements in machines for cutting the teeth of gears, commonly called "gear-cutters," and relates more especially to the reciprocating movement of the carriage and to the rotating mechanism for the index. It is fully explained and illustrated in this specification and the annexed drawings.

Figure 1 is a side elevation of a part of a machine with my improvements and a portion of the reversing mechanism in section attached thereto. Fig. 2 is a top view of the front part of the machine, showing the reciprocating carriage with my improvements attached thereto. Fig. 3 shows a vertical section of the carriage and bed on line 3 3 in Fig. 2 looking to the left, with index mechanism in elevation. Fig. 4 is an elevation of the part shown in Fig. 3, taken from the back side looking in the direction of the arrow 7 in Fig. 2. Fig. 5 shows a trip-motion on the index-feed enlarged. Fig. 6 shows other details of the index-feed motion enlarged.

The construction and operation of the invention are as follows:

A is the base or stand of the gear-cutter.

D is a part of the arm that supports the outer end of the cutter-mandrel.

D′ is the main arbor, held in bearings on the top of the gear-cutter, and C is a cone of pulleys on the arbor D′, by which a belt runs the machine.

B is the cutter-mandrel in the end of the main arbor and on a center in the end of the arm D.

J is a cutter held on the mandrel B. An arbor H, that holds the blanks T to be cut, is held in the stands N N, fast on the carriage E, that slides across the front of the gear-cutter on the bed F. The screw-shaft L, that moves the carriage E back and forth on the bed F, is held in bearings T′, attached to the under side of the carriage. (See Fig. 2.) The shaft L is driven by a half-clutch *h*, sliding on that shaft and engaging with a half-clutch made on the hub of the bevel-gear G, otherwise loose on the shaft L. A short bar D^2 is held to slide in a socket in the end of the screw-shaft L, and a pin *i*, fast in the bar D^2, projects through a slot in the shaft L and enters the half-clutch *h*, so as to cause the clutch to engage or disengage by sliding the bar D^2 out or in, which is done by the curved bar C′, one end of which is connected to the outer end of the bar D^2 and the other end to the shifting bar S′, which has a stud *t*′ on it, which operates to stop the carriage, if it overruns in one direction, by striking against the pin *h*′ in the bed and disengaging the half-clutch *h*. To stop it if it overruns in the other direction, a lever R′, held on a pin attached to the carriage E, has its inner end in a hole in the shifting bar S′ and is arranged to strike the pin *k*′ in the bed and disengage the clutch by sliding the bar S′ to the left, as before.

The mechanism that reverses the motion of the bevel-gear G is shown mainly in Fig. 1. This bevel-gear is driven by a short shaft held in a long bearing Y on the back of the gear-cutter, which has a cone-pulley *v* fast on its outer end, and its inner end is connected by universal joint V to a telescoping intermediate shaft V′, which is connected by another universal joint V to the shaft A′, having bearings in a case B′, attached to the carriage E. The shaft A′ has a loose sleeve O on it that holds a small bevel-gear *g* fast on its end. This engages with the large bevel-gear G on the screw-shaft L. The two universal joints V V, with the telescoping shaft V′, are used to allow the case B′ to travel back and forth with the carriage E, while the bearing Y is held stationary. A gear P in the case B′ is made fast on the shaft A′, and a collar *s* is held to slide on the sleeve O, but is made to turn with it by means of a spline *c* in the sleeve O. The fork *s*′ of a shifting-lever F′ has pins that enter a groove in the collar *s*. This shifting mechanism is seen in Fig. 2. The shifting-lever is held on an arm attached to the case B′ and has the fork *s*′ on one end and a pin *r*′ in its other end. This

