March 1, 1938. C. F. CARLBORG 2,109,740

GEAR PULLER

Filed July 15, 1936

FIG. 1

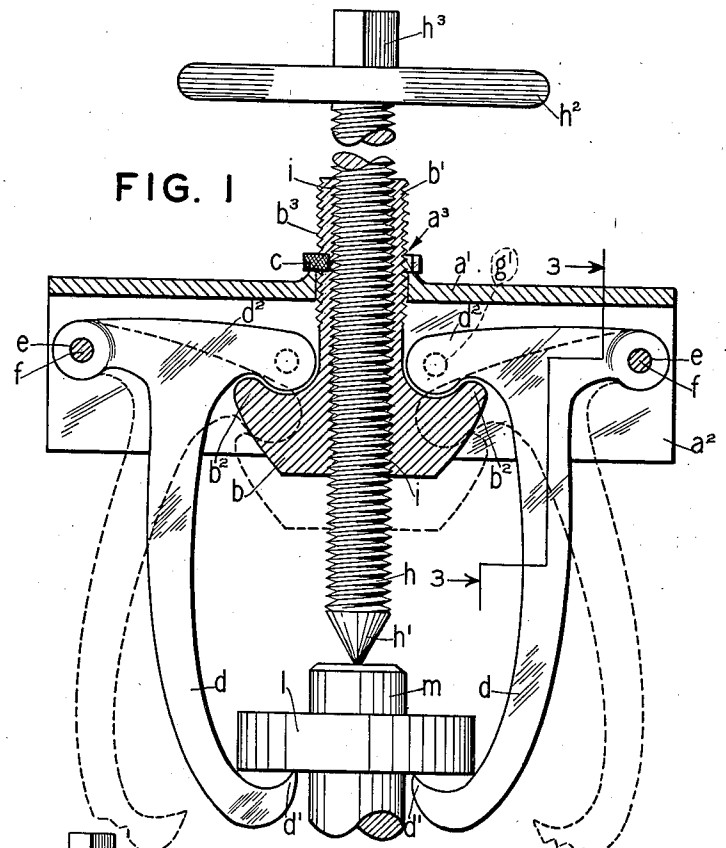

FIG. 2

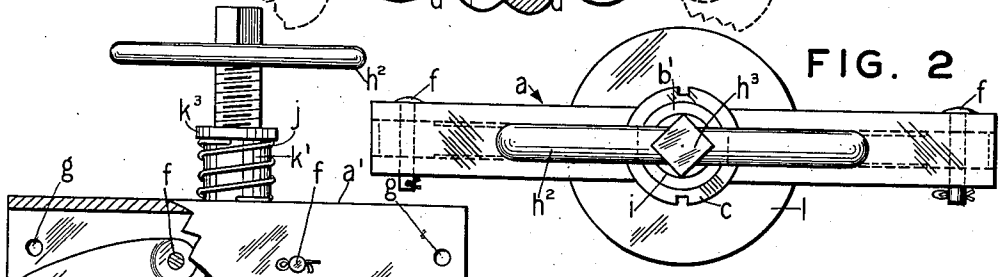

FIG. 3

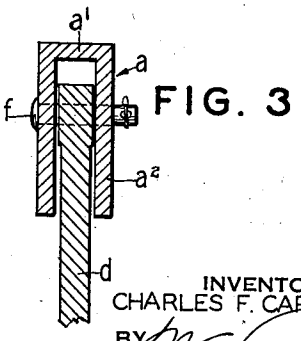

FIG. 4

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GEAR PULLER

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4 Claims. (Cl. 29—85)

My invention relates to removing tools for use with gears and like devices which are seated relatively tightly upon shafts or into recesses. Other devices which require a substantial amount of pressure to remove them are bearings and battery terminal clamps.

The principal object of my invention is to provide a removing tool for use with such devices, which tool is provided with jaws swung either inwardly or outwardly and held tightly into engagement with the face of a device of this character and with further means for holding said devices in place and increasing the pressure somewhat in proportion to the pressure exerted to unseat said devices.

A further and more specific object of my invention is to improve devices of this character by providing a firm, strong and positive engagement between the jaws and the pressure-exerting devices, so as to minimize the stresses to which said parts are subject in operation, and to increase their effectiveness.

A further and more specific object of my invention is to provide a device of this character with removable engaging pieces which are not only interchangeable with each other as to right and left hand, but are also interchangeable to produce an inwardly extending jaw for extending about the external portions of an object and which also are extensible to pass thru the bore of a device and engage the face of said device.

