O. SPERLING.

ATTACHMENT FOR FLEXIBLE SHAFTS.

APPLICATION FILED MAR. 2, 1918.

1,320,582.

Patented Nov. 4, 1919.

2 SHEETS—SHEET 1.

Fig. I

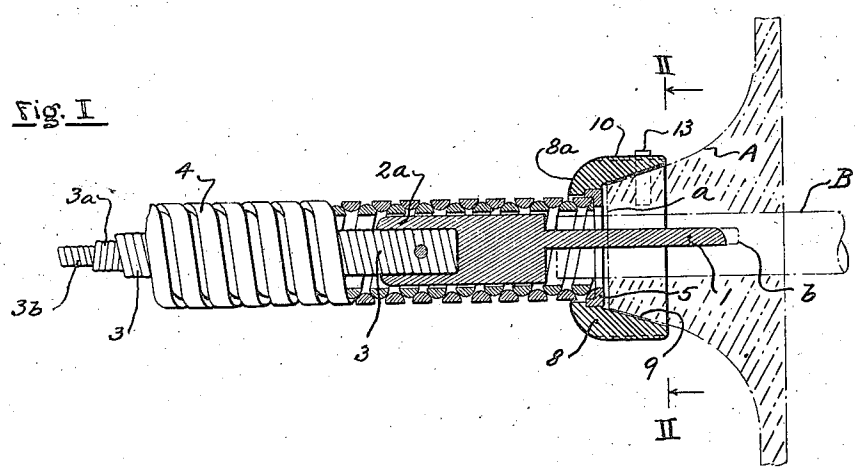
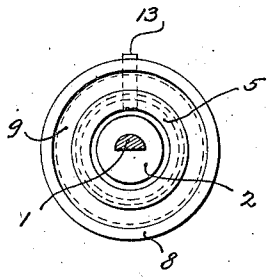



