No. 789,222. PATENTED MAY 9, 1905.

L. D. LOVEKIN.

SHAFT COUPLING.

APPLICATION FILED NOV. 10, 1904.

2 SHEETS—SHEET 1.

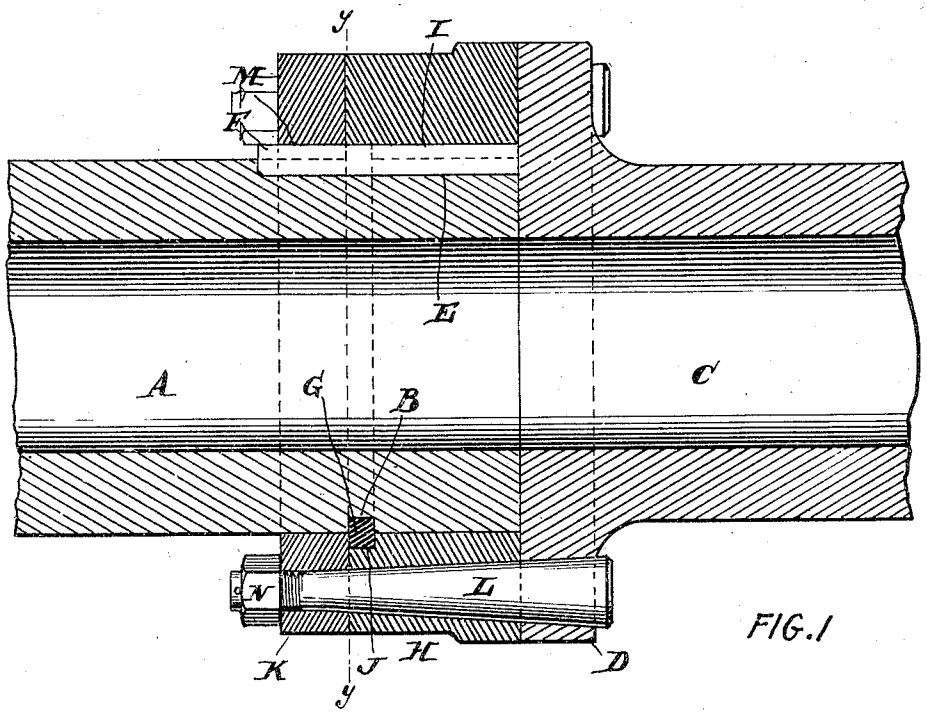



FIG. 1

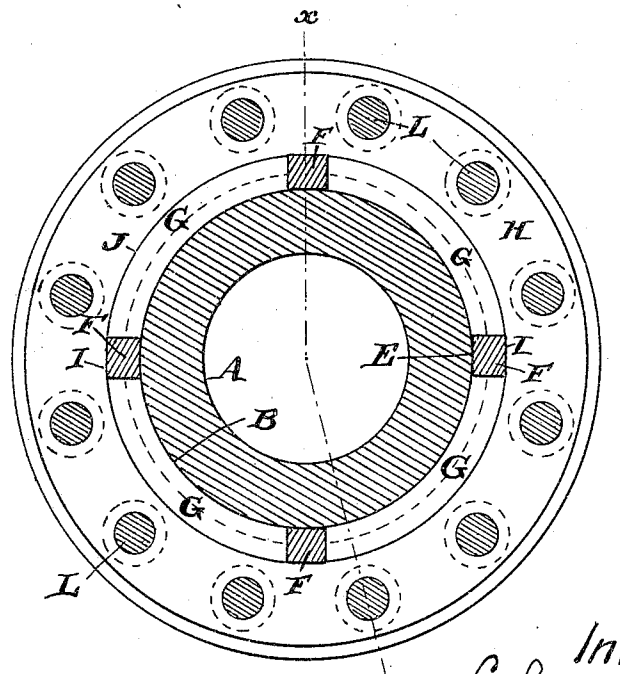



FIG. 2

Attest
R. M. Kelly
Wm. Rubney.

Inventor
Luther D. Lovekin
By his atty
[illegible]