Further operating advantages and the details of construction are hereinafter described with reference to the accompanying drawing, in which:

Fig. 1 is a longitudinal section thru a removing tool embodying my invention with the movement of the device indicated in dotted lines;

Fig. 2 is a plan view thereof;

Fig. 3 is a sectional view taken on the line 3—3 in Fig. 1; and

Fig. 4 is a view similar to Fig. 1, but on a reduced scale of a modification of my invention, and said figure further indicates the manner in which the jaws can be arranged to face outwardly to pass thru the bore of a device and engage a face thereof.

My improved removing tool comprises a body *a*, which is, in the main, of inverted U-shaped section, as is shown in Fig. 3. That is, said body is provided with a relatively flat head *a'* and skirted portions *a2* pendent from the sides thereof. Slidably mounted in said body and extending thru an aperture *a3* in the head portion is a lifting jack *b*, having a neck *b'* and lateral shoulders *b2*. The neck portion is externally threaded as at *b3* and a nut *c* engages said threaded portion and rides against the exterior face of the head *a'*.

Pivotally secured between the skirted portions *a2* are two pulling jaw members *d*, which are preferably curved inwardly upon a gradual sweep and terminate in hooked points *d'* extending laterally from the main portion of said jaws. The pivoted ends of said jaws are provided with lateral projections *d2*, so that said pulling jaws are roughly T-shaped in elevation. Each of said jaws is provided with an aperture *e* thru which a pivot pin *f* may extend.

The skirted portions of the body are provided with two pairs of alined apertures *g* and *g'* and the pivot pins *f* are removable and may be inserted in either of said apertures depending upon whether the removing tool is to be used with an externally-arranged gear or similar device upon a shaft, or whether said removing tool is to be used with an internally-arranged device such as a bearing. In Fig. 1, I have shown the jaws arranged so that the hooked points face each other and the pivot pin extends thru the apertures *g* and *e* in the skirted portions of the body and the pulling jaws, respectively.

The engaging faces of the lateral projecting portions *d2* of the pulling jaw and the lateral shoulders *b2* of the lifting jack are formed to interlock, but the interlocking faces are rounded so as to permit relative angular movement between said opposed faces. It is to be noted that the sweep or the curvature of the operating face of the lateral projecting portions *d2* of each pulling jaw differ from each other. The sweep or curvature of the face of the lateral projecting portion underlying the aperture *e* is substantially flatter than the other arranged more distantly therefrom. Said face likewise is substantially flatter than the curvature of the operating face of the lateral shoulders of the lifting jack.

The reason for flattening the curvature of the operating face under the pivot point is when said jaws are arranged as is shown in Fig. 4, they must be extended outwardly by the pressure of the device. Thus the extremity of the lateral shoulders *b2* must strike the operating face of the pulling jaws in advance of the remainder, so that said engagement will rock said pulling jaws about their pivot and tend to cause them to diverge.

Operating pressure is provided in my removing tool by a threaded screw *h*, which operatively engages the internally-threaded or tapped bore *i* of the lifting jack *b*. The end of said screw is

preferably provided with a coned or pointed end *h'*, which is adapted to fit into the center mark on the end of the shaft, so as to prevent the point of said screw from shifting laterally. The upper end of said screw is provided with a handle *h2* or a non-circular or squared tool-engaging end *h3*, or both, so as to provide means by which increased leverage may be attained for turning said screw.

The only difference between the modifications shown in Figs. 1 and 4 respectively being that in Fig. 1, I show a nut *c* and threaded neck *b3*, which are adapted to adjust the lifting jack with relation to the body *a*. In Fig. 4, I show a coil spring *j* adapted to extend between the head *a'* of the lifting jack and the laterally-extending flange *k3* upon the lifting jack *k*. The neck portion *k'* of said lifting jack is thus not provided with an external thread and the lateral shoulders *k2* thereof are identical to the similar shoulders *b2* shown in Fig. 1.

As has been pointed out heretofore, the pulling jaws *d* are arranged so that the pivot pin *f* extends thru the apertures *g'* in the skirted portion *a2* of the body and thus the relative movement of the jack upwardly in the head, as is viewed in Fig. 4, will cause said pulling jaw to spread outwardly instead of inwardly, as is viewed in Fig. 1. All of the other parts of the modification shown in Fig. 4 are identical with the parts shown in Fig. 1, and thus are given the same reference characters.

The operation of my device is as follows: When said removing tool is used to remove a gear *l* from the end of a shaft *m*, the nut *c* is backed away from the head so that the latter can be moved towards the handle *h2* and the jaws swung open to extend around the external portions of said gear and so that the hooked points *d'* may be swung over and engage the face of said gear more distant from the end of the shaft *m*. The nut is then rotated until it engages the head *a'* of the body very closely. The external portion of the nut is preferably knurled and radially-extending apertures may be provided in the periphery thereof so as to be engageable by a spanner wrench, or similar tool, if it is necessary to exercise a greater force to hold said points in engagement than can be attained by turning said nut with the fingers.