Fig. II



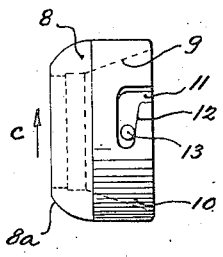




Fig. III

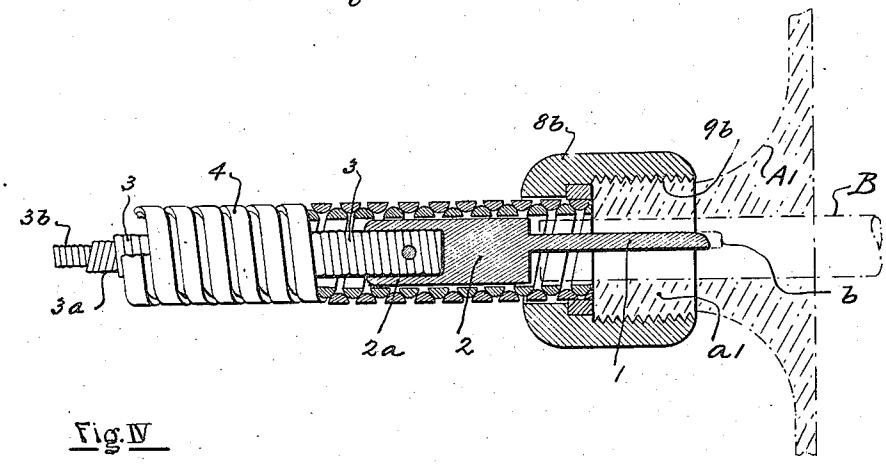



Fig. IV

INVENTOR

OSCAR SPERLING

BY

H. C. Karlson

ATTORNEY

O. SPERLING.

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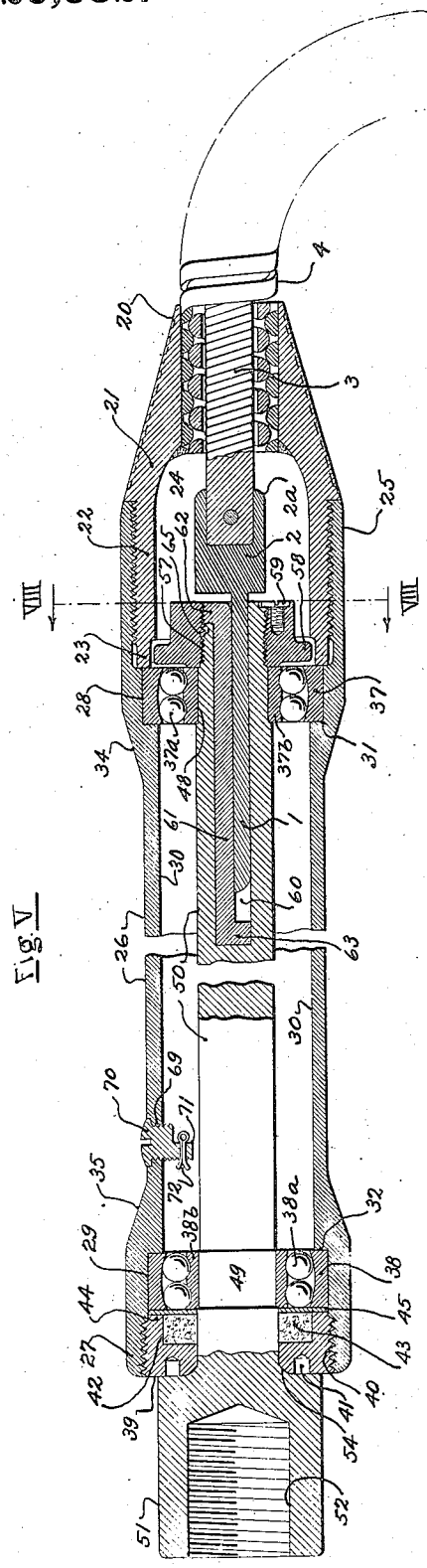


Fig. V

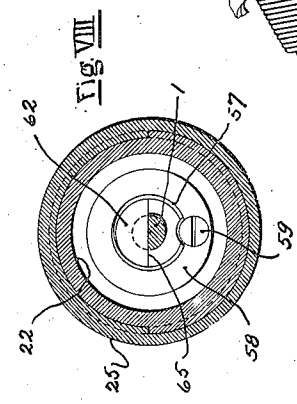


Fig. VIII

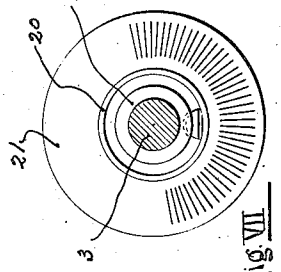


Fig. VIII

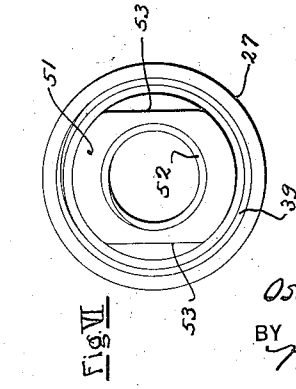


Fig. VI

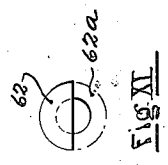


Fig. XI

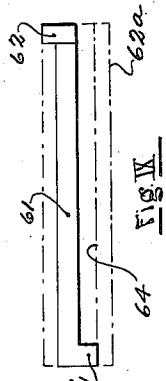


Fig. IX

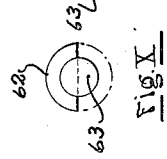


Fig. X

INVENTOR

OSCAR SPERLING

BY H. C. Karlson

ATTORNEY

# UNITED STATES PATENT OFFICE.

OSCAR SPERLING, OF NEW YORK, N. Y., ASSIGNOR TO ROTARY SCRAPER COMPANY INC., OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

## ATTACHMENT FOR FLEXIBLE SHAFTS.

1,320,582. Specification of Letters Patent. Patented Nov. 4, 1919.

Application filed March 2, 1918. Serial No. 220,072.

*To all whom it may concern:*

Be it known that I, OSCAR SPERLING, a citizen of Sweden, and a resident of the borough of Manhattan, in the county, city, and State of New York, have invented certain new and useful Improvements in Attachments for Flexible Shafts, of which the following is a specification.

