J. F. CRAWFORD.

GEAR MAKING MACHINE.

APPLICATION FILED MAR. 14, 1921.

1,428,219.

Patented Sept. 5, 1922.

4 SHEETS—SHEET 1.

Fig. 1.

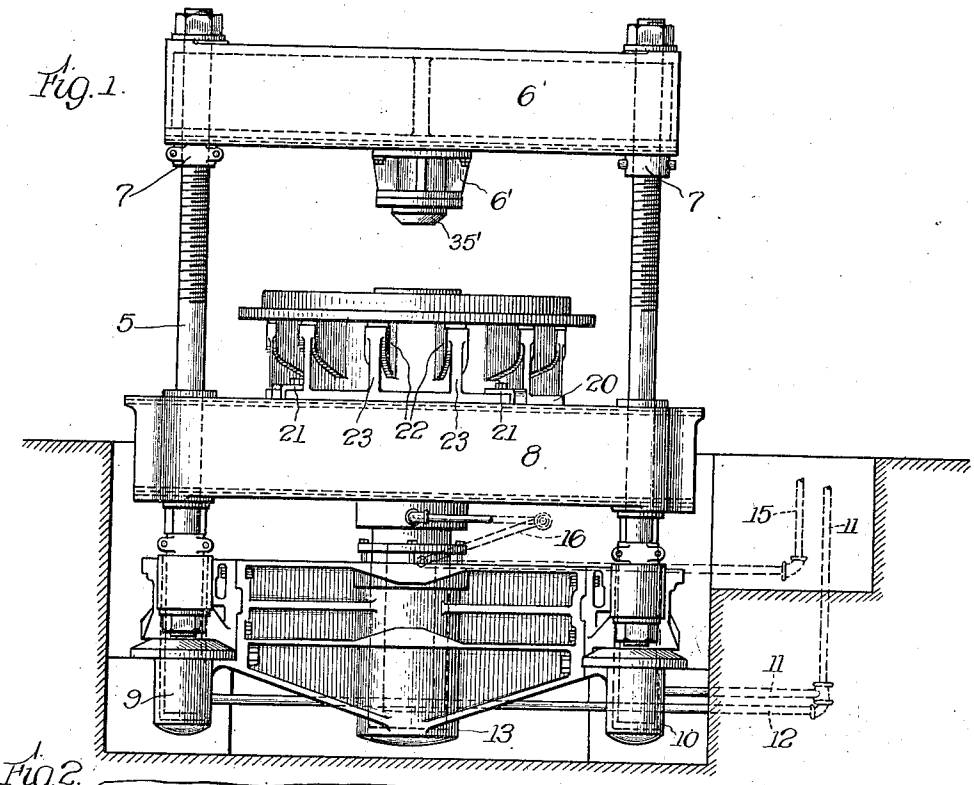
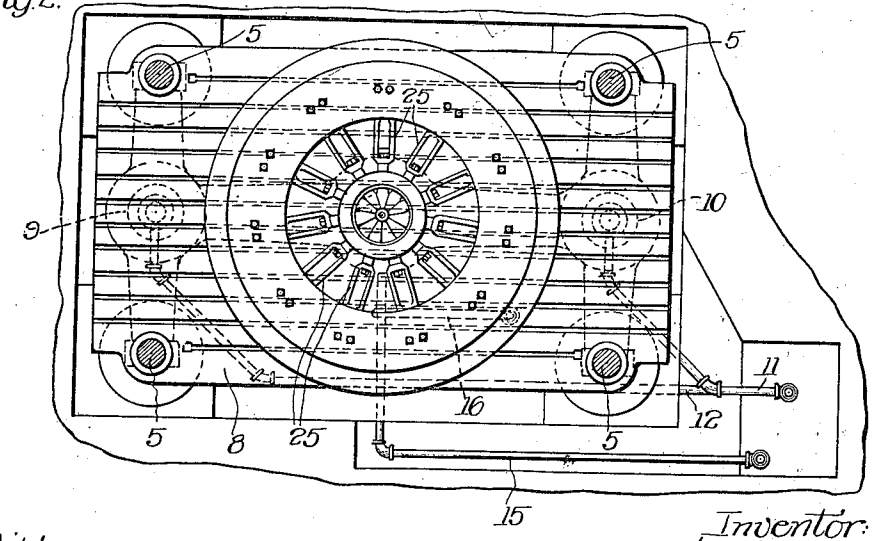


Fig. 2.



