G. K. GARVIN & E. J. McCLELLAN.

CHUCK FOR HOLDING GEARS.

APPLICATION FILED AUG. 11, 1911.

1,036,994.

Patented Aug. 27, 1912.

2 SHEETS—SHEET 1.

Fig. 1.

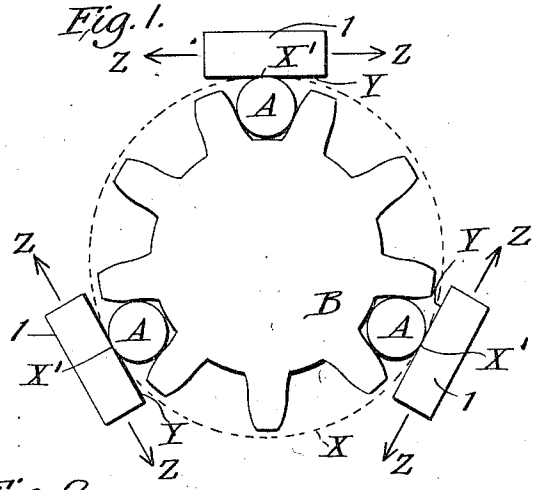


Fig. 2.

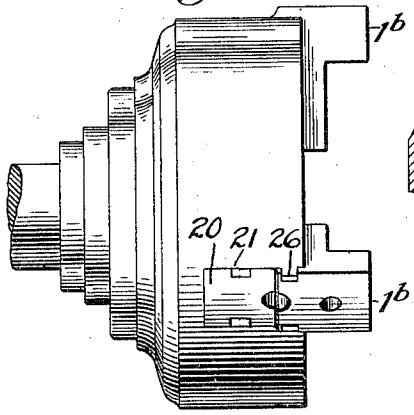


Fig. 3.

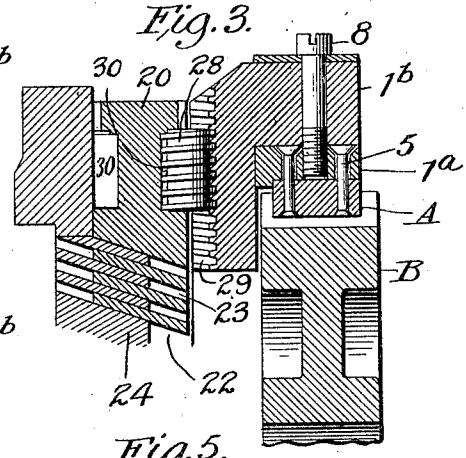


Fig. 4.

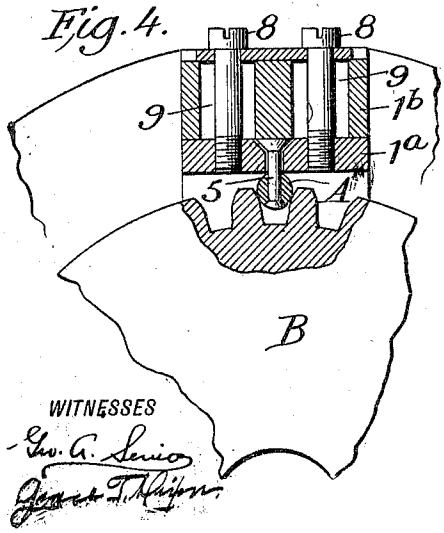
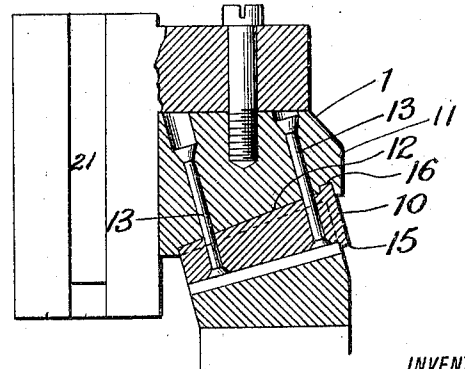


Fig. 5.



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2 SHEETS—SHEET 2.

Fig. 6.