The present invention relates to couplings, such as are utilized for connecting the opposite ends of a flexible shaft with a prime mover and some implement to be rotated thereby.

One of the objects of the invention is to produce an improved coupling of the class mentioned, which shall afford revolving supports for a flexible shaft that are spaced far apart so as to obtain a better guiding effect than heretofore and at the same time lessen the vibration upon the tool spindle and the handle carrying the same.

A further object is to provide a construction whereby the leverage of the flexible shaft and of its conduit connection with the handle and the spindle shall be materially reduced.

Another object is the provision of a suitable packing at the outer end of the handle, and means for properly retaining lubricant therein.

A still further object is the production of loose and yielding means of attachment at both ends of the flexible shaft, enabling it correctly to aline or centralize itself within its conduit or casing when the latter is bent on sharp curves.

Still another object is so to shape the coupling members at the handle ends, and likewise at the connection of the shaft's conduit with the prime mover, that these parts may be freely shifted from one position to another without risk of catching against any obstructions.

A supplementary object is to make the tool carrying spindle of such form as will insure its positive axial alinement at all times in both directions.

An additional object is to devise an arrangement that will cause the outward thrust of the said spindle to be taken by the before mentioned revolving or rotative supports.

Again another object is to furnish the said revolving supports as well as the spindle with means operating to resist dislocation thereof in the event of an undue stress being exerted thereon.

Other objects and advantages of the invention will be readily discerned upon perusal of the detailed description thereof hereinafter contained.

With all of the said objects in view the invention consists of the improvements, novel construction, arrangements and combinations of parts hereinafter described, defined in the subjoined claims, and illustrated in their preferred embodiments by the annexed drawings, wherein like elements are designated by the same reference numerals throughout the several views.

In the said drawings:—

Figure I is a sectional elevation of the coupling members between the power-receiving end of a flexible shaft and the corresponding end of a prime mover therefor, *e. g.* an electric motor, the view disclosing further an improved connection between the shaft's casing and the motor's housing;

Fig. II is a transverse section taken on the line II—II of the preceding figure, looking in the direction pointed out by the arrows;

Fig. III is a top plan view of a sleeve shown in longitudinal section and in end elevation, respectively, in the said Figs. I and II;

Fig. IV represents a modified construction of the combination of parts shown in Figs. I to III;

Fig. V is a broken longitudinal section of the coupling members provided between the power-delivery end of the flexible shaft and the corresponding end of a tool-carrying handle, and also between the latter and the envelop of the same shaft;

Fig VI is an end view, looking from the left-hand side of Fig. V;

Fig. VII is a similar view looking from the right-hand side of the same figure;

Fig. VIII is a cross-section on the line

VIII—VIII, also of Fig. V, viewed in the direction indicated by the arrows;

Fig. IX is a detail view, in longitudinal elevation of a key element, which the said Fig. V further illustrates in section; and

Figs. X and XI are end views of the said key element, showing the opposite terminals thereof, respectively.

The reference characters A and B respectively denote the housing and driving-shaft of the prime mover, which may be an electric motor, as before intimated, or any other suitable source of energy. In the driving-shaft B, longitudinally thereof, is provided a keyway *b*, adapted to receive a tongue 1, extending from one end of an anchor member 2, the opposite end of which has a socket $2^a$, wherein is entered the driven terminal of a flexible shaft 3. By preference, this terminal of the shaft 3 is firmly secured within the said socket both by being pinned and soldered thereto, as represented in Figs. I and IV.

The said flexible shaft may consist of a set of helical, closely wound, wire springs, of which the outermost one is designated by the numeral 3, while the inner springs are respectively indicated by the compound characters $3^a$ and $3^b$, all as shown in Figs. I, IV and V. The several spring coils are placed inside of and surrounded by a flexible conduit or casing 4, in the ordinary manner.