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4 SHEETS—SHEET 2.

Fig. 3.

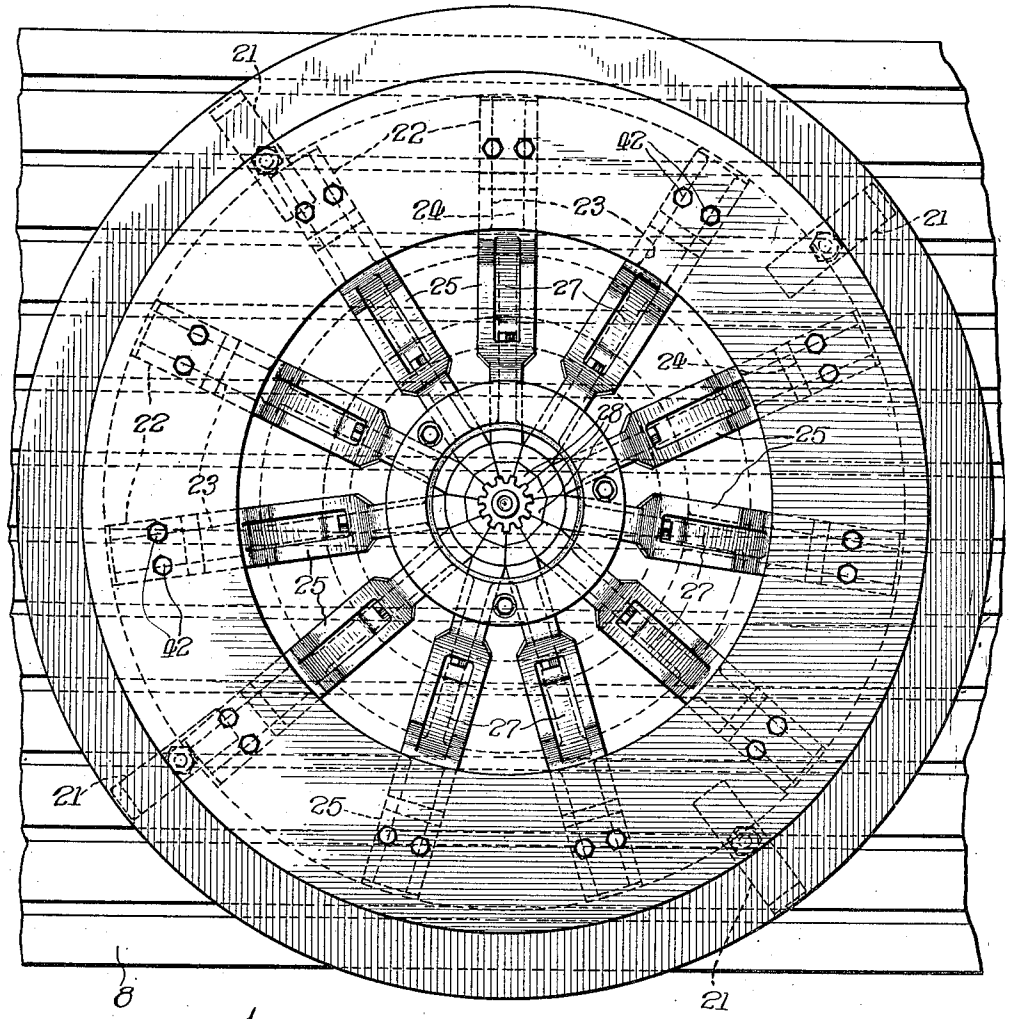
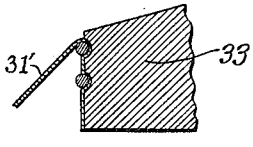


Fig. 9.



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4 SHEETS—SHEET 3.

Fig. 4.

