

No. 622,686.

Patented Apr. 11, 1899.

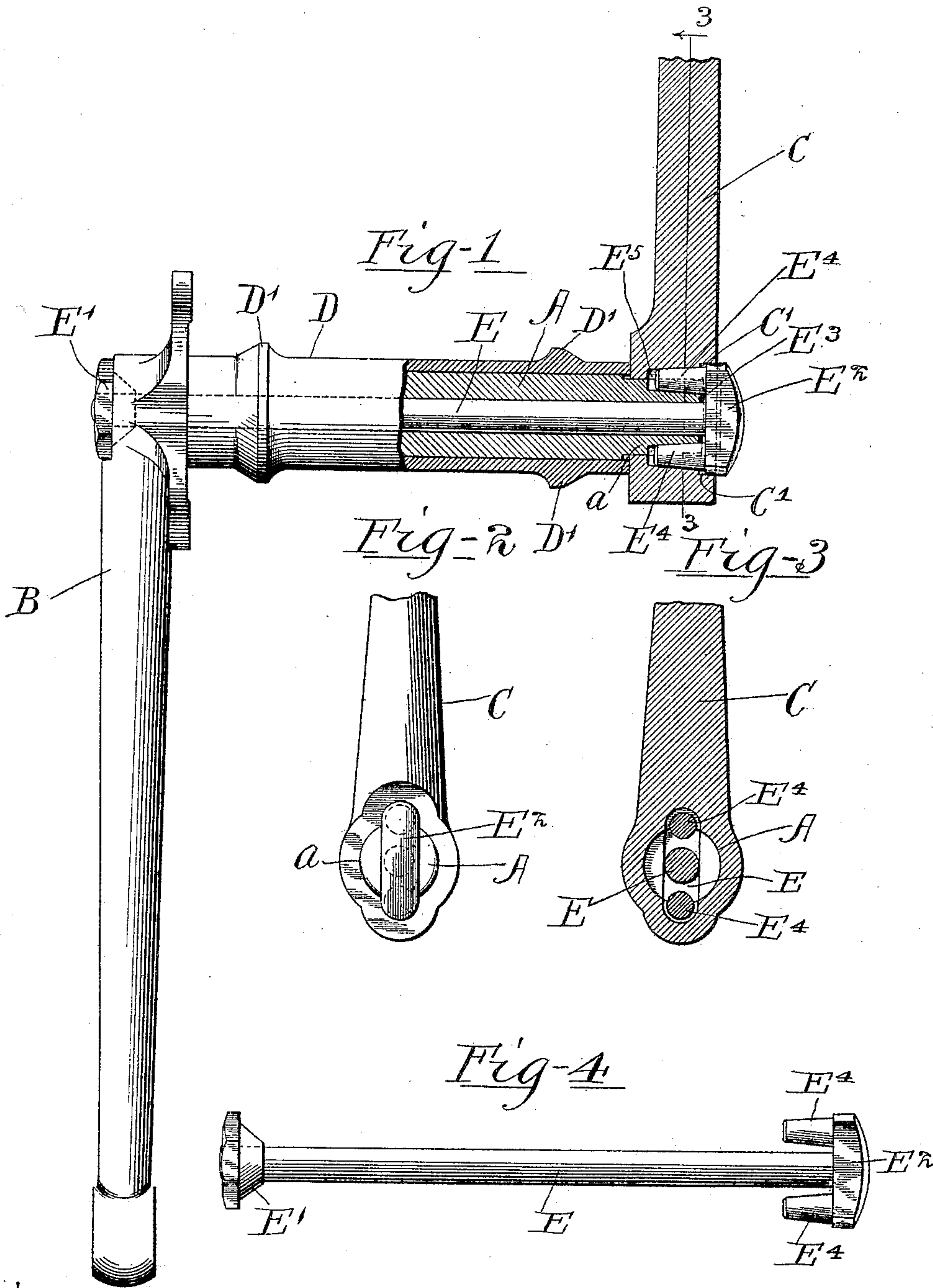
J. H. HOLCK.