It is usual that the centering mark is left on the end of a shaft and the pointed or coned end *h'* is thus inserted in said center mark. If no center mark is provided, it is common to use an adapter (not shown) over the end of the shaft, which adapter is provided with a centering mark for engaging the pointed or coned end of the screw. Said screw is then turned and pressure is exerted to remove said gear. The lateral shoulders *b2* of the lifting jack and the lateral projecting portions *d2* of the pulling jaws when the latter are arranged in this position are interlocked. The faces are rounded, however, to accommodate angular movement of said jaws and at the same time an engagement is had between said parts which does not tend to force them outwardly and away from each other as would be the case if inclined surfaces were provided for producing angular movement of the pulling jaws. Thus it is evident that the greater the force exerted between the hooked points of the pulling jaws and the screw, the greater the force will be provided for holding said hooked points against slipping outwardly, and out of engagement with the face of the gear *l*.

When the jaws are arranged with their hooked points extending away from each other to pass within the bore of a bearing or similar element and to engage the opposed face of said bearing, the nut *c* is similarly backed off to permit said parts to be thus arranged and is tightened to hold said parts in firm engagement.

In Fig. 4, I have shown the pulling jaws thus arranged, but have shown a coil spring *j* adapted to exert a definite resisting force for extending said jaws, and it is thus necessary to force said jaws together manually and release them when they are in position, and the spring will tend to hold them in place. The application of a spring to hold said parts in engagement with the element to be removed is adapted for relatively small tools, and when only a small force is necessarily exerted to hold the hooked points in engagement. This is for the reason that if a larger spring is provided, difficulty is encountered in manually moving said jaws so that they can be extended or compressed to seat them. I consider it preferable that some positive holding and pressure producing device, such as the nut *c*, be provided for producing the initial seating of the said hooked points. This is because the most common fault with removing tools is that said points come out of engagement more frequently than any other failure, in use.

I do not wish to limit my invention to be used with pointed screws *h*. In some instances, such as when a tool of this character is used for removing battery terminal clamps, it is desirable to provide the end of said screw with a rotatable head of such diameter that it corresponds quite closely to the face of the terminal and so that it fits tightly within the clamp. Thus the clamp holds the point of the screw in alinement with the terminal. A pointed end gouges out the relatively soft material and permits disengagement of the parts.

I claim:

1. A removing tool comprising a body, a plurality of pulling jaws pivotally mounted in said body, each jaw comprising angularly-arranged arms joined together, the free end of one arm terminating in an offset work-engaging element and the free end of the other terminating in an operating element, a lifting jack movably mounted in said body and comprising offset shoulders each operatively engaging an operating end of a pulling jaw, the operative engagement of said shoulders with said pulling jaws interlocking through two reversely curved complementary engaging faces, and a power transmitting element operatively connected to said lifting jack, one end extending between said jaws.

2. A removing tool comprising a body, a plurality of pulling jaws pivotally mounted in said body, each jaw comprising angularly-arranged arms joined together, the free end of one arm terminating in an offset work-engaging element and the free end of the other terminating in an operating element, a lifting jack movably mounted in said body and comprising offset shoulders each operatively engaging an operating end of a pulling jaw, the operative engagement of said shoulders with said pulling jaws interlocking through curved complementary engaging faces, the faces provided with rounded reversely curved bearing surfaces presented relatively to each other for relative rotary movement therewith, and a power transmitting element operatively connected to said lifting jack, one end extending between said jaws.

3. A removing tool comprising a body, a plurality of removable and reversible pulling jaws pivotally mounted in said body, each jaw comprising angularly-arranged arms joined together with one arm joined to the other intermediate the ends of the latter, the free end of the first-mentioned arm terminating in an offset work-engaging element and the free ends of the other terminating in operating elements, a lifting jack movably mounted in said body and comprising offset shoulders each operatively engaging an operating end of a pulling jaw, and a power transmitting element operatively connected to said lifting jack, one end extending between said jaws.

4. A removing tool comprising a body, a plurality of removable and reversible pulling jaws pivotally mounted in said body for angular movement about said pivotal mounting, each jaw comprising angularly-arranged arms joined together with one arm joined to the other intermediate the ends of the latter, the free end of the first-mentioned arm terminating in an offset work-engaging element and the free ends of the other terminating in operating elements, a lifting jack movably mounted in said body and comprising offset shoulders each operatively engaging an operating end of a pulling jaw, the operative engagement of said shoulders with said pulling jaws interlocking through curved complementary engaging faces, each pulling jaw being provided with two bearing surfaces and said bearing surfaces differing in curvature with respect to each other and with respect to that of the shoulders of said lifting jack to reverse their direction of movement relatively about their pivotal mountings, and a power transmitting element operatively connected to said lifting jack, one end extending between said jaws.

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