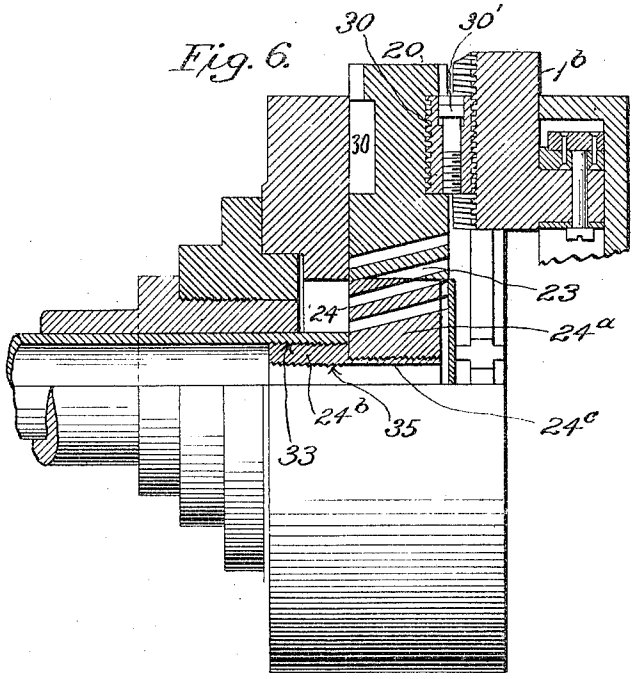
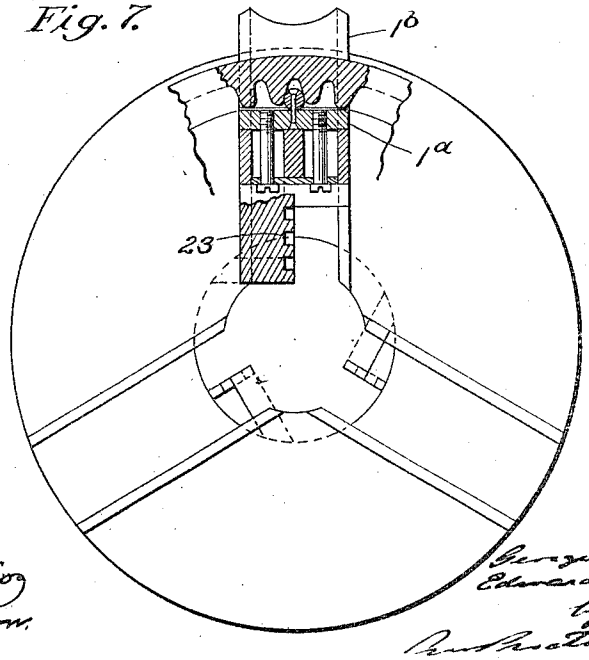


Fig. 7.



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CHUCK FOR HOLDING GEARS.

1,036,994. Specification of Letters Patent. Patented Aug. 27, 1912.

Application filed August 11, 1911. Serial No. 643,486.

To all whom it may concern:

Be it known that we, GEORGE K. GARVIN and EDWARD J. MCCLELLAN, citizens of the United States, residing at New York city, in the county of New York and State of New York, have invented a new and useful Improvement in Chucks for Holding Gears, of which the following is a specification.

This invention relates to chucks of the class in which a plurality of jaws, generally three, are drawn together or expanded simultaneously.

The invention includes features of improvement in chucks of this class and further relates to features for centering gears true to the pitch surface of the gear. As to this latter aspect it will be understood that the pitch surface of a gear is a circle, cylinder or cone which is not represented by any actual surface formed on the gear, but which is nevertheless fixed in any particular gear by the form of the working faces of the teeth. It will be understood that when a gear is in use it will work properly or otherwise in accordance with whether or not its pitch surface is concentric or eccentric to the axis of rotation of the gear. In the processes of making gears the pitch surface is generally somewhat eccentric to the cylindrical or other blank from which the gear was originally cut, so that this blank cannot be relied upon in the processes of boring, grinding or otherwise forming the central axial hole.

The present invention relates particularly to a chuck having protuberances which enter between the teeth at three points about one hundred and twenty degrees apart, the protuberances then being put in a fixed relation to a chuck which not only fixes their position, but also binds them tightly in the said indentations between the teeth. In finishing bevel gears the invention has a special field of utility, as will later be pointed out.