MEANS FOR DETACHABLY SECURING HUBS OF CRANK ARMS OR LIKE PARTS TO SHAFTS.

(Application filed Feb. 28, 1898.)

(No Model.)

2 Sheets—Sheet 1.



Witnesses

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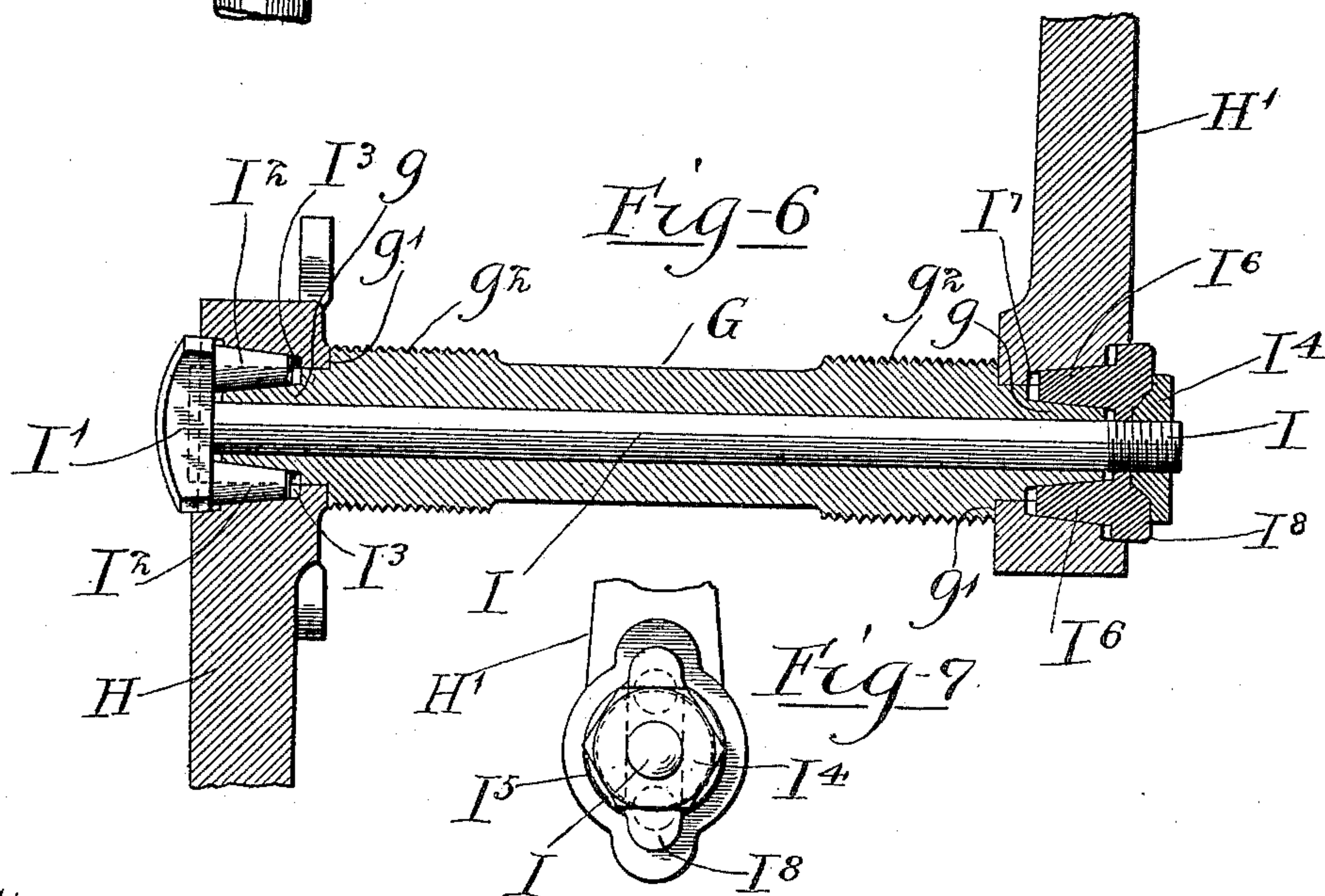
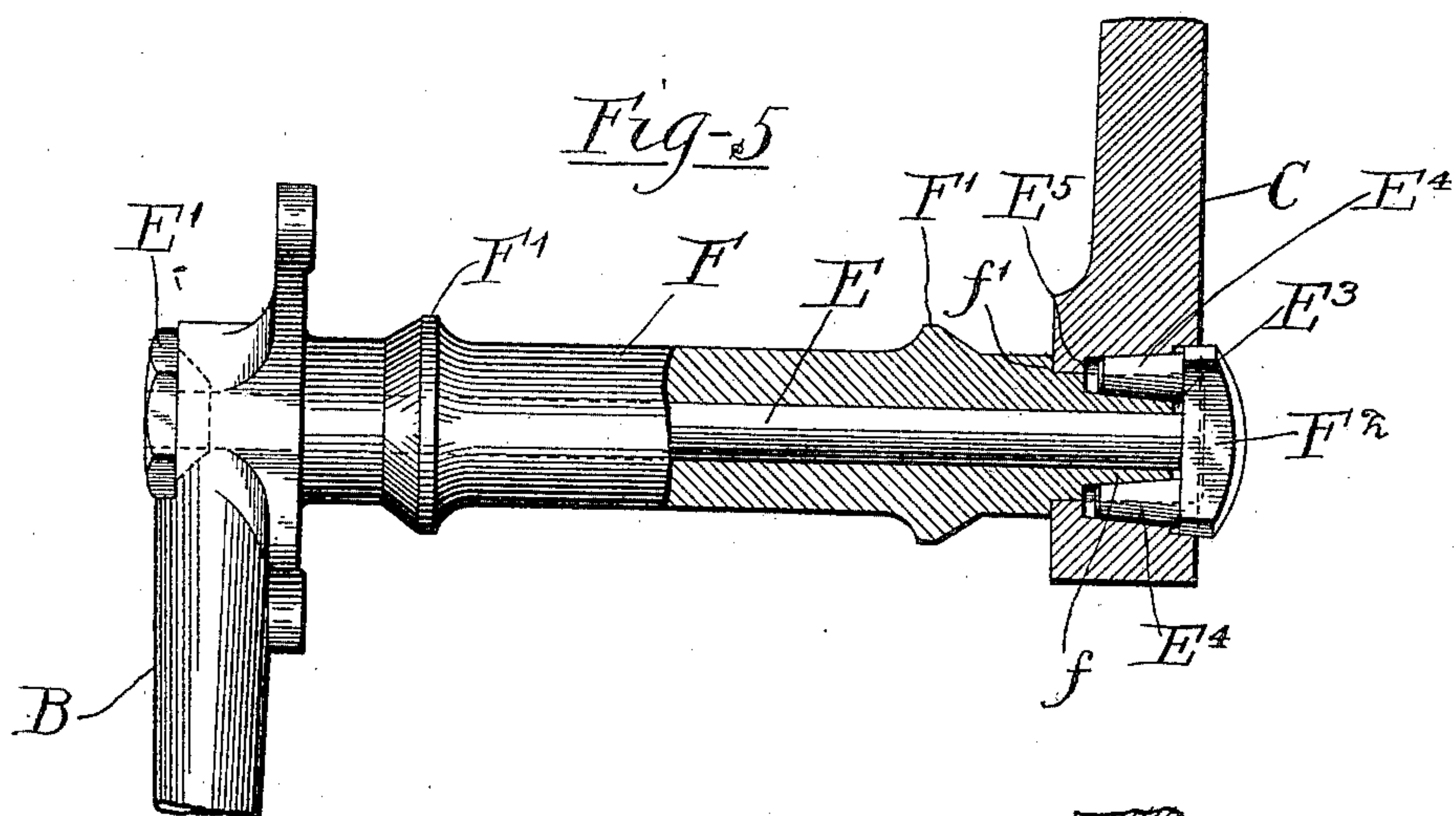
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MEANS FOR DETACHABLY SECURING HUBS OF CRANK ARMS OR LIKE PARTS TO SHAFTS.