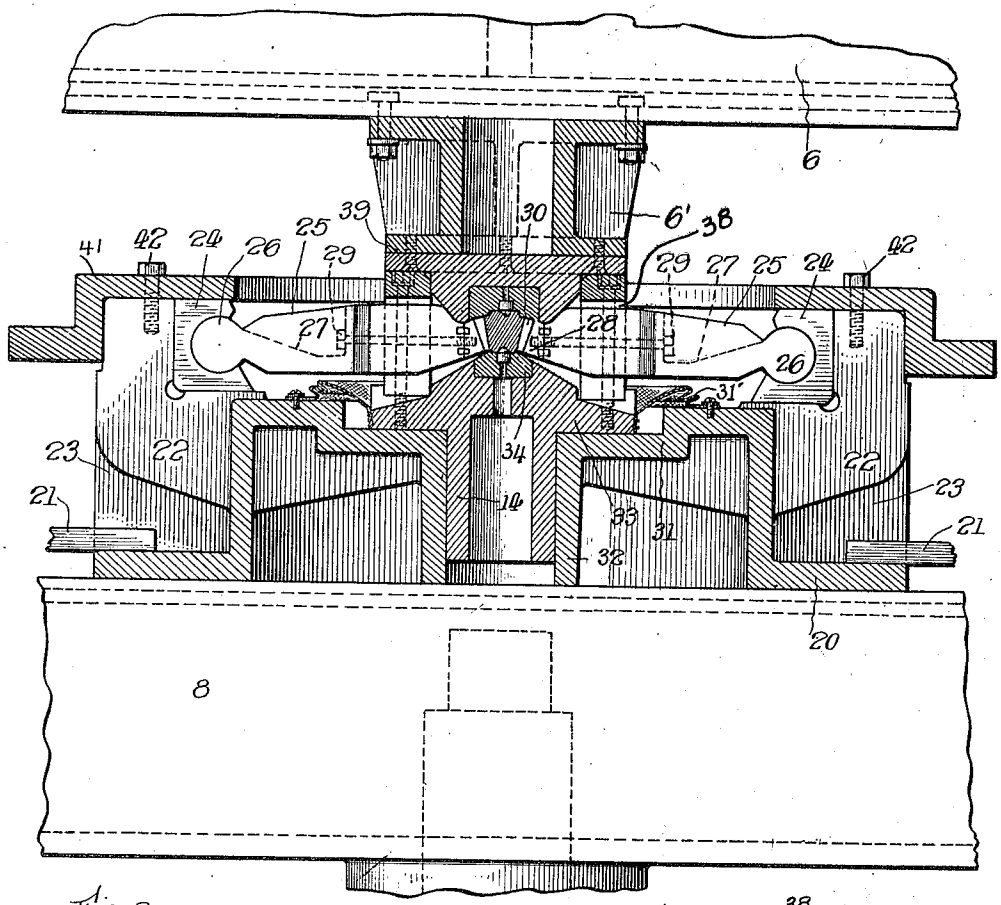


Fig. 8.

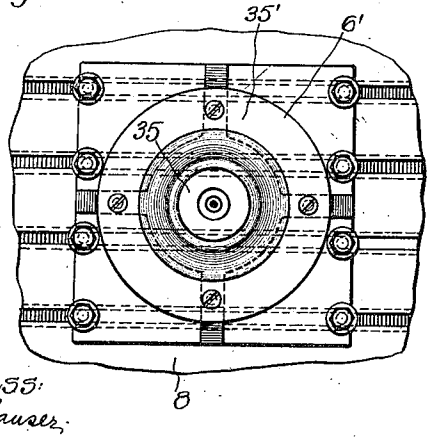
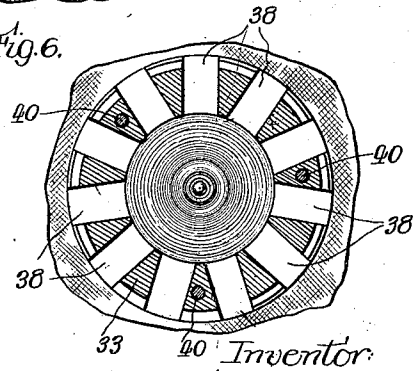


Fig. 6.



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4 SHEETS—SHEET 4.