It has been found in practice that a series of hardened gears, although cut in the same way and at the same time, present differences due perhaps to hardening, and on account of these differences it will happen that three protuberances having one position for one gear will be found to occupy a slightly different position when they have been firmly seated in corresponding indentations or tooth spaces of another gear. On account of this different location there is a certain difficulty encountered when the protuberances are formed on or permanently seated as fixed parts of the jaws of a three-jaw chuck. In a draw-chuck, such as forms the subject of Patent No. 927,424, granted July 6, 1909, the jaws tend to draw to certain fixed positions after any original adjustment or setting has been made, and while such fixed positions may be exactly suited to any particular gear when held for example by protuberances of the jaws between the teeth thereof, such positions would not suit another gear which differed slightly from the first, perhaps due to hardening. The deviation from correctness will not be extensive, indeed it will not amount to more than a few thousandths of an inch in ordinary cases, but this error is serious in itself and furthermore may produce trouble by preventing an equal and positive gripping of the gear by the protuberances at all points of their contact.

As to those features or parts of the invention which relate to the actuating mechanism of the chuck, we have provided a plan which adapts the construction to grinding internal gears as well as ordinary spur-gears, or to any similar purposes where special jaws for holding gears are not used.

In this latter aspect the invention has for its object to provide for a positive expansion of the jaws as well as a positive contraction, resulting from a movement of the draw-tube in the same direction in each case, this action being accomplished in an improved manner and by a mechanism which is very simple, easily adapted for its various purposes, and durable.

The invention consists in the features of construction and combination as hereinafter set forth.

In the drawings, Fig. 1, is a front elevation showing the main features of a chuck embodying the principles of the present invention employed for holding a spur-gear; Fig. 2, is a side elevation of the complete chuck with the protuberances removed; Fig. 3, is a detail view partly in section showing one of the jaws; Fig. 4, is a front view of the same; Fig. 5, is a detail side view showing an embodiment of the invention specifically adapted for bevel-gears; Fig. 6, is a sectional view showing the complete chuck, and particularly

showing the mechanism for expanding and contracting the jaws. In this figure the mechanism is arranged to positively expand the jaws, and the jaws are further provided with devices to hold an annular gear, and Fig. 7, is a front view partly in section of the same.

The invention will include a plurality of protuberances or bodies A, as rollers, adapted to fit in the spaces between adjacent teeth of a gear B, and contacting with the working faces of the teeth, preferably at or near the pitch surface. Three rollers will ordinarily be provided, and disposed about one hundred and twenty degrees apart. If the rollers are of equal size their peripheries will theoretically lie in a circle or surface X Fig. 1, being tangent thereto at the points X^1. With different supposedly similar gears the points X^1 may be found in different angular or circumferential positions in the circle X, but such cicumferential deviation will not amount to more than a few thousandths of an inch.

The invention will further include a chuck having jaws which are capable of drawing inward simultaneously to certain unvarying or fixed positions after any preliminary adjustment, and in the best constructions embodying the invention the jaws will be independently adjustable in addition to their main clamping movement or action just referred to. 1 designates jaws of this sort which are adapted to clamp together into contact with the rollers or bodies A at three points or lines corresponding to the outer surfaces of the respective rollers. In this way an equal pressure is brought on the rollers and they are clamped securely in the chuck. They are furthermore each caused to bear with equal pressure on the working faces of two adjacent gear teeth, so that the closing force of the chuck is distributed equally to six points or lines on the gear. The foregoing assumes that the rollers do not have a fixed engagement with the jaws 1 and this is in accordance with the invention.