At the power-receiving end of the flexible shaft 3, its said casing 4 terminates in a ring or annulus 5, secured thereto by brazing or otherwise. A socket-piece 8 takes over this annulus and has an abutment against the edge thereof which faces the rim of the casing. In the embodiment of the invention exemplified in Fig. I, the socket 8 has a conical outwardly-flaring inner seat 9, which coacts with a correspondingly-shaped portion *a*, formed on the bearing part of the aforementioned housing A. The rear edge of the socket is rounded, as at $8^a$, so as to prevent it from catching against obstructions that might be encountered in the handling of the flexible shaft. Besides, the socket is provided with a cylindrical corrugated portion 10, for convenience in manipulation.

The said portion 10 of the socket-piece 8 has formed therewith a lock 11, which may be in the nature of an angular slot tapered on one side, as at 12, so that a wedging fit can be obtained against the coöperating face of a pin 13, carried by the before mentioned portion *a* of the housing A. The arrangement is such that a twist upon the socket 8, in the direction of the arrow *c*, will force the pin tight against the said tapered portion. Preferably, the angular offset of the slot 11 runs opposite to the direction in which the shaft 3 is rotated, and thus any rubbing action of the latter upon the interior walls of the casing 4 will be transmitted to the socket 8, whereby there is maintained a constant tendency for this socket to tighten itself in place. To release the socket from the said portion *a* of the housing, it is merely necessary to turn the same until the open mouth of the angular slot 11 comes opposite the pin 13, whereupon the socket can immediately be drawn away, that is, parted from the housing.

In Fig. IV is illustrated a modified form of socket $8^b$, provided with internal screw-threads $9^b$, which are made to engage a correspondingly threaded portion $a^1$ of a housing $A^1$.

At the other end of the flexible shaft, the casing 4 thereof is sweated into a tapered shank 20, of a coupling member 21, which includes an externally threaded shell or cylindrical extension 22, terminating beyond its screw-threads in an annular abutting portion 23, and affording an interior chamber or recess 24. The shell 22 is received within an enlarged, internally-threaded sleeve portion 25, of a tubular handle 26, the opposite end whereof is also provided with a similar sleeve portion 27, likewise enlarged and internally threaded, but preferably of shorter length.

Within the two said sleeves 25, 27, at the inner ends thereof, are recesses 28, 29, of annular formation and coaxial therewith. These recesses are of less diameter than the sleeves, but of larger size than the internal bore 30 of the handle 26, so that shoulders 31 and 32 are formed at the meeting points with the bore. Externally, where the circumferential surfaces of the sleeves join or merge into the intervening periphery of the handle, the latter is formed with oppositely tapered portions 34 and 35, which enable it to be drawn past obstructions without catching against the same, in either direction.

Into the said annular recesses 28 and 29, are forced the outer races 37 and 38, of anti-friction bearings containing one or more sets of bearing balls, as $37^a$ and $38^a$. The race 37 is maintained in the recess 28, against the shoulder 31, by the previously mentioned abutting portion 23 of the shell 22, while the race 38 is similarly held against the shoulder 32 and within the recess 29, by a hollow plug 39, externally threaded as at 40, to engage the internal threads of the sleeve 27.

In order to facilitate the screwing in of the plug 39, the outer face thereof is provided with suitable holes, as 41, for the insertion of a face-spanner or pin-wrench. The inner side of this plug is formed with a recess 42, made to receive a packing ring 43, of felt or other suitable material. The wall of the plug, between its external thread 40 and its recess 42, constitutes an annular abutment 44, which bears against the race

38, through the medium of an interposed washer 45, that prevents interference of the packing-ring 43 with the bearing balls $38^a$.

