

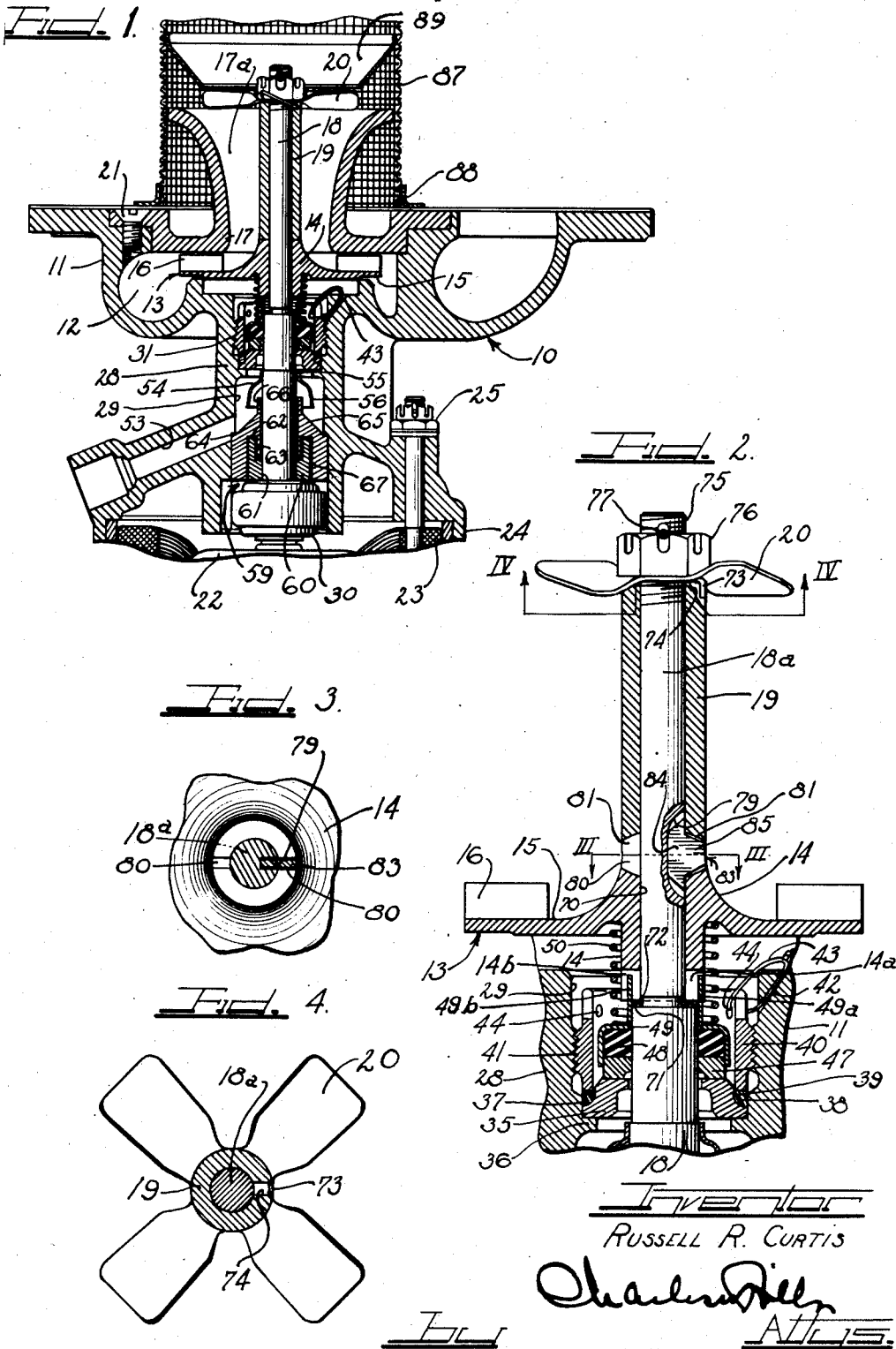
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R. R. CURTIS

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IMPELLER AND PROPELLER CONSTRUCTION FOR BOOSTER PUMPS

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IMPELLER AND PROPELLER CONSTRUCTION FOR BOOSTER PUMPS

Russell R. Curtis, Dayton, Ohio, assignor to Curtis Pump Company, Dayton, Ohio, a corporation of Ohio

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This invention relates to an impeller-propeller assembly for booster pumps and the like and pertains particularly to an impeller-impeller sleeve-propeller assembly and to means for securing such an assembly on a driving shaft. A specific feature of the invention is a key and keyway construction for simultaneously securing several members of assemblies such as those mentioned hereinabove to each other and to a driving shaft.