If a series of differently warped gears, each having the same rollers between their teeth are clamped as above described by the chuck jaws 1, (assuming a correct initial adjustment of the jaws) the circle X and correspondingly the pitch circles or surfaces of the different gears will be concentric to the axis of the chuck in all cases, provided the chuck jaws engage the rollers at about the same points on the jaws in all cases. In other words, in view of the fact that the jaws have surfaces Y which are practically tangent to the circle X, it makes no real difference as to be above precision whether or not the rollers A are a few thousandths of an inch either one side or the other of say, the central points X^1 of the jaws. Accordingly if the rollers are maintained substantially *i. e.* within a few hundredths or thousandths of an inch laterally of a certain point on the respective jaws 1, they will be capable of centering different gears with equal accuracy, notwithstanding the fact that on account of warping or other irregularities which are always present the rollers do not occupy exactly the same circumferential positions on the circle X in the various cases.

In our approved practical construction embodying the invention, the rollers A will be loosely pinned to the jaws 1, as by headed pins 5 passing through slightly larger holes in the rollers and in the jaws 1. We do not wish to confine ourselves to this precise arrangement of rollers, since the gist of the invention resides in the provision of shifting, wabbling or rocking bodies angularly or laterally movable, and related to the jaws of the chuck and to the gear to be held in accordance with the principles and mode of operation above described.

In accordance with the most practical embodiment of the invention, the jaws will be adjustable laterally *i. e.*, in the direction of the arrow Z, Fig. 1, so as to constitute secondary jaws. This permits an initial positioning of the rollers for gears having numbers of teeth not multiples of three. As practically illustrated, there is provided a plate 1^a shiftable laterally on the jaw 1^b and secured thereto by bolts 8 which pass through slots 9 on the jaw 1^b and may be tightened in different positions of adjustment. This plate 1^a may be said to constitute a form of secondary jaw.

In the specific application of the invention to bevel gears the rollers are tapered and furthermore held on an angle so that their axes and also their conical surfaces converge toward the apex of the bevel-gear. (See Fig. 5.) The conical rollers are denoted 10 and are guided against an inclined surface 12 on the jaw 11. 13 denotes the pins by which the rollers are loosely held to the jaws.

It appears that in holding bevel-gears certain requisites demand that one of the rollers be firm and rigid, and we accordingly make one of the rollers rigid with the jaw which holds it. In this case the jaw may be said to have a fixed part not constituting a movable protuberance. The same plan may be of course adopted with spur-gears. Also in conection with bevel-gears there is a force developed tending to throw the gear forward or out of the chuck. We provide means for adequately resisting this force, which is furthermore very convenient, and furthermore adapted to keep the gear in a plane of rotation which is

perfectly normal or perpendicular to the axis of the chuck. In accordance with the best constructions for this purpose each roller will have an enlargement, head or collar 15, and the chuck-jaw 11 will have an annular groove 16 into which the head 15 is received. The bevel gear rests against the head 15 on the roller which resists the endwise thrust, and in turn the endwise thrust imparted to the roller is resisted by the groove 16.

In the best constructions embodying the invention, the chuck provided will have jaw supports 20 movable radially of the chuck in ways 21, the respective jaw supports having portions 22 with inclined recesses 23 which engage with correspondingly inclined projections on the head 24 of the draw-tube or rod. The effect is to draw the jaw supports equally inward by endwise movement of the draw-tube so that the jaws are forcibly brought into a fixed and unvarying engagement with the object to be clamped. The jaw-supports do not in the best constructions carry the jaws directly, but the jaws are adjustable independently of the jaw-supports. This is accomplished by mounting the jaws in ways 26 separate from those of the jaw-supports, and further interposing a threaded plug 28 between the jaws and the jaw-supports, the threads meshing with thread grooves 29 in the jaw, and the plug being prevented from endwise movement by a socket 30 in the jaw-supports. The turning of these plugs independently fixes the position of the jaws on the jaw-supports. The plugs can be firmly clamped by screws 30^1. These interior screws 30^1 are co-axially threaded into the plugs 28 from which they can be projected so as to bind the plugs by the endwise pressure thereon. The secondary jaws already referred to are supported so as to be laterally adjustable of the jaws. In other words, in the best constructions there will be jaw-supports having a universal *i. e.* simultaneous closing movement produced by inclined teeth on a draw tube or rod; there will be jaws proper independently adjustable of the jaw-supports and guided in separate ways, there will be secondary jaws laterally adjustable on the jaws proper; and protuberances, bodies or rollers supported in generally fixed positions on the secondary jaws but capable of a free limited, angular or lateral movement *i. e.* a movement in the direction of rotation of the chuck. In the specific form of the invention for bevel-gears, the secondary jaws will ordinarily be omitted, and one of the protuberances, bodies or rollers will be fixed firmly to its supporting-jaw.