(Application filed Feb. 28, 1898.)

(No Model.)

2 Sheets—Sheet 2.



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UNITED STATES PATENT OFFICE.

JOHN HENRY HOLCK, OF AURORA, ILLINOIS, ASSIGNOR TO THE AURORA
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MEANS FOR DETACHABLY SECURING HUBS OF CRANK-ARMS OR LIKE PARTS TO SHAFTS.

SPECIFICATION forming part of Letters Patent No. 622,686, dated April 11, 1899.

Application filed February 28, 1898. Serial No. 671,898. (No model.)

To all whom it may concern:

Be it known that I, JOHN HENRY HOLCK, of Aurora, in the county of Kane and State of Illinois, have invented certain new and useful
5 Improvements in Means for Detachably Securing the Hub of a Crank-Arm or Like Part to a Shaft; 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
10 marked thereon, which form a part of this specification.

This invention relates to an improved means for detachably securing the hub of a crank-arm or like part to a shaft where it is desirable that such arm be so constructed as to be easily removed and which at the same time affords a strong and rigid connection between
15 said parts when connected in their operative relation.

The invention is herein shown as applied to a crank-shaft for bicycles, whereby one arm may be detached and the shaft easily and quickly separated from its bearings; but
25 it is to be understood that the invention is not limited to such application.

The invention consists in the matters herein set forth, and more particularly pointed out in the appended claims.

30 In the drawings, Figure 1 is a view, partly in side elevation and partly in section, of a crank-shaft embodying my invention. Fig. 2 is a view of one end thereof. Fig. 3 is a section taken on line 3 3 of Fig. 1. Fig. 4 is
35 a longitudinal side elevation of the locking-bolt removed. Fig. 5 is a view, partly in longitudinal section and partly in elevation, of another form of crank-shaft provided with my invention. Fig. 6 is a longitudinal section of still another form of crank-shaft provided with my invention. Fig. 7 is an end
40 view of the same as seen from the right-hand side thereof.

Referring first to the construction shown
45 in Figs. 1 to 4 of said drawings, A designates the crank-shaft, which in the present instance is provided on one end with an integral crank-arm B.

C designates a detachable crank-arm which
50 is provided with an apertured hub or enlarge-

ment which fits over a reduced portion *a* of the shaft.

D designates a tube or sleeve adapted to fit closely about the shaft. Said sleeve is enlarged adjacent to its opposite ends to form
55 the inner annular parts or cones D' D' of the bearing, the same being permanently attached thereto and preferably made of one piece or integral therewith. Said sleeve D is of a
60 length to extend at its opposite ends into contact with the inner faces of the crank-arms B and C, so that the end faces of the sleeve form, in effect, shoulders on the shaft against which the crank-hub rests and which determine the
65 position of the said hub upon the shaft.