While the key and keyway construction of the present invention is particularly adapted for securing an impeller-propeller assembly to a pump shaft, it will be understood that this feature of the invention is broadly applicable whenever it is desired to secure to a shaft two associated elements embracing said shaft to prevent relative rotation between the shaft and said elements. Examples of such elements are hubs, sleeves, gears, pulleys, cams, cranks, rollers, and the like.

Generally speaking, the present invention provides improved removable means for securing a pump impeller and an impeller sleeve driven propeller on a shaft. The impeller is bored to fit slidingly on the shaft and to seat on a shoulder thereon. The impeller sleeve and the propeller also fit the shaft slidingly with the sleeve normally seated on the free end of the impeller and the propeller seated on the free end of the sleeve. The impeller sleeve functions (apart from the driving of the propeller) to space the propeller from the impeller, as where the propeller and the impeller are to actuate a fluid, respectively, at the top and bottom of an extended passageway. If desired, shims may be inserted between the impeller and the shaft shoulder to position properly the impeller, impeller sleeve, and propeller longitudinally along the shaft. Means are provided for operatively connecting the impeller and the impeller sleeve to each other and to the shaft at the abutment of the impeller and the impeller sleeve. The free end of the shaft is threaded for receiving a nut which secures the impeller-impeller sleeve-propeller assembly on the shaft against the shaft shoulder or against the adjusting shims thereon.

The shaft, the impeller, and the impeller sleeve all have keyways provided therein with the shaft keyway extending longitudinally along the shaft a greater distance than the combined length of the keyways in the impeller and the impeller sleeve. When the shaft and impeller keyways are in proper alignment in radial and axial directions relative to the shaft, a T-shaped key is inserted therein. The key cross bar seats in the

shaft keyway, while the leg of the key member seats in the impeller keyway and projects out of this keyway longitudinally of the shaft. The impeller sleeve is then seated against the free impeller end with the sleeve keyway aligned with the other keyways so as to receive the projecting part of the key leg. The propeller is then mounted on the shaft to seat on the free end of the sleeve. The nut is finally threaded on the shaft against the propeller-impeller sleeve-impeller assembly thereby locking the key within the keyways since the cross bar key portion underlaps the impeller and the impeller sleeve and secures the impeller, impeller sleeve, and shaft against relative rotation. Removal of the key from the registered keyways is effected by threading the nut towards the shaft end to permit retraction of the impeller sleeve from the impeller for a distance sufficient to provide clearance for the withdrawal of the key.

It is, therefore, an important object of the present invention to provide an impeller-propeller assembly including a member for spacing the impeller and the propeller and means for operatively connecting the several members of the assembly to each other and to a driving shaft on which the members are mounted.

Another object of this invention is to provide an impeller-impeller sleeve-propeller assembly for mounting on a shaft and means for securing the impeller and impeller sleeve against relative rotation to the shaft.

A further object of this invention is to provide a key for insertion in and removal from more than two registered keyways in relatively movable members without disassemblage of the members from mounted position.

A still further object of this invention is the provision of a key and keyway construction for securing a pump impeller and an impeller sleeve to a shaft which has an abutment for seating the impeller-impeller sleeve and a nut threaded to the shaft and operative for locking the key in the keyway and the impeller-impeller sleeve assembly on the shaft.

Another and still further object of this invention is the provision of keyways in a shaft, an impeller, and an impeller sleeve which, when in alignment, receive a T-shaped key having a crossing member seated in the shaft keyway and a leg member seated in the registering keyways of the impeller and the impeller sleeve.