The features of the invention which we have previously referred to for expanding and contracting the chuck jaws positively by a movement of the draw-tube or rod in one direction, are in many respects independent of the gear holding features of the invention.

In Figs. 6 and 7 a construction which constitutes an approved one for the just referred to purposes of the invention is particularly illustrated. The jaws 1, with their main portions 1^b, and the jaw supports 20, are shown the same as in Fig. 3, with the exception that both have been turned around or reversed in position in a manner which will be clear from a comparison of these figures. This reversibility entirely alters the character of the action in a manner which will be presently described. It also introduces certain features of construction which have not been hitherto referred to. Particularly it is characteristic of the construction that the jaw supports have ways 21 which are symmetrical with respect to a common central transverse plane passing through each support, such plane being also in the lines of radial movement of the jaw supports. In addition to this the jaw supports 20 are provided with sockets 30 on both sides, the sockets being just alike and symmetrically constituted with respect to one another and with respect to the plane just mentioned. On account of these features of construction, it is possible to take the jaw supports out and turn them around, and when turned around they will serve as well in their relation to the jaws 1 as when in their original position first described. They have however this difference when turned around that the inclined recesses 23 are now inclined in an opposite sense to that which they previously assumed. This fact calls for a different head 24 on the draw tube or else a reversal of position of the head 24, either of which is a part of the present invention. If a different head 24 is used it will have different characteristics suitable to a new service. For the purposes of illustrating such new characteristics, we have shown a head 24 comprising a main portion 24^a and a boss 24^b which is threaded exteriorly and interiorly at 33 and 35 so as to be attachable to either a draw tube or a draw rod. In the form illustrated the boss is further shown detachable from the main portion 24^a of the head, having a stud 24^c which screws into said head. By unscrewing the boss from one side of the head and then screwing it onto the head from the opposite side, the head is adapted to serve its new purpose in the structure. In other words, the head as thus changed is adapted to serve with the reversed position of the jaw supports 20 and the latter are adapted to positively expand rather than positively contract the jaws when the draw tube or rod is pulled toward the left. This is in accordance with the practice of the invention already referred to and is particularly adapted

to use in grinding gears of annular form or holding annular parts of any description. The same result is obviously secured by substituting a different or extra head 24.

It will of course be understood that many features of the chuck are not dependent for their utility on their use with the particular form of adjustment for the jaw-supports just described. So far as the gear holding features are concerned, the chuck-jaws need not have any radial adjustment to suit different sized gears, provided they are capable of a slight contracting or clamping movement sufficient to locate them tightly in their clamping relation. In other words, it is only necessary for the jaws to have a locating movement to clamp the gear without having an adjustment to suit different sized gears.

While the embodiments of the invention are considered as the best practical constructions for the purposes of use and practice, we do not desire to be particularly limited or restricted thereto, since it is obvious that variations may be made within the scope of the appended claims, but still embodying the principles of the invention and without departing from the spirit or scope thereof.

What we claim is:—

1. In a chuck for holding indented or toothed articles, the combination of protuberances for engaging the indentations of the article, and means for locating the radial and also the lateral positions of said protuberances circumferentially of the chuck.

2. In a chuck for holding indented or toothed articles, protuberances for engaging the indentations of the article, means for locating the radial and lateral positions of said protuberances, and means for permitting a free lateral displacement of a plurality of said protuberances.

3. In a chuck for holding indented or toothed articles, laterally yieldable bodies for entering the indentations of the article and engaging both side walls of the respective indentations, and means for locating the radial and also the lateral positions of a plurality of said bodies.

4. In a chuck for holding indented or toothed articles, protuberances for entering the indentations of the articles and engaging both side walls of the respective indentations, means for locating the radial and lateral positions of said protuberances, and means for permitting a free lateral displacement of a plurality of said protuberances.