To now refer to the parts more particularly concerned in my present invention, E designates a clamping-bolt which passes through an axial opening in the shaft and is provided
70 on one end thereof with a head or shoulder which engages the removable arm C and is provided on its opposite end with a screw-threaded nut which engages the outer face of the opposite arms and by means of which
75 the removable arm is clamped rigidly upon the shaft in contact with the shoulder formed by the adjacent end of the sleeve D. The construction by which locking action is secured is made as follows: The head of the
80 bolt E consists, in the instance illustrated, of a narrow block or T-head E², which extends at right angles to the axis of the bolt and parallel with the arm C and is provided with two locking studs or pins E⁴ E⁴. A recess or slot
85 E³ is formed in the outer end of the shaft A to receive said head, which is of greater length than the diameter of the axle and extends at its outer ends thereof into recesses C', forming extensions of the recess E³. The locking-
90 pins E⁴ E⁴ constitute a means for preventing rotation of the arm upon the shaft when said locking-bolt is in place and also to force or hold the hub of the crank-arm in contact with the shoulder on the shaft. Said locking-pins
95 E⁴ are tapered and extend parallel with the axis of the locking-bolt E and fit within oppositely - arranged inwardly - extending tapered openings or sockets E⁵, the inner halves of which are formed in the shaft and the outer
100 halves of which are formed on the inner sur-

face of the base of the hub which receives said shaft, said sockets being divided along lines which extend parallel with the axes thereof. The pins and sockets are preferably circular in cross-sectional form. Said sockets and the pins E^4 , fitting therein, being made of conical shape, it follows that when said pins are drawn into the sockets by the action of the nut E' upon the bolt the resulting wedge action will not only clamp the parts rigidly from relative rotation, but will tend to force and hold the hub in contact with the shoulder on the axle. The end portion a of the axle over which the arm fits is made of such length that the sleeve D extends beyond the same at the end adjacent to the arm C , so that when the arm C is placed on the axle it will rest in contact with the outer end of the sleeve D . The recess E^3 in the axle end is made of such depth as to leave a space between the same and the inner face of the bolt-head E^2 when the parts are assembled. Said space is provided not only for movement of the pins into the wedge-shaped holes within which they fit, but to provide for the movement necessary to take up all of the motion between the opposite ends of the sleeve B and the inner faces of the arms B and C , whereby such parts may be rigidly locked together when the nut is turned tightly upon the bolt. The tapering faces of the pins, which bear against the outer parts of the holes within which they fit, or those parts formed in the arm C , constitute bearing-surfaces which coact with the tapering bearing-surfaces formed in said arm by the conical construction of the holes to force the hub of the arm toward the adjacent end of the sleeve D .

With the construction described it will be seen that rotary movement of the arm C upon the shaft A is prevented both by the T -head E^2 , which fits in the recess E^3 in the end of the shaft and engages at its opposite ends the oppositely-arranged recesses C' in the arm C , and by the pins E^4 , which engage on the opposite sides thereof the oppositely-arranged circular longitudinal recesses in the shaft and arm and which form when the parts are assembled the sockets within which said pins fit. The construction in which the pins E^4 engage sockets formed partly in the shaft and partly in the arm is of much importance, as it greatly increases the strength of the connection between said parts, for the reason that the strain thereon is distributed throughout the length of the pins.

The construction described in which the locking-pins E^4 and the recesses in which they fit are made of conical shape is of much practical importance, as it provides means for making an absolutely rigid connection between the parts notwithstanding the slight inaccuracies in construction or variations in the size of the parts which necessarily exist even with the most careful fitting of the parts, it being obvious that if the pins and holes

were made of uniform diameter throughout their length a slight looseness of fit between the pins and the engaging parts would permit lost motion between the arm and shaft. With the tapering construction described, on the other hand, it will only be necessary to draw the pins farther into the sockets, when the parts will be forced into frictional engagement and the rigid connection between the arm and shaft secured.

A further and important advantage gained by the use of the construction herein described is the facility with which the crank-arms may be removed from the shaft. In removing said arm the nut E' will be unscrewed and a slight tap upon the end of the bolt E will then loosen the same from its seat, so that the same may be easily withdrawn. The reduced portion a of the shaft being of circular form and of uniform diameter, said arm may be quickly and easily removed therefrom after said bolt has been removed.