Another object of this invention is the provision of a key and keyway construction for securing an impeller-impeller sleeve assembly or the

like to a shaft with a nut threaded to the shaft for seating against a propeller interposed between the nut and the free end of the impeller sleeve in driven connection with the sleeve end, the parts being so arranged that turning of the nut away from the impeller provides sufficient clearance for disassemblage of the key and keyway construction without the need of disassembling the impeller or the impeller sleeve from the shaft.

The novel features believed to be characteristic of the present invention are set forth with particularity in the appended claims. The invention itself, however, both as to its organization and manner of construction, together with further features, objects, and advantages thereof, may best be understood by reference to the following description of the accompanying drawings showing, by way of an example, a pump embodying the present invention. The drawing shows the following views:

Figure 1 is a fragmentary view in vertical section, with parts in elevation, of a centrifugal pump including an impeller-propeller assembly, as well as a key and keyway construction, according to this invention.

Figure 2 is an enlarged fragmentary view in vertical section, with parts in elevation, of the shaft-impeller-impeller sleeve-propeller assembly of the pump in Figure 1.

Figure 3 is an enlarged transverse cross sectional view taken along the line III—III of Figure 2.

Figure 4 is an enlarged transverse cross sectional view taken along the line IV—IV of Figure 2.

The following description relates specifically to a sliding impeller-impeller sleeve-propeller assembly and to a construction for securing this assembly to the driving shaft of a centrifugal pump. It is to be understood, however, that the securing means to be defined may be used in connection with the securing together of any type of assembly including members some of which are mounted upon other members.

As best shown in Figure 1, the pump construction 10 includes a casing 11 which is so shaped as to define an internal volute chamber 12 through which fluids may be pumped by an impeller 13. The impeller 13 comprises a hub 14, a flat disk flange 15, and a series of upstanding radially curved vanes 16 projecting from the flange 15 toward a ring 17 mounted on the pump casing and secured there by screws 21. The ring 17 defines an extended flared throat or opening 17a to the impeller. This throat communicates freely (below the ring 17) with the volute 12 through the space spanned by the impeller 13.

The impeller 13 is mounted on a shaft 18 which extends above the impeller through and beyond the throat 17a. The projecting shaft portion receives an impeller sleeve 19 and an auxiliary propeller 20. The manner in which the impeller-impeller sleeve-propeller assembly is mounted on the shaft, as well as the relationship of this assembly to associated pump structures is described in detail hereinbelow.

The shaft 18 extends downwardly through an electric motor having an armature 22, spaced field coils 23, and a housing 24 integral with the pump casing 11. Studs 25 hold the field coils 23 in place.

Between the motor and the impeller the casing 11 has a hollow intermediate restricted portion 28 defining a shaft well 29. The shaft 18 is sup-

ported in the well 29 by an anti-friction bearing 30. Within the shaft well is also provided a liquid seal construction generally indicated on Figure 1 by the reference numeral 31 for sealing the pump and the motor portions against liquid leakage therebetween.

In the details of construction best shown in Figure 2, the seal construction 31 includes a metal ring 35 loosely embracing the shaft 18 and seated on an inwardly extending shoulder 36 formed on the inner periphery of the casing portion 28 intermediate its ends. The marginal edges at the periphery of the ring 35 are of reduced thickness to define a slot 37 between the ring body and the casing periphery. A resilient member 38 is seated in the slot 37. A ring washer 39 is seated on the resilient ring member 38 and is urged thereagainst by a tubular seal nut 40.

The seal nut 40 is externally threaded as at 41 for engaging internal threads in the casing portion 28. When the seal nut 40 is threaded toward the shoulder 36, the washer 39 expands the resilient ring 38 in a radial direction to seal tightly the slot 37. The seal construction seals the well portions on opposite sides of the shoulder 36 and the inner periphery of the casing portion 28.

An angularly extending bore 42 is formed through the corner at the pump end of the housing portion 28 for receiving therethrough a locking wire 43. Circumferentially spaced apertures 44 are provided radially through the free end of the seal nut 40. When the seal nut 40 has been threaded to its proper position, the aperture 44 nearest the bore 42 receives therethrough the locking wire 43, the ends of which are twisted together to form a closed loop.