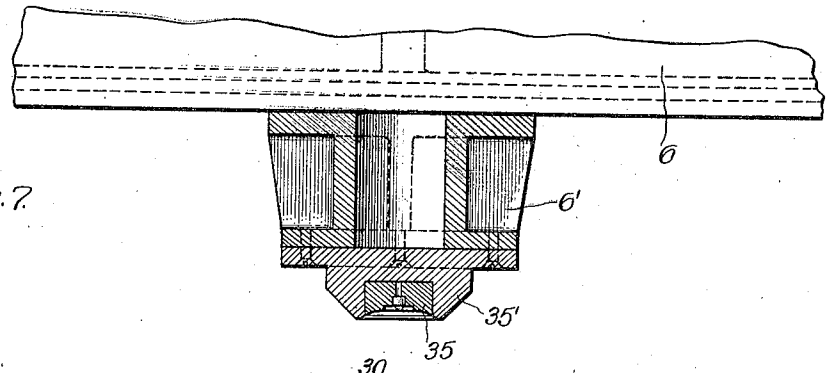


Fig. 7.

Fig. 5.

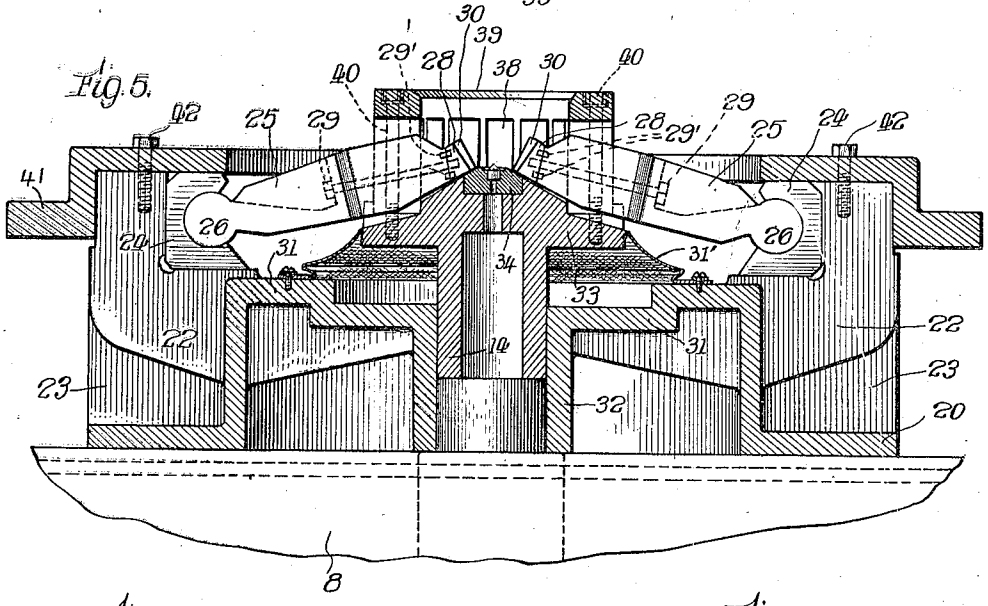


Fig. 10.

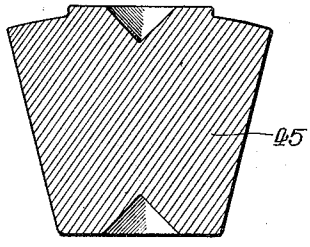
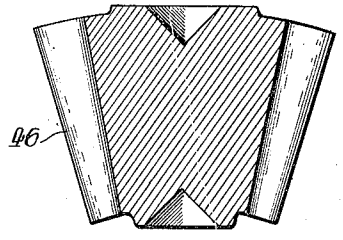


Fig. 11.



Witness:
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Patented Sept. 5, 1922. 1,428,219

UNITED STATES PATENT OFFICE.

JOHN F. CRAWFORD, OF RACINE, WISCONSIN, ASSIGNOR TO J. I. CASE THRESHING MACHINE COMPANY, OF RACINE, WISCONSIN, A CORPORATION.

GEAR-MAKING MACHINE.

Application filed March 14, 1921. Serial No. 452,309.

To all whom it may concern:

Be it known that I, JOHN F. CRAWFORD, a citizen of the United States, residing at Racine, in the county of Racine and State of Wisconsin, have invented certain new and useful Improvements in Gear-Making Machines, of which the following is a specification.

In the manufacture of gears, such as bevel and spur, and various forms of gear wheels, it has been the practice to produce such gearing by machine cutting, rolling, casting, and drop forging, some of which methods are not entirely satisfactory, as for instance when employing the casting or drop forge plan a certain amount of draft must be included with the article, and particularly when making spur gears, which condition limits the accuracy of the product when finished.