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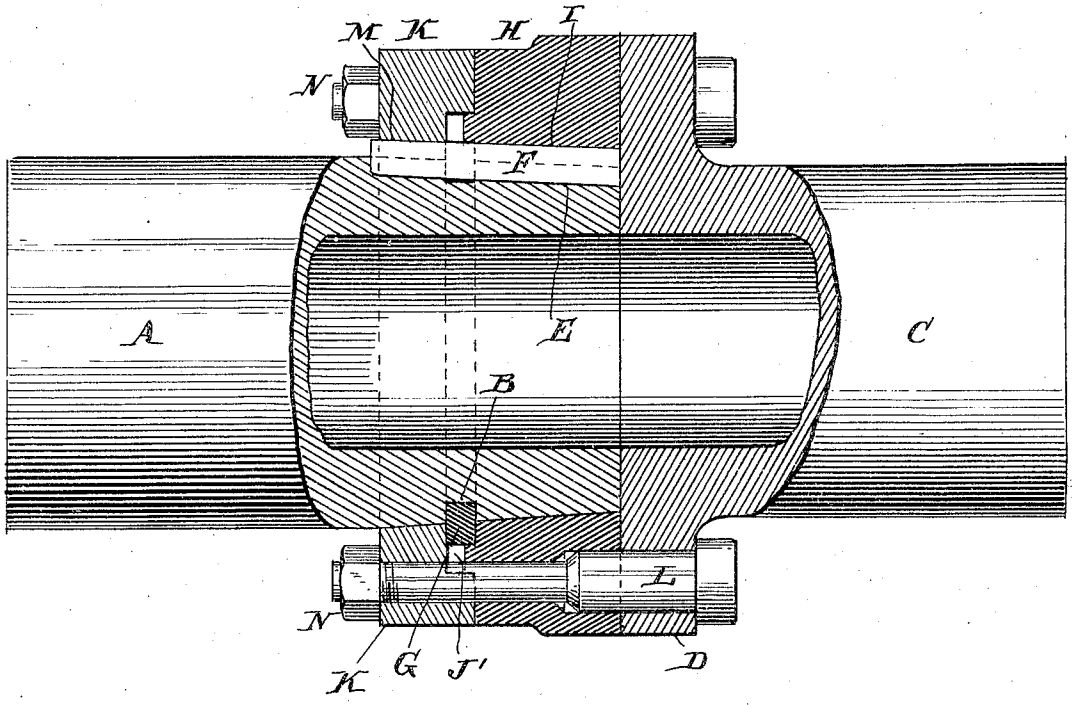
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SHAFT COUPLING.

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2 SHEETS—SHEET 2.

FIG. 3



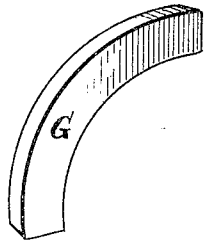




FIG. 4

Attest
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Wm. Rooney.

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Luther D. Lovekin
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No. 789,222. Patented May 9, 1905.

# UNITED STATES PATENT OFFICE.

LUTHER D. LOVEKIN, OF PHILADELPHIA, PENNSYLVANIA.

## SHAFT-COUPLING.

SPECIFICATION forming part of Letters Patent No. 789,222, dated May 9, 1905.

Application filed November 10, 1904. Serial No. 232,198.

*To all whom it may concern:*

Be it known that I, LUTHER D. LOVEKIN, of the city and county of Philadelphia and State of Pennsylvania, have invented an Improvement in Shaft-Couplings, of which the following is a specification.

My invention has reference to shaft-couplings; and it consists of certain improvements which are fully set forth in the following specification and shown in the accompanying drawings, which form a part thereof.

My invention embodies improvements upon the type of shaft-coupling set out in Letters Patent No. 636,411, granted to me on November 7, 1899. In that construction the propeller-shaft was coupled with the line-shaft by means of a coupling comprising a flange on the line-shaft, a collar bolted to the flange and keyed to the propeller-shaft, and a split thrust-ring fitted into a groove near the end of the propeller-shaft and clamped between the flange of the line-shaft and the collar. The objection to this was that the torsional strains were transmitted through keys located wholly on one side of the thrust-ring and required to pass through the collar and bolts of the coupling, which involved a weakness, to overcome which the present invention is designed.

In my present improvement the coupling is so designed as to utilize the entire length of the same for keys which transmit the strains from the engine or line shaft to the propeller. The thrust-groove in the propeller-shaft is located at a point from the end predetermined by the moment of resistance of the shaft at its reduced section, and the amount of work transmitted through that portion of the key between the groove and the end of the shaft is made proportional to the strength of the reduced portion of the shaft at said groove. Furthermore, the portion of the key beyond the thrust-ring need only be of sufficient length to transmit the torsion required to make up the full torsional strength of the adjoining or line shaft. In the case of propeller-shafts for steamships this line-shaft is always made of less diameter than the propeller-shaft, and consequently I am enabled to design the coupling in the manner described without adding any additional metal to the inside of the grooved propeller-shaft, thereby simplifying the construction and reducing the weight of the coupling as a whole. The coupling-bolts are designed so as to transmit the entire shearing load at the joint of the coupling adjacent to the line-shaft and to transmit such proportions of the total load in the coupling beyond the thrust-ring as may be required by that portion of the key beyond the said ring. In this construction the bolts employed have a larger sectional area adjacent to the line-shaft than at the distant end adjacent to the thrust-ring, and the threads of the bolts need only be of sufficient strength to withstand the thrust of the propeller when going astern and which is usually very small as compared to the actual strength of the shaft proper. The thrust-rings are made in small sections fitting into the thrust-groove of the propeller-shaft between the keys only and are provided with liberal bearing-surfaces for taking the thrust when the vessel is going astern.