A compressed graphitic carbon seal ring 47 slidably embraces the shaft 18 for movement axially along the shaft. The carbon ring 47 and the metal seal ring 35 are mounted in sliding face engagement. The carbon ring 47 is covered by a resilient cushion washer or member 48 preferably formed of fuel and oil resisting artificial rubber such as neoprene. The cushion washer snugly engages the shaft 18 in sealing relation thereto. A cup member 49 has a reduced neck end slidably surrounding the shaft 18 and an expanded skirted end surrounding the cushion member 48. Axially extending tangs or fingers 49a and 49b on the reduced end of the cup member 49 engage within slots 14a and 14b in the impeller hub 14 to form a positive drive connection with the impeller. A coil spring 50 is interposed between the cup member 49 and the impeller flange 15, so that a constant force is exerted on the resilient cushion 48 for maintaining the carbon ring 47 tightly against the metal seal ring 35. At the same time the urging of the cup by the spring serves to squeeze the resilient ring 48 in the skirted portion of the cup to insure rotation of the ring 48 with the cup, and the ring 48 in turn drives the carbon ring to effect sliding face engagement with the metal ring 35.

This construction provides a seal around the shaft dividing the well 29 into two isolated chambers that are effectively sealed against excessive liquid leakage therebetween.

It is preferred that graphitic carbon be used in the rotating seal ring 47, as it provides satisfactory wear and seal characteristics during the pressed sliding engagement with the face of the metal seal ring 35. It is to be understood, however, that any other suitable material having similar properties may be used.

The frictional drive for the rotating carbon seal ring 47 through the resilient ring 48 and the cup 49 has been found desirable due to the fragility of the carbon ring which will chip or crack if driven directly by the shaft.

Inasmuch as some liquid fuel or vapor may leak from the chamber in the well which is adjacent the impeller to the chamber adjacent the motor, even with the provision of an efficient seal construction such as 31, it is necessary to provide a drain for such material. As shown in Figure 1, the casing portion 28 is formed to provide drain passageways 53 communicating with the well 29 below the shoulder 36, and these passageways slope outwardly to the periphery of the head 24.

A flared finger member 54 has a tubular end 55 tightly embracing the shaft 18 and an outwardly flared skirt 56 extending in a direction axially of the shaft away from the seal construction 31. Any liquid leaking from the pump end of the device through the seal 31 is peripherally urged by the finger member 54 against the inner periphery in the well of the casing portion 28 where it drains through one or more of the drain openings 53.

A flame barrier construction 59, for preventing propagation of flame from the motor to the pump, is interposed in the well between the finger 54 and the anti-friction member 30.

This construction 59 includes a sleeve member 60 having one end 61 snugly engaging a portion of the shaft for rotation therewith. The end 62 of the sleeve 60 is axially recessed as at 63 adjacent the shaft. A second sleeve member 64 has one end of its outer periphery sized for snugly engaging the wall of the well 29. The opposite end of the sleeve 64 slopes inwardly toward the longitudinal axis of the shaft 18 to provide a frusto-conical surface 65 terminating in a cylindrical portion 66 which extends into the flared skirt 56 of the finger member 54. The inner peripheral surface of the sleeve 64 is so shaped as to embrace complementally the entire outer periphery of the sleeve 60. A portion of the sleeve 64 extends into the recess 63 and includes therein a portion of the shaft 18 from the bottom of the recess to a part adjacent the restricted end 55 of the finger member.

The inner periphery of the sleeve 64 is sized to embrace the sleeve 60 and a portion of the shaft 18 in spaced relation therefrom to define a tortuous conduit 67 therebetween. This clearance space or conduit serves the purpose of sealing flame propagation from within the electric driving motor to the well 29. It is well known that flame will not pass through tortuous openings of reduced size, and since it is intended to deliver gasoline as the fuel by the pump, it is necessary that the pump and seal portions be made explosion proof. Furthermore, as the pump assembly described in this application is intended preferably for use on aircraft, it is desirable to hold the weight and size to a minimum, and consequently the labyrinth arrangement of the narrow clearance space 67 is provided for obtaining the required length of a flame trap within the shortest practical longitudinal length along the shaft 18.

It will be clear from the foregoing and from Figures 1 and 2 that any liquid fuel leaking past the seal construction 31 will be flung outwardly by the finger member 54 and will drain over the sloping surface 65 into one of the outlets 53. As the cylindrical portion 66 of the seal sleeve 64 extends upwardly into the finger member, there

will be no liquid fuel leakage into the clearance space 67.