The object of my invention is to produce a machine for pressing into accurate form bevel and spur gears, worm gear wheels, and the like, which I accomplish in a rapid manner by forming the required number of teeth on the periphery of the gear blank and completing the toothed surface of the gear at a single operation, as will be furthermore fully explained.

In the accompanying drawings, forming part hereof, Figure 1 is a side elevation of a hydraulic press adapted to operate my improvement which is shown in connection therewith; Fig. 2, a plan showing the platen of said press with my improved mechanisms mounted thereon; Fig. 3, a plan of the presser-arms forming part of my invention; Fig. 4, a detail vertical sectional view showing the position of the presser-arms after a gear has been pressed into form; Fig. 5, a detail sectional view somewhat similar to Fig. 4 but showing the presser-arms in position to receive and operate upon a gear blank; Fig. 6, a detail plan showing the presser-arm guides which I employ; Fig. 7, a vertical sectional view of the die at the upper end of the press; Fig. 8, an underside view of said die; Fig. 9, a detail sectional view of a portion of said invention; Fig. 10, a detail sectional view of a bevel gear blank, and Fig. 11 is a detail sectional view of a gear produced from said blank.

In said drawings the portions marked, 5, indicate the posts of the press which I may employ; 6, the adjustable head thereon carrying a die, 6′; 7, the adjusting collars for changing the position of said head; 8, the platen; 9, 10, the rams or plungers for hydraulically actuating the platen; 11, 12, the pipes for conveying fluid to said rams; 13, the ram for operating the presser-arm actuating ram, 14; and 15, 16, the pipes for conveying fluid to said rams 13 and 14. The press construction is of a well known form and arrangement, and while the same is adapted for carrying out my invention it will be understood that any desired form of hydraulic or air press, or mechanically driven press or other mechanism may be employed for the purpose, and, therefore, such press will only be hereinafter referred to incidentally in describing my invention and its operation.

Upon the platen 8 I mount a circular frame having a base, 20, which is secured to said platen by clamps, 21, or otherwise, and which frame embodies a plurality of presser-arm bearing supports, 22, which preferably are of considerable width in cross-section and depressed at their lower ends, as at 23. In each of said bearing supports I insert a bearing, 24, in which is mounted a presser-arm, 25, said arm preferably comprising a rounded shank, 26, constituting a journal fitted into said bearing so that the arm may be rocked in a vertical direction. The arm 25 is recessed in its upper side, at 27, and is centrally bored from the termination of said recess to its forward end upon which end a bit, 28, is mounted and held securely in position by a bolt, 29, or otherwise, and may be further secured by dowel pins, 29′, said bit being provided with one or more tooth sections, 30, in accordance with the character of the gear to be produced. It will be noted that frame base 20 comprises several angles in its formation which provide a seat, 31, and a chamber, 32, for purposes which will appear. Mounted in said chamber 32 is a plunger, 33, adapted to be reciprocated vertically, and when in lowermost position rests in seat 31, its lower end terminating in the ram 14. In said plunger I provide a suitable hardened die-block, 34, between which and a similar block, 35, on the upper die 6′ and the bit ends of arms 25 is positioned the blank to be formed into a gear. In order to prevent scale or other material from lodging on seat 31 I may place a canvas covering, 31′, about the space between said seat and plunger 33,

attaching the same to each such element by screws, or otherwise, so that it will follow the movement of the mechanism to which it is attached. As indicated in the drawings, the journal 26 of arm 25 is merely inserted in the bearing 24 and not otherwise secured therein, and, therefore, in order to insure that each arm 25 will accurately operate I project the forward or bit ends thereof through a slotted guide, 38, there being a complement of guides for the number of arms 25 employed. Said guides 38 (Fig. 5) can be part of a unitary structure, 39, which I prefer to make circular in form and secure the same to plunger 33 by bolts, 40, or otherwise. It will be understood that a structure for the purpose disclosed must necessarily be of a massive character and entirely rigid, and, therefore, in order to securely bind the frame comprising the base 20 and bearings 22, I place a heavy flanged ring, 41, on top of said bearings and fixedly connect such parts, as by the bolts 42, by which arrangement bearings 22 are not disturbed by the lateral end thrust of arms 25. The upper side of plunger 33 and the die-block 35′ are so shaped as to conform to the shape of arms 25 so that the latter rest upon said plunger (Fig. 5) and register with the upper die-block 35′ when contacting therewith (Fig. 4).