My improved coupling combines the features of extreme simplicity and the greatest possible reduction in weight consistent with strength.

My invention will be better understood by reference to the drawings, in which—

Figure 1 is a longitudinal sectional elevation of a coupling embodying my improvement on line *x x* of Fig. 2. Fig. 2 is a cross-section of same on line *y y* of Fig. 1. Fig. 3 is a sectional elevation of a modification, and Fig. 4 is a perspective view of one of the sections of the thrust-ring.

A is the propeller-shaft, and when of large diameter is usually made hollow or tubular to reduce weight. This shaft is provided with a thrust-groove B, extending around its circumference at a predetermined distance from its end.

C is the line-shaft, and is provided with a flange D on its end, abutting the end of the propeller-shaft. The diameter of the line-shaft is usually somewhat less than the diameter of the propeller-shaft, though this is not essential. The propeller-shaft is also provided with keyways E, of which four are shown, and said keyways extend from the end

of the shaft throughout the whole length of the coupling and are fitted with keys F, as shown. Interposed between these keys and fitting the groove B of the propeller-shaft are the sections G of the thrust-ring, said sections terminating adjacent to the keys F.

Inclosing the end of the shaft A up to the point of the thrust-ring sections G is a coupling-ring H, which tightly fits the shaft and has keyways I for the keys F and a groove J for the sections of thrust-ring. It will be seen from this that the coupling-ring is directly connected with the end of the shaft beyond the thrust-rings through the keys, and the length of these keys is made proportional to the strength of the shaft on the section of the thrust-groove B and would be longer or shorter, accordingly as the strength of this portion of the shaft was decreased or increased to suit the requirements of the work.

In practice the end of the shaft A is made with a very slight taper, approximating one-sixteenth of an inch per foot, and the ring H is made to correspond and is pressed upon the end of the shaft to make a tight fit. The collar K of the coupling encircles the shaft A with a tight fit, as is the case of the ring H, and is bolted up tightly against the ring by the bolts L. This collar is provided with key-slots M to receive those portions of the keys F which are beyond the thrust-ring sections G and is designed to perform the double duty of transmitting power from the line-shaft to the propeller-shaft and also to take the end thrust of the propeller-shaft through the sections of the thrust-ring in going astern.

While I have the juncture of the collar K with the ring H of the coupling adjacent to the rear surface of the thrust-ring sections, such juncture may, if desired, be at the forward surface of these ring-sections or at any point intermediate of said surfaces, as will be readily understood, as it is immaterial whether the groove J for the said thrust-ring sections is formed in the part H or part K or partly in each, since the operation of the structure would be the same.

The bolts L for uniting the flange D of the line-shaft to the ring H and collar K of the coupling are made tapering, so as to be much stronger adjacent to the end of the flange D of the line-shaft than at the point of juncture between the ring H and collar K, since the cross-section of these bolts at the end of the ring adjacent to the flange D must be of sufficient area to transmit all of the shearing load which may be produced by the power transmitted through the keys F between the flange D and the thrust-ring sections G, together with the strains transmitted from the shaft, through the portions of the key connecting with the collar K beyond the thrust-ring sections. The section of these bolts at the juncture of the ring H and collar K must be sufficient to transmit the shearing load which would be due to the strains transmitted through the collar K and that portion of the keys F in contact therewith. The screw threads or nuts N of these bolts must be sufficiently strong to resist the end thrust of the shaft on the collar K in going astern. It is evident that, while the tapering form of the bolt is the most satisfactory construction, I do not confine myself to any particular shape of the bolt, so long as the cross-section thereof at one end of the ring H is greater than the cross-section at the other end, to secure the results pointed out above. It is also evident that, while the diameter of the bolts must be sufficiently large at the end of the ring adjacent to the line-shaft to transmit the entire shearing load, it is only necessary to my invention that the cross-sections of the bolts at the other end of the ring H shall be at least large enough to transmit the shearing load at this point, and the object of making the bolt small at this point is to reduce weight by enabling the diameter of the ring H and collar K to be kept within the smallest possible limits.

The tapered end of the propeller-shaft is clearly shown in Fig. 3, and in this figure the recess J′ for the thrust-ring is shown in the coupling-collar K instead of the coupling-ring H, as hereinbefore referred to, as these modifications or either of them may be employed in place of what is shown in Fig. 1.

While my invention is especially designed for propeller-shafts and the particular illustration is that which is employed in the battle-ships of the United States Navy of the *Kansas* class, the improvements are applicable to any line of shafting where a strong and compact coupling is required.