The driving and sealing contrivances for the shaft 18 having been described in the preceding paragraphs, the mounting of the impeller-impeller sleeve-propeller assembly on the shaft 18 will now be described, with particular reference to Figures 2 to 4.

The impeller 13 is bored as at 70 to receive slidably therethrough a reduced portion 18a of the shaft 18 at the lower end of which is an abutment shoulder 71 disposed above the cup 49. Normally, the lower end of the impeller hub seats against the abutment shoulder 71 on the shaft. However, shims 72 may be inserted between the end of the impeller hub and the shaft shoulder if necessary to adjust the impeller along the shaft to a position in which proper clearance is provided between the impeller and the pump casing as well as between the impeller and the throat ring. It is to be noted that the shims 72 seat within the reduced end of the cup member 49 without interfering in any way with the cooperation of the tangs 49a and 49b and the slots 14a and 14b in the impeller hub.

The impeller sleeve 19 is also bored internally to fit slidably over the shaft portion 18a and has a length such that when seated on the free impeller hub end, the sleeve will extend above the top of the throat ring 17. The four-bladed propeller 20 is likewise bored to fit slidably over the shaft portion 18a for seating on the free end of the sleeve 19. As shown in Figures 2 and 4, the propeller 20 is provided with one or more axial tangs 73 capable of being received by axial slots 74 in the free end of the sleeve 19 so that the propeller 20 will be driven by the sleeve 19.

The shaft portion 18a terminates in a threaded end 75 adapted to receive thereon a threaded abutment nut 76. The nut may be appropriately slotted and the shaft end may be suitably pierced to receive a cotter pin 77 for holding the nut in locking position. When the parts are assembled and the nut is turned to locking position, the nut forces the propeller-impeller sleeve-impeller assembly tightly against the shimmed or unshimmed shaft shoulder 71 to lock the assembly against relative axial movement of the shaft.

The shaft portion 18a is provided with a longitudinally extending parallel-sided, flat-bottomed keyway 79 terminating in circularly tapered end portions, somewhat on the order of the keyways used with Woodruff keys. The keyway 79 is disposed with its middle at the level of abutment of the impeller hub 14 and the impeller sleeve. Radially extending, parallel-sided keyways 80 and 81 are formed, respectively, in the top face of the impeller hub 14 and the bottom face of the impeller sleeve 19. The combined length of the keyways 80 and 81 is less than the length of the keyway 79, so that a T-shaped key can underlap the impeller and the impeller sleeve, with keyway space to spare. When the position of the keyways 80 and 81 lengthwise of the keyway 79 is varied by insertion or removal of the shims 72, the keyways 80 and 81 will nevertheless register with the keyway 79, since the latter is made excessively long.

When the keyways 79, 80, and 81 are in registry, a key 83 is seated therein for securing the impeller and the impeller sleeve to the shaft and to each other to eliminate relative rotation therebetween.

The key 83 is shaped in the form of a T hav-

ing a crossing member 84 and a leg portion 85. In general, the key is flat to fit loosely between the parallel sides of the keyways, with the ends of the cross bar 84 being tapered to be capable of engaging complementally the terminal curved bottom of the shaft keyway 79. The leg member 85 is wide enough to fill both the keyways 80 and 81 at the same time and relatively short so as not to project radially beyond the impeller hub and the impeller sleeve when seated in the hub and sleeve keyways with the flat top of the cross bar 84 seated on the bottom of the keyway 79.

When the parts are assembled, the key portion 84 seats in the keyway 79 and the key portion 85 seats in both the keyway 80 and the keyway 81. In this manner, the two ends of the cross bar 84 lie within and in engagement with the inner peripheries of the impeller hub 14 and the impeller sleeve 19. Pressure exerted by the locking nut 74 is transmitted through the propeller 20 to the impeller sleeve and the impeller hub to maintain the sleeve and the impeller hub above the ends of the key cross bar 84 to lock the key within the keyways with the cross bar seated between the bottom of the keyway 79 and the inner peripheries of the impeller hub and the impeller sleeve and the leg of the key member seated in the impeller and impeller sleeve keyways.