pin r' when the carriage E is going in one direction passes along on one side of the bar b', holding the collar in one position; but when the pin r' by the motion of the carriage E has passed the end of the bar b' the spring f' will throw it to the other side of the bar and move the collar by the fork s' to the other end of its motion, and as the carriage E returns it will be held there until the pin r' passes the other end of the bar b', when the spring g' will throw it back to its first positions, and also the collar s. Returning to Fig. 1, it will be seen that when the collar s is in one position a pin i', fast in it, will be engaged with the pin c^2 in the gear j, loose on the collar s, which gear is being driven by the gear P, fast on the shaft A', through the intermediate gears N' and J', pinned together and running on the shaft K, and gear J', engaging with the small gear N^2, will drive the gear j, that engages with it, faster in the direction from that in which gear P is running, and the gear j will drive the collar s by the pins i' c^2, which drive the sleeve O by the spline c. Then the bevel-gear g on that sleeve will give motion to the screw-shaft L through the bevel-gear G. When the carriage E has moved across and cut a tooth in the blank or blanks T, the shifting of the lever F', as described *supra*, will throw the collar s over to the right, and the pin i' in the collar will engage by the pin w' in the gear P, which gear being fast on the driving-shaft A' will drive the sleeve O and bevel-gears g and G direct through the spline c in the sleeve O. It will readily be seen that in moving the carriage E in one direction it is driven directly by the pin w' in the gear P and the pin i' in the collar s; but moving the carriage in the other direction it is driven by the gear P through the intermediate gears N', J', N^2, and j. This is for the purpose of giving a quick return of the carriage after having cut a tooth.

The mechanism for turning the blanks T the proper distance each time for a tooth, according to the number of teeth the blanks are intended to have, consists of an index-gear R, secured to the blank-arbor H, and the other parts shown in Figs. 3 and 4. The gear R is held stationary while cutting a tooth by a sliding bolt w, held in a clasp r on the stand N. (See Fig. 3.) This bolt w has its lower end extended down into a recess o in the carriage E, and an open spiral spring d is placed in the recess o under the bolt to throw it up, so its upper end will enter a space between two teeth in the gear R. When the gear R is turned, this bolt is drawn out of the gear by means of a lever a, pivoted to the stand N, which lever has one end resting in a notch in the side of the bolt w. On the other end of the lever a rests a cam-plate Y', held stationary on the bed F, so that when the carriage E approaches the end of its motion the rise d' in the cam Y' (see Fig. 6) will raise the outer end of the lever a and push down the bolt w by its inner end, and when the index-gear has turned the proper distance the carriage E will return and drop the end of the lever at d' on the cam and allow the spring d to throw the bolt up into the gear again. The devices that move the index-gear are shown in connection in Figs. 3 and 4. They consist of a dog m, held to slide and swing on a stud c', fast in an arm of the stand N. A closed spiral spring t has one end attached to a pin in the stand N and the other end on a pin fast in the dog m. (See Fig. 4.) This spring t is to hold the end of the dog in between the teeth of the index-gear R when not drawn out by the cam. The dog m is drawn back out of contact with the index-gear and swung on the pin to turn it by a double cam b, held fast on the bed F. These motions are effected by a small latch-plate y, hinged to the dog m, (see Fig. 5,) and a closed spiral spring y^2, attached to the upper end of the latch and to a pin in the dog m, tends to hold the latch in line with the dog, but allows it to trip on the cam b on the return of the carriage. The double cam b consists of a top face, with an incline e, that draws the inner end of the dog m out of mesh with the teeth of the index as it passes along on the cam. Then by means of the hook end on the latch y as it comes in contact with the inclined part of the cam p the tail of the dog is raised, carrying the inner end down preparatory to engaging another tooth in the index. A small spring y^2, attached to the latch or dog and to the stand N, tends to hold the latch down on the cam b when it is not tripped on the return of the carriage, as in Fig. 5. These two cams b and Y' act in unison to draw the dog m and bolt w out of the index R, as follows: As the carriage passes to the end of its motion in cutting a tooth on the blanks T the latch y passes onto the incline e on the cam b, which by the hook o' on its end draws the dog m out of engagement with the teeth of the index R. Then the latch comes to the side or incline p on the top face of the cam, (see Fig. 4,) which incline raises the tail of the dog m by the latch y and turns the upper end of the dog down opposite to another space between the teeth of the index. By this time the hook o' of the latch reaches the let-off at e', which allows the dog to be drawn into the new space in the index-teeth by the spring t. Then the end of the lever a resting on the cam Y' reaches the rise d' on the cam, which raises it and draws the bolt w out of the gear-index. At this point the latch y of the dog m reaches the drop-off on the cam b at j', which allows the spring y' to draw down the tail of the dog and rotate the index one or more spaces, as may be determined by the set of the cam and the adjustable stop-screw v', and then as the lever a on the return motion of the carriage E slides down the incline d' on cam Y' the spring d is allowed to push the bolt up into the index again in the new space presented. The blanks are thus held rigidly from turning while being cut by both