Coacting with the outer races 37 and 38, through the intermediary of the bearing balls $37^a$ and $38^a$, are inner races $37^b$ and $38^b$, which are forced over shouldered portions 48 and 49, of a spindle 50. At the outer end of the latter is formed a head 51, which has a threaded recess 52, adapted to receive the shank of a rotary implement (not shown). The head 51 is provided with oppositely flattened portions 53, Fig. VI, permitting application thereto of a wrench when entering the said implement or removing it. The juncture between the said head and the forward end of the spindle 50 is formed with a liberal fillet 54, and the inner front edge of the hollow plug 39 is correspondingly rounded or chamfered to reduce friction between these parts when the thrust on the head is inward or toward the handle, as well as to increase the strength of the spindle at that point. The opposite end of the latter, beyond the shoulder 48, is threaded as at 57, and a flanged collar 58 is screwed thereon. The outwardly facing hub portion of this collar is made to abut against the inner ball race $37^b$, so as to hold the same against its shoulder 48, on the spindle 50, while its flanged portion is slightly relieved in order that it may stand away from the outer race 37, unless an outward pull be exerted upon the spindle, for instance, if the implement held in the head 51 happened to be tangled in the work and the operator were to try and wrench it free. It might then occur that the inner races $37^b$ and $38^b$ would be stripped from their bearing balls, if no provision were made to prevent it, but in that event the flanged portion of the collar 58 would encounter the outer race 37 and preclude such a condition taking place. A small screw 59 is tapped into the inner end of the collar 58 with its head counterbored into the inner end of both the collar and the spindle, to hold the latter from turning on the screw threads 57.

The power delivery end of the flexible shaft is provided also with a tongue 1 and socket $2^a$, similar to those pertaining to the power-receiving end thereof, and hereinbefore described. The inner terminal of the spindle 50 is formed with a seat 60, of suitable shape to receive the said tongue. This seat is made by drilling an axially extended hole in the spindle, and a key 61, shown in detail in Figs. IX, X and XI, is forced into the same. The key 61 is made from stock that is originally of the round shape indicated at 62 and $62^a$, which is then turned down to a smaller cylindrical body 63, leaving a head of the size 62, $62^a$ at one end thereof. Next a portion is cut away, as at 64, all the way out to the other extremity of the body 63, so that a key is formed, including this small cylindrical portion 63, the semi-cylindrical portion 61 of same diameter, and the larger semi-cylindrical head 62. The inner end of the spindle is cut away as represented at 65, Fig. V to receive the head 62, which is thus held from rotation, while the portion 63 prevents the key from sagging down. When the latter is forced and sweated into the spindle, there is no danger of its becoming loose or shaky. The end 62 of the key is threaded correspondingly to the threads 57 to receive the collar 58.

An oil-hole 69 is provided in one side of the handle 26, to facilitate the injection of lubricant into its internal bore 30. This hole is threaded for the reception of a screw-plug 70, the inner end whereof is cut away for approximately one-half of its thickness, as indicated at 71. The diminished portion thereby produced on the inner end of the screw-plug is adapted to carry a stop, which may be in the nature of a split-pin 72. Constructed in this way, the plug 70 may be partly unscrewed and sufficiently raised to permit the squirting of oil into the bore of the handle, and still there will be no danger of its becoming detached.

The anchor members 2, at both ends of the flexible shaft, stand away from the proximate extremities of the spindle 50 and driving-shaft B, respectively, so that the said flexible shaft is enabled to centralize itself within its conduit or casing 4, even though the latter be bent sharply. Excessive friction between the flexible shaft and the internal surface of its envelop is thus avoided. At the same time the tongues 1 can slide to and fro to a limited extent within their respective seats. The recess 24 in the shell 22 and the bore 30 of the handle 26 form chambers that provide ample reservoirs for lubricant, which can surge back and forth between the said chambers and the flexible conduit.

While a certain preferred embodiment of this device has been shown and described, it will be understood that changes in the form, arrangements, sizes, proportions and details thereof may be made without departing from the scope of the invention as defined by the appended claims.

Having described my invention what I desire to secure by Letters Patent and claim is:—

1. An attachment for connecting the casing of a flexible shaft to the stationary part of a prime mover, including a substantially conical element on the latter, a coupling member formed with a correspondingly shaped interior seating surface adapted to engage said element, and means serving to tighten said member on the element while their engagement is being effected.

2. An attachment affording an adjustable connection between the housing of a prime mover and the casing of a flexible shaft, including a tapering abutment on said housing, a coupling member loosely engaging one end of said casing and provided with an interior flaring surface adapted to take over said abutment, and wedging means on the latter and said member coöperating to draw the same tightly together.