5. In a chuck for holding indented or toothed articles, protuberances for engaging the identations of the article, means for locating the radial and lateral positions of said protuberances, and means for permitting a free shifting displacement of a plurality of said protuberances within narrow limits in the direction of their rotative movement when the chuck is used.

6. In a chuck for holding indented or toothed articles, jaws having radial adjustment, secondary jaws having a lateral adjustment on the first mentioned jaws, and protuberances having a lateral movement on said secondary jaws.

7. In a chuck for holding indented or toothed articles, jaws having a radial adjustment, protuberances for engaging the indentations of the article, means for locating the radial and lateral positions of said protuberances, and means for permitting a free lateral displacement of said protuberances.

8. In a chuck for holding indented or toothed articles, jaws having a radial adjustment, secondary jaws having surfaces generally tangent to a common surface of rotation concentric with the axis of the chuck, and protuberances for engaging the indentations of the article and supported to shift on said surfaces.

9. In a chuck for holding indented or toothed articles, jaws having a radial adjustment, secondary jaws having surfaces generally tangent to a common surface of rotation concentric with the axis of the chuck, protuberances for engaging the indentations of the article and supported to shift on said surfaces, and means for locating the radial and lateral positions of said protuberances.

10. In a chuck for holding indented or toothed articles, three protuberances for engaging the indentations of the article, means for locating the radial and lateral positions of said protuberances, and means for permitting a limited, free, lateral displacement of said protuberances.

11. In a chuck for holding indented or toothed articles, jaw supports, means for simultaneously drawing said jaw-supports inward, jaws independently adjustable on said jaw-supports, and rollers having a limited lateral movement with respect to said jaws.

12. In a chuck, reversible jaw-supports having guiding ways symmetrical thereon with respect to a common central axis of such supports, and reversible about such axis, a draw member, and means coöperating with said jaw-supports in two positions reversed with respect to one another, whereby similar movements of said member produce expansions and contractions of said supports respectively.

13. In a chuck, reversible jaw-supports having ways symmetrical to a common central axis of said supports and reversible about such axis and having sockets also symmetrical on said supports on opposite sides of said axis, a draw member, and means coöperating with said supports in two posi-

tions reversed with respect to one another, whereby similar movements of said draw member produce expansions and contractions of the jaws respectively.

14. In a chuck, reversible jaw-supports having ways symmetrical to a common central axis of said supports and reversible about such axis and having sockets also symmetrical on said supports on opposite sides of said axis, a draw member, and means differently formed in the respective cases coöperating with said supports in two positions reversed with respect to one another, whereby similar movements of said draw member produce expansions and contractions of the jaws respectively.

15. In a chuck for holding indented or toothed articles, jaw supports, three protuberances for engaging the indentations of the articles, means for locating the lateral positions of said protuberances, means for permitting a limited, free, lateral displacement of said protuberances, and means to draw inward the jaw supports for clamping said protuberances in the indentations of the article.

16. In a chuck for holding indented or toothed articles, jaws having a clamping movement, secondary jaws having a lateral adjustment on the first mentioned jaws, and protuberances having a lateral movement on said secondary jaws.

17. In a chuck for holding indented or toothed articles, jaws having a limited clamping movement, secondary jaws on the first mentioned jaws, having surfaces generally tangent to a common surface of rotation concentric with the axis of the chuck, and protuberances for engaging the indentations of the article and supported to shift on said surfaces.

18. In a chuck, jaws, reversible jaw supports, a draw member, and a head having inclined teeth coöperating with said jaw supports in two positions reversed with respect to one another, said head being attachable to the draw member at either end of its own central axis, whereby similar movements of said draw member may be made to produce expansions and contractions of the jaws respectively.

19. In a chuck, jaws, three reversible jaw supports, a draw member, and a head having three toothed faces coöperating with said jaw supports, said head being attached to the draw member at either end of its own central axis, whereby similar movements of said draw member may be made to produce expansions and contractions of the jaws respectively.

In testimony whereof, we have signed our names to this specification in the presence of two subscribing witnesses, this 8th day of August 1911.

GEO. K. GARVIN.
EDWARD J. McCLELLAN.

Witnesses:
FREDERICK E. SEDDON,
FRANK A. POWER.