A further advantage arising from the use of the construction described is that the shoulder which the hub of the crank-arm engages bears a constant or uniform relation to the opposite end of the shaft or to a second crank-arm connected with said opposite end thereof, so that the distance between such removable crank-arm and the opposite end of the shaft is absolutely fixed, the lost motion between the parts which is required for the tightening of the clamping-bolt being wholly outside of said shoulder and therefore not affecting the relation between the arm and the parts of the shaft inside of the same. Such a construction is especially desirable in crank-shafts for chainless wheels, in which it is absolutely essential that the coacting gears be maintained in uniform relation with respect to each other. This would obviously not be true if the connection between the arm and the shaft were such that the position of the arm upon the shaft would not be accurately defined, as in the case of a wedge-shaped connection between the parts of a crank-arm and shaft, in which the final position of the arm upon the shaft could only be determined in each case by the particular shape of the parts and amount of clamping pressure brought to bear thereon.

The construction described affords a neat finish upon the outer face of the arm, the bolt-head being made of convex form on its outer face, so that whether or not it rests entirely within the slot E^3 , formed in the end of the axle, there will be no angular corners which would present an unattractive appearance. The crank-arm B , against which the nut E' at the opposite end of the bolt rests, is provided with a conical recess, and the inner face of the nut is provided with a correspondingly-shaped part which rests therein and which forms a frictional bearing between the same to lessen the liability of the turning of the nut when it is in place. Said nut will pref-

erably be provided outside the face of the arm with angular faces of sufficient depth to be engaged by a wrench or other tool.

It will be seen from the drawings that the locking-pins are located at such radial distance from the clamping-bolt as to permit the adjacent end of the shaft to extend between said pins and the bolt. With this construction said locking-pins exert a radial clamping action directly upon the shaft and the part secured thereto, as well as a lateral clamping action. This is obviously of great importance, as it produces a connection of great strength between said parts.

So far as the general features of my invention are concerned the means for clamping the arm C from endwise movement on the shaft may be provided with but one locking-pin or more than two of the same. A construction in which two pins are provided is preferred, however, as it gives suitable strength in the joint and is cheaply and easily made.

In Fig. 5, F designates a tubular crank-shaft, which is provided at one end thereof with a reduced end portion *f*, forming with said end of the shaft an outwardly-facing shoulder *f'*, against which the inner face of the arm C bears when slipped over said reduced portion of the shaft. Said shaft is provided adjacent to each end thereof with enlargements forming cones *F'* on the inner members of antifriction-bearings, said cones being made an integral part of the shaft. The clamping-bolt E and the parts connected therewith are of the same construction as that described in connection with Figs. 1 to 4, inclusive, and operate in the same manner as therein set forth.

My invention is shown in Figs. 6 and 7 as applied to a crank-shaft in which both of the arms are removably secured to the shaft. In said construction, G designates a tubular shaft which is provided upon its opposite ends with reduced end portions *g*, forming outwardly-facing shoulders *g'*. Said shaft is provided adjacent its opposite ends with screw-threaded portions *g''*, upon which the inner members of the bearings, of any preferred construction, will be secured. H H' designate crank-arms which are constructed to be slipped over the reduced end portions *g* of the shaft and which bear at their inner faces against the shoulders *g'*. I designates a clamping-bolt provided on one end with a T-head like that hereinbefore described, which is provided with inwardly-extending locking-pins *I'*, which fit in sockets *I''*, formed partly in the shaft and partly in the arm, as in the previously-described constructions. The construction of this end of the shaft and the parts connected therewith is the same as those hereinbefore described and need not be repeated. At the opposite end of the shaft said bolt is provided with a screw-threaded portion upon which fits a nut *I''*, and between said nut and the outer face of the adjacent