3. An attachment affording a connection quickly effected and severed between the casing of a flexible shaft and the frame of a prime mover, including a conical protuberance on said frame, a coupling with a correspondingly shaped internal surface arranged to slide onto said protuberance, and coacting receiving and retaining means pertaining to said coupling and the protuberance whereby the same are locked together by partial rotation of one over the other.

4. An attachment permitting a readily established connection between the stationary part of a prime mover and the casing of a flexible shaft, including a substantially conical plug member projecting from said part, a coupling formed with an interior seat slidable over said member, and a retaining element on the latter positioned to enter an angular slot in said coupling, said element exerting against an inclined edge of said slot a wedging action produced by partly rotating the coupling over the plug member.

5. An attachment for operatively uniting the driving shaft of a prime mover, a flexible shaft and the casing therefor, a tool supporting spindle, and a carrier for the latter, including couplings respectively joining a stationary part of the prime mover to one end of said casing, and the other end thereof with said carrier, and slidable connections permitting endwise play of the terminals of said flexible shaft relatively to both said driving shaft and said tool supporting spindle.

6. An attachment effecting working engagement between a tool supporting spindle, a carrier therefor, a flexible shaft with a relatively stationary conduit therearound, and the driving shaft of a primer mover, including members to which the opposite extremities of said flexible shaft are respectively anchored each at a predetermined distance from said spindle and said driving shaft, torsion transmitting elements extending from said members so as to slide axially into longitudinal recesses provided in the spindle and the driving shaft respectively, and couplings connecting said carrier with one end of said conduit, and the other end thereof with a fixed part of the prime mover, the arrangement being such as to permit centralizing of the flexible shaft within the conduit irrespective of any abrupt bends to which the latter may be subjected.

7. An attachment for connecting a flexible shaft to a tool supporting spindle and a carrier therefor, including a tubular handle inclosing said spindle, inner ball races carried by the latter near the opposite ends thereof, outer ball races positioned oppositely to said inner races each against an abutment formed inside said handle, bearing balls interposed between the inner and the outer races, retaining members engaging the ends of the handle and arranged to bear upon the outer races on the sides thereof remote from their respective abutments, one of said members serving to take the inward thrust of the spindle at the tool supporting end thereof, and a thrust taking element on the inner end of the spindle located intermediately of the flexible shaft and the adjacent inner race, said element being capable of contacting with the corresponding outer race when an excessive outward pull is exerted upon the spindle.

8. An attachment for connecting a tool supporting spindle, a carrier therefor, and a flexible shaft casing, including a handle having a contracted central part and enlarged end portions, the latter being provided with annular recesses and threaded extremities adjacent thereto, outer ball races lodged in said recesses against abutments formed contiguous to said contracted part, inner ball races set against similar abutments on said spindle, bearing balls interposed between said outer and said inner races, a plug member through which the outer end of the spindle passes engaging the corresponding extremity of said handle in position to hold the adjoining outer race up to its abutment, a coupling member for said casing engaging the opposite extremity of the handle around the inner end of the spindle so as to maintain the outer race against the abutment therefor, and a collar on the last mentioned end of the spindle bearing against the inner race at said end, said collar being capable of transmitting an excessive outward thrust of the spindle to the proximate outer race.

9. An attachment for connecting a flexible shaft, its casing, a tool supporting spindle, and a carrier therefor, including a hollow handle serving as a container for lubricant, said handle having an internally threaded end and a recess adjoining the same, a ball bearing lodged in said recess so as to rest at its inner side against an abutment in the handle, a washer encircling said spindle on the opposite side of said bearing, a recessed plug member taking over the spindle between a head thereon and said washer, said member engaging said threaded end of the handle and forcing the washer against said bearing, a packing confined between the washer and the recessed face of the member in contact with the spindle to prevent escape

of the lubricant at that point, and means for uniting the spindle with said flexible shaft within the opposite end of the handle permitting free flow of the lubricant to said casing.

10. An attachment for connecting a tool supporting spindle, a carrier therefor, a flexible shaft and its casing, including a hollow handle provided with an internally threaded end and a recess contiguous thereto, a ball-bearing having its outer portion received in said recess against an abutment in said handle and taking over said spindle at the end thereof remote from the tool, a coupling for said casing in engagement with said threaded end of the handle and pressing against said outer portion of the bearing, means for joining said flexible shaft to said remote end of the spindle interiorly of said coupling, a collar threaded on the same end of the spindle against the inner portion of the ball-bearing and extending also over its said outer portion, and means for locking said collar against rotation on the spindle.