The details of construction may be modified without departing from the principles of construction involved in my invention, and I therefore do not limit myself to the minor details.

Having now described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In a shaft-coupling, the combination of one shaft provided on the end with a flange, a second shaft provided with a circumferential groove near its end and one or more continuous key-grooves in the surface of the shaft extending from its end across the circumferential groove to a distance beyond the same, one or more continuous keys fitted to said key-grooves, a thrust-ring made in two or more parts fitted to the circumferential groove intermediate of the keys, a coupling-ring inclosing the end of the second-mentioned shaft and receiving those portions of the keys between the thrust-ring and first-mentioned shaft, a collar inclosing the shaft and located at the end of the coupling-ring distant from the first-mentioned shaft and provided with grooves to receive those portions of the keys beyond the thrust-ring, and a series of bolts

for clamping the first-mentioned shaft the coupling-ring and the coupling-collar together.

2. In a shaft-coupling, the combination of one shaft provided on the end with a flange, a second shaft provided with a circumferential groove near its end and one or more continuous key-grooves in the surface of the shaft extending from its end across the circumferential groove to a distance beyond the same, one or more continuous keys fitted to said key-grooves, a thrust-ring made in two or more parts fitted to the circumferential groove intermediate of the keys, a coupling-ring inclosing the end of the second-mentioned shaft and receiving those portions of the keys between the thrust-ring and first-mentioned shaft, a collar inclosing the shaft and located at the end of the coupling-ring distant from the first-mentioned shaft and provided with grooves to receive those portions of the keys beyond the thrust-ring, and a series of bolts for clamping the first-mentioned shaft, the coupling-ring, and the coupling-collar together and in which the cross-section of the bolts at the juncture of the coupling-ring and flange of the first-mentioned shaft is greater than the cross-section of the same bolts at the juncture of the coupling-ring and coupling-collar.

3. In a shaft-coupling, the combination of one shaft provided on the end with a flange, a second shaft provided with a circumferential groove near its end and one or more continuous key-grooves in the surface of the shaft extending from its end across the circumferential groove to a distance beyond the same, one or more continuous keys fitted to said key-grooves, a thrust-ring made in two or more parts fitted to the circumferential groove intermediate of the keys, a coupling-ring inclosing the end of the second-mentioned shaft and receiving those portions of the keys between the thrust-ring and first-mentioned shaft, a collar inclosing the shaft and located at the end of the coupling-ring distant from the first-mentioned shaft and provided with grooves to receive those portions of the keys beyond the thrust-ring, and a series of tapered bolts for clamping the first-mentioned shaft the coupling-ring and the coupling-collar together and in which the smaller ends of the bolts are located in the coupling-collar.

4. The combination of a shaft, a second shaft having a circumferential groove at a distance from its end and one or more longitudinal key-grooves extending from the end of the shaft to the circumferential groove, keys arranged in the key-grooves, a thrust-ring in sections arranged within the circumferential groove of the second shaft, a coupling-ring inclosing the shaft and having key-grooves for the keys, a collar inclosing the shaft and fitted against the surface of the thrust-ring sections, and clamping-bolts for connecting the first-mentioned shaft with the coupling ring and collar.

5. The combination of a shaft, a second shaft having a circumferential groove at a distance from its end and one or more longitudinal key-grooves extending from the end of the shaft to the circumferential groove, keys arranged in the key-grooves and extending across the circumferential thrust-groove, a thrust-ring in sections arranged within the circumferential groove of the second shaft and intermediate of the keys, a coupling-ring inclosing the shaft and having key-grooves for the keys, a collar inclosing the shaft and fitted against the surface of the thrust-ring sections, and clamping-bolts for connecting the first-mentioned shaft with the coupling ring and collar.

6. In a shaft-coupling, the combination of one shaft provided on the end with a flange, a second shaft having its end tapered and provided at a distance from its end with a circumferential groove and one or more continuous key-grooves in the surface of the shaft extending from its end across the circumferential groove to a distance beyond the same, one or more continuous keys fitted to said key-grooves, a thrust-ring made in two or more parts fitted to the circumferential groove intermediate of the keys, a coupling-ring having a tapered hole inclosing the end of the second-mentioned shaft and receiving that portion of the keys between the thrust-ring and first-mentioned shaft, a collar inclosing the shaft and located at the end of the coupling-ring distant from the first-mentioned shaft and provided with grooves to receive that portion of the keys beyond the thrust-ring, and a series of bolts for clamping the first-mentioned shaft the coupling-ring and the coupling-collar together.

In testimony of which invention I hereunto set my hand.

LUTHER D. LOVEKIN.

Witnesses:
R. M. KELLY,
M. J. EYRE.