An important feature of the present invention is the possibility of inserting or removing the key 83 from operative cooperation with its associated parts with a minimum of disassemblage of such parts. It is only necessary to turn the locking nut in a loosening direction or away from the impeller a sufficient distance to permit retraction of the propeller and the impeller sleeve to provide clearance for the key cross bar 84. The entire key may then be inserted in the aligned keyways or removed therefrom. Once the key is inserted in the keyways and the locking nut threaded home, the propeller-impeller sleeve-impeller assembly is locked to the shaft to prevent relative axial and rotative movements therebetween.

The pump described in this application further includes a cylindrical closed screen 87 having a flange 88 secured to the throat ring 17 around the rising internal ring portion defining the extended throat 17a. The screen 87 carries an inverted frusto-conical hollow shield 89 in spaced relation above the throat ring. As shown in Figure 1, the throat ring extends upwardly into the internal screen space forming the extended throat 17a. The propeller 20 overlies the flared opening of this throat, which converges toward the axis of the pump and then is undercut or beveled into communication with the volute chamber 12 of the pump. The pumping vanes 16 of the impeller underlie the throat ring for pressuring the liquid into the volute chamber.

The shaft portion 18a and the impeller sleeve extend through the throat 17a to the interspace between the top of the ring 17 and the bottom of the shield 89 to support and drive the propeller 20 at this level.

When the pump 10 is disposed at the bottom of a fuel tank, liquid from the tank is screened through the screen 87 and then flows downwardly through the shield 89 where it is agitated by the propeller 20. The propeller 20 then throws bubbles of gases and vapors outwardly back through the screen 87 where they can rise along a gradually widening path to the top of the liquid. The bubbles, as they rise, become larger and will not again pass through the screen so that recircula-

tion of bubbles back to the propeller is eliminated, or at least minimized.

The agitated fuel, freed from the bubbles, then flows downwardly through the mouth 17a of the throat ring and is pressured by the pumping vanes 16 into the volute chamber 12.

It will be apparent from the foregoing that the present invention provides a key and keyway construction for pumps including an impeller-impeller sleeve-propeller assembly seated on the same driving shaft. The invention provides, more specifically, a shaft-impeller-impeller sleeve-propeller-nut assembly particularly adapted for use in pumps such as the pump described hereinabove including an extended throat or inlet underlapped by an impeller and overlapped by a propeller or the like. The invention is, of course, not limited to this specific application but is adapted for use whenever it is desired to provide operative connection between a shaft and at least two members otherwise rotatable on the shaft, especially where two spaced members are to be driven from the shaft and an intermediate force transmitting and spacing member is additionally provided. Many details of construction may be varied within a wide range without departing from the principles of this invention and it is, therefore, not my purpose to limit the patent granted on this invention otherwise than necessitated by the scope of the appended claims.

I claim as my invention:

1. In a pump assembly, a shaft, adjustable abutment means on said shaft, an impeller slidable on said shaft, a sleeve slidable on said shaft, a propeller slidable on said shaft and operatively connected to said sleeve, registerable keyways in said shaft, impeller, and sleeve, a key for seating in said keyways, and adjustable locking means on said shaft for securing said impeller-sleeve-propeller assembly against said abutment means on said shaft, said locking means being adjustable away from said impeller a sufficient distance to provide clearance between said impeller and said sleeve whereby said key may be removed from the keyways without disassemblage of the impeller from the shaft.

2. In a pump assembly, a driving shaft having a shoulder thereon, an impeller mounted on said shaft, bottomed by said shoulder, a sleeve-propeller assembly in operative connection mounted on said shaft with said sleeve in abutment against said impeller, registered keyways in said shaft, impeller, and sleeve, a key seated in said keyways, and a nut threaded on said shaft for locking the impeller, sleeve, and propeller against said shoulder, said key being shaped for engagement between said shaft and said impeller, between said shaft and said sleeve, and between said impeller and said sleeve.