11. An attachment for uniting a flexible shaft with a tool supporting spindle and a carrier for the same, including a hollow handle, an anti-friction bearing in said handle carrying the end of said spindle remote from the tool, a slidable connection between said flexible shaft and the spindle entering a bore in the latter, a key-element lodged within said bore at one side of said connection, said element having reversely disposed projections serving to maintain the element against lateral and rotative displacement, and a collar taking over said remote end of the spindle exteriorly of the outer one of said projections in contact with the adjacent side of said anti-friction bearing.

12. An attachment for connecting a flexible shaft with a tool supporting spindle and a tubular carrier handle inclosing the same, including inner and outer races with bearing balls therebetween, the inner ball races being carried by said spindle near the opposite ends thereof and the outer races positioned oppositely to the said inner races each against an abutment formed inside said handle, and retaining members arranged to bear upon the outer races on the sides thereof remote from their respective abutments.

13. An attachment for connecting a flexible shaft with a tool supporting spindle and a tubular carrier handle inclosing the same, including inner and outer races with anti-friction elements therebetween, the inner races being carried by said spindle near the opposite extremities thereof and the outer races positioned oppositely to the said inner races each against an abutment formed inside said handle, retaining members arranged to bear upon the outer races on the sides thereof remote from their respective abutments, and means on the inner end of the spindle capable of contacting with the corresponding outer race when an excessive outward thrust is exerted on the spindle.

14. An attachment for connecting a flexible shaft its casing and a tool supporting spindle, including a carrier handle having a contracted central part and enlarged annular recesses with threaded terminals, anti-friction bearings in said handle comprising inner races carried by said spindle and outer races received in said recesses against abutments formed by said contracted part, a member surrounding the outer end of the spindle and engaging the corresponding terminal of the handle so as to hold the adjoining outer race up to its abutment, and another member entering the other terminal of the handle to maintain the opposite outer race against the abutment therefor, the latter serving as a coupling for said casing.

15. An attachment for connecting a flexible shaft its casing and a tool supporting spindle, including a carrier handle having a contracted central part and enlarged annular recesses with threaded terminals, anti-friction bearings in said handle comprising inner races carried by said spindle and outer races received in said recesses against abutments formed by said contracted part, a member surrounding the outer end of the spindle and engaging the corresponding terminal of the handle so as to hold the adjoining outer race up to its abutment, another member entering the other terminal of the handle to maintain the opposite outer race against the abutment therefor, the latter named member serving as a coupling for said casing, and a collar at the inner end of the spindle capable of transmitting an excess outward thrust to the proximate outer race.

16. An attachment for connecting a flexible shaft with a tool supporting spindle, including a hollow carrier handle serving as a container for lubricant, said handle being recessed at one end, an anti-friction bearing lodged in the recess at said end of the handle against an abutment therein, a member taking over the spindle between a head thereon and said bearing, a packing confined between the member and the bearing in contact with the spindle, and means intermediate of said packing and the bearing to prevent the former from interfering with the latter.

17. An attachment for connecting a tool supporting spindle with a flexible shaft and its casing, including a hollow carrier handle having a recess at one end, an anti-friction bearing the outer portion whereof is received in said recess against an abutment in said handle and takes over said spindle remotely from the tool carried thereby, a coupling for said casing in engagement with said end of the handle, one face of said cou-

pling being arranged to hold the outer portion of said bearing against said abutment, means for joining said flexible shaft to the remote end of the spindle, and a collar on the same end of the spindle adapted to contact with said outer portion of the bearing.

18. An attachment for uniting a flexible shaft with a tool supporting spindle, including a hollow carrier handle, a slidable connection between said flexible shaft and said spindle entering a bore in the latter, and a key-element lodged within said bore at one side of said connection, said element having a projection to maintain it against rotative displacement.

OSCAR SPERLING.