arm is interposed a washer *I''*, which is provided on its inner face with locking-pins *I''*, similar to the locking-pins *I'* on the opposite end of the bolt, which fit in inwardly-extending sockets *I''*, formed partly in the arm and partly in the shaft. Said washer, as shown in Fig. 7, is of generally circular form and is provided in its margins with oppositely-extending projections *I''*, which fit in oppositely-arranged recesses *H''* in the arm. The locking-pins *I'* are connected with the inner faces of said projections *I''*. The face of said washer adjacent to the nut *I''* is provided with a conical recess, and the nut is provided with a correspondingly-shaped projection which fits in said recess and which provides between the same a frictional bearing by means of which said nut is retained in place. With this construction when the parts are assembled as shown in Fig. 6 and the nut *I''* tightened upon the bolt it will act to force the locking-pins *I'* and *I''* into their respective sockets, and thereby to force the crank-arms into rigid engagement with the shoulder *g'* and to lock said arms from rotary movement upon the shaft.

The construction herein described is a desirable one for use in attaching a crank-arm of a bicycle to the shaft thereof, as it securely locks the arm upon the shaft without lessening the distance between the arms while being tightened. Furthermore, with this construction unsightly projections at the ends of the axles are avoided, as the clamping-nut is so arranged as to be entirely out of the way and takes up no extra room, while the head at the opposite end of the axle is such as to provide a neat finish between the same and the adjacent arm.

While the invention has been described in connection with crank-shafts and is herein shown in connection with bicycle crank-shafts, it is evident that it need not be restricted to such application. The invention may obviously be used with equal advantage for removably fastening a gear or pulley to the end of a shaft, in which event the operative parts of the invention would be made in all respects similar to those herein shown.

I claim as my invention—

1. The combination with a tubular crank-shaft and the hub of a crank-arm or the like constructed to be slipped over one end of said shaft, of means for detachably connecting the arm with the shaft comprising a clamping-bolt, a T-head on one end of said bolt, tapered locking-pins upon said head, said pins being adapted to engage tapered sockets formed partly in the shaft and partly in the arm and being located at such radial distance from said bolt as to permit a portion of the shaft to pass between the same and the said bolt.

2. The combination with a tubular crank-shaft and the hub of a crank-arm or the like constructed to be slipped over one end of said shaft, said shaft being provided in its end

with a transverse recess, of a clamping-bolt, a T-head on the end of said bolt engaging said recess and a tapered locking-pin attached to said T-head and adapted to engage a tapered socket formed partly in the shaft and partly in the arm.

3. The combination with a tubular crank-shaft and the hub of an arm or the like constructed to be slipped over one end of said shaft, said shaft being provided in its end with a transverse recess, of means for detachably connecting the hub with the shaft comprising a clamping-bolt, a T-head on said bolt engaging the slot or recess in the end of the shaft and engaging at its opposite ends recesses in said hub and a locking-pin connected with said T-head and fitting with a socket formed partly in the shaft and partly in the arm.

4. The combination of a tubular crank-shaft having on one end an arm, a sleeve of less length than said shaft, surrounding said shaft which engages at one end said arm and forms at the other end of the shaft a shoulder, a removable arm fitting over said other end of the shaft and engaging said shoulder, and a bolt passing through said tubular shaft and provided on one end with a clamping-nut

and on its other end with a tapered locking-pin fitting into a socket formed partly in said shaft and partly in said arm.

5. The combination of a tubular crank-shaft having on one end an arm, a sleeve surrounding said shaft of less length than the shaft which engages at one end said arm and forms at the other end of the shaft a shoulder, a removable arm fitting over said other end of the shaft and engaging said shoulder, said shaft being provided in its free end with a transverse recess, a bolt passing through said tubular shaft and provided on one end by a clamping-nut, a T-head on the opposite end of said bolt engaging said recess in the end of the shaft, and a tapered locking-pin connected with said T-head and fitting into a socket formed partly in the shaft and partly in the arm.

In testimony that I claim the foregoing as my invention I affix my signature, in presence of two witnesses, this 26th day of January, A. D. 1898.

JOHN HENRY HOLCK.

Witnesses:

AXEL LEVEDALX,
BERT KING.