In operation a blank, as 45, is placed between die-block 34 and the bits 28, the arms 25 being in the position indicated in Fig. 5. The blank is then brought into contact with a die, as 6′, and extreme pressure applied to the parts, as by the hydraulic system herein referred to, or otherwise. Such pressure results in forcing the material of which the blank is composed between the toothed sections 30 of bits 28, and as such pressure continues the arms 25 with the plunger 33 carrying die-block 34 are forced downwardly from the position shown in Fig. 5 to that shown in Fig. 4, so that as the contact between the parts exists until such latter position is reached, a constant spreading or pressing of the material into the grooves between the bits 28 occurs, as indicated in Fig. 3, and as the operation is completed a perfectly and accurately formed gear, 46, is produced without fins or draft as hereinbefore referred to, and which require no finishing. The gear may be readily removed by raising or withdrawing the arms 25 to a position such as indicated in Fig. 5 when another blank may be introduced and the work continued.

While I have shown and described an arrangement involving a plurality of radially positioned arms I desire it to be understood that such form is especially adapted to pressing bevel gears, but where work of a different character is required the number of arms may be materially reduced in proportion to the number of teeth to be formed, as for example, when making a comparatively large gear or a gear of special tooth shape, as a less number of arms with properly designed bits may accomplish the work.

I claim as my invention:

1. In a gear making machine, means upon which a gear blank is positioned, vertically swinging arms having toothed sections adapted to grip the periphery of said blanks, and means for contacting the opposite end of said blank, said elements when actuated pressing said blank into gear form.

2. In a gear making machine, a frame embodying bearings, vertically swinging presser-arms mounted in said bearings, means between said arms for supporting a gear blank, means adapted to contact with one side of said blank, and means for actuating said supporting means for engaging said contacting means to press said blank therebetween and between said arms.

3. In a gear making machine, a frame embodying a bearing, a vertically movable presser-arm mounted in said bearing, and means for actuating said arm to engage a gear blank.

4. In a gear making machine, a frame, a plurality of vertically movable presser-arms mounted therein, means between said arms for supporting a gear blank, and means for actuating said arms to grip and form teeth in said blank.

5. In a gear making machine, a frame, vertically movable presser-arms mounted in said frame, movable means upon which the upper ends of said arms rest, and means for actuating said movable means to bring said arms into engagement with a gear blank and to disengage the same from said blank.

6. In a gear making machine, a frame, a vertically movable presser-arm mounted therein, a tooth-forming bit mounted at one end of said arm, and means for securing said bit thereto.

7. In a gear making machine, a frame, a vertically movable presser-arm mounted therein, a tooth-forming bit mounted at one end of said arm, and a bolt in said arm for securing said bit thereto.

8. In a gear making machine, a frame, and a vertically movable presser-arm mounted therein having a shank at one end and a removable bit at its opposite end.

9. In a gear making machine, a frame, a plurality of swinging presser-arms mounted therein in radial relation, a plunger beneath said arms adapted to support a gear blank between the ends of said arms, means for contacting the opposite end of said blank, and means for actuating said plunger to carry said arms and blank against said contacting means for pressing said blank into gear formation between said arms.

10. In a gear making machine, a frame,

swinging presser-arms mounted therein, guides within which the movement of said arms is controlled, and means for actuating said arms through said guides.

11. In a gear making machine, a base having a chamber therein, a plunger in said chamber, bearings mounted on said base, presser-arms mounted in said bearings and supported by said plunger, a die, and means for actuating said plunger to move said arms into contact with said die for pressing a gear blank.

12. In a gear making machine, a base, a chamber in said base, a plunger mounted in said chamber, means for preventing the entrance of extraneous matter between said base and plunger, bearings mounted on said base, arms mounted in said bearings, a die, and means for actuating said plunger to move said arms into contact with said die for pressing a gear blank.

13. In a gear making machine, a base, a plunger mounted therein, a plurality of bearings mounted upon said base, a plurality of guides mounted on said plunger, presser-arms mounted in said bearings and passing through said guides, and means for actuating said plunger and arms to press a blank into gear formation.

In testimony whereof I affix my signature.

JOHN F. CRAWFORD.