the bolt *w* and the dog *m* being in engagement with the index-gear, thereby forming a double lock. On the return motion of the carriage E the latch *y* will trip on the cam *e'* and swing off to the right on its hinge (see Fig. 5) and the dog *m* and bolt *w* will not be disturbed.

The mechanism is entirely automatic. After setting the arbor with the blanks in place and starting the cutter it will continue to run and cut the teeth without attention from the operative until the gear is finished, when it is stopped by hand. This mechanism is also applicable as an attachment for milling-machines or other like engines and is designed to be readily attached thereto for the purpose of cutting of gears, thereby doing away with the necessity of keeping a machine made exclusively for that purpose in shops where the use of one is limited.

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

1. In a gear-cutter the combination of a stationary bed, a carriage to slide on the bed, an arbor for blanks held on bearings on said carriage, an index fast on said arbor, a bolt to hold the index when set, a swinging and sliding dog to move the index, a double cam to operate the dog, a latch hinged to the dog and arranged to trip when going in one direction and pass the cam without operating the dog, with means for operating the bolt, substantially as described.

2. In a gear-cutter the combination of a stationary bed, a carriage to slide on the bed, an arbor held in bearings on said carriage to hold the blanks, an index fast on said arbor, a bolt to hold the index when set, a lever to move the bolt, a cam to operate the lever, a dog sliding and swinging on a pin, a double cam to operate said dog, a latch hinged to said dog to rest on the double cam and move the dog, and arranged to trip when going in one direction and pass over the cam without operating the dog, substantially as described.

3. In a gear-cutter the combination of a stationary bed, a carriage to slide on said bed, a screw-shaft to move said carriage, a gear on said shaft, a short bar held in a socket in the end of the screw-shaft, a half-clutch on the hub of the gear, a half-clutch held to slide on the shaft, a pin fast in the short bar and projecting through a slot in the screw-shaft to engage in the sliding half-clutch, a sliding bar held on the front of the carriage and connected with the short bar, a pin in said sliding bar, a pin in the stationary bed to engage with the pin in the sliding bar, a hand-lever pivoted to the carriage and entering the sliding bar, a pin on said bed to engage with the hand-lever, substantially as described.

4. The combination of a stationary bed, a carriage to slide on said bed, a screw-shaft to move the carriage, a gear on said screw-shaft, a driving-shaft, a sleeve on said driving-shaft, a bevel-gear on said sleeve engaging with the gear on the screw-shaft, a collar sliding on said sleeve with a spline in the sleeve to prevent the collar from turning, a pin in the collar, a gear fast on said driving-shaft with a pin in it, a gear loose on the collar, a pin in said gear, intermediate gears to connect the gear on the driving-shaft and the gear on the collar, with means for sliding the collar at each end of the carriage-traverse, substantially as described.

5. The combination of a stationary bed, a carriage to slide on the bed, a screw-shaft to move the carriage, a bevel-gear on the screw-shaft, a driving-shaft, a sleeve on the driving-shaft, a bevel-gear on the sleeve engaging with the bevel-gear on the screw-shaft, a collar sliding on said sleeve with a spline in the sleeve to prevent the collar from turning a pin in said collar, a gear fast on the driving-shaft with a pin on it, a gear loose on the collar with a pin in its face, intermediate gears to connect said gear on the driving-shaft and the gear on the collar, a lever to slide the collar on the sleeve, a pin in the end of the lever, a plate to guide the pin, a spring at each end of the plate to throw the pin past the end of the plate, substantially as described.

In testimony whereof I have hereunto set my hand this 13th day of July, A. D. 1900.

CHARLES H. FIELD.

In presence of—

BENJ. ARNOLD,

HOWARD E. BARLOW.