3. In a pump assembly, a driving shaft having an abutment shoulder, an impeller slidably mounted on said shaft to be bottomed by said abutment shoulder, a sleeve-propeller assembly in operative connection mounted on said shaft with said sleeve in abutment against said impeller, a nut threaded on said shaft for holding said impeller, sleeve, and propeller against said shoulder, an axially extending keyway in said shaft, a radially extending keyway in a face of said impeller opposed to said sleeve in registry with the shaft keyway, a radially extending keyway in a face of said sleeve opposed to said impeller in registry with the shaft keyway and with the impeller keyway, and a T-shaped key having the

crossing member thereof seated in the shaft keyway and the leg member thereof seated in the registering impeller and sleeve keyways.

4. In a pump assembly, a driving shaft having an abutment shoulder, an impeller slidably mounted on said shaft, shims between said shoulder and impeller for positioning said impeller at a predetermined position on said shaft, an impeller sleeve slidably mounted on said shaft for abutment against said impeller, a propeller slidably mounted on said shaft for abutment against said sleeve in driven relationship therewith, a nut threaded on said shaft for locking said impeller, impeller sleeve, and propeller in abutting relationship against said shims, an axially extending parallel-sided flat-bottomed keyway having circularly tapering end portions in said shaft, a radially extending parallel-sided keyway in the face of said impeller engaging said impeller sleeve registering with the shaft keyway, a radially extending parallel-sided keyway in the face of said impeller sleeve engaging said impeller registering with the shaft keyway and the impeller keyway, and a T-shaped key having a crossing member with tapering ends and shorter than said shaft keyway seated in the shaft keyway and having a leg member broad enough to have one longitudinal margin seated in the impeller keyway and the opposed longitudinal margin seated in the sleeve keyway, said key being insertable and removable from said keyways when said nut is moved away from the impeller and the impeller sleeve is retracted from the impeller.

5. In a pump assembly including a driven pump shaft and a pump impeller on said shaft, a propeller on said shaft having a sleeve slidable on said shaft into abutment with said impeller, an axial keyway in said shaft, radial keyways in said impeller and said sleeve adapted to register with each other and with the shaft keyway, a key disposed in the shaft keyway and projecting into the impeller keyway and the sleeve keyway, and a nut threaded on said shaft holding said impeller, sleeve, propeller, and key in position.

6. In combination a driving member having a keyway therein, a driven member having a keyway therein in registry with the keyway in said driving member, a second driven member having a keyway therein in registry with the keyways in said driving and said driven member, said driven members partially overlapping the keyway in said driving member, a key having one portion seated in the keyway in the driven member and another portion seated in the keyways in the driven members, and means on said driving member for positioning said driven members to lock said key in said keyways.

7. In combination, a shaft, two members to be secured on said shaft in abutting relationship thereto and to each other, said shaft and said members having keyways in registering relationship, the shaft keyway being longer than the combined length of the member keyways so as to extend beyond the member keyways under the members, a key seated in said keyways and underlapping said members, and locking means for maintaining said abutting relationship of said shaft and members.

8. In combination, a shaft, two members embracing said shaft to be secured thereto in relative abutting relationship, said shaft having an axial keyway and said members having register-

ing radial keyways whose combined axial length is less than the axial length of the shaft keyway, a key having one portion disposed in the shaft keyway and underlapping said members and another portion angular to the first key portion disposed in the registering radial keyways of the two members, and a shoulder and a locking nut on said shaft engaging said two members for locking the members and the key in secured abutting relationship.

9. In combination, including a driving shaft, two spaced members mounted on said shaft to be driven by force transmitted from said shaft, a spacing member mounted on said shaft between said two spaced members normally abutting one of said spaced members and operatively connected to the other spaced member for transmitting driving force thereto, a T-shaped key, said shaft, spacing member, and said first spaced member being formed with registering keyways for seating said T-shaped key with the crossing member seated in the shaft keyway and underlapping said spacing member and said first spaced member and with the leg member of the key seated in the keyways of the spacing member and of said first spaced member, and means on said shaft for adjustably locking the spaced and spacing members in operative connection at a shaft location where the keyways will register to seat the key to prevent relative rotation of all said elements.

10. In a pump assembly, a throat ring forming a pump inlet, a shaft extending through said throat ring, an impeller slidable on said shaft underlapping said throat ring, a propeller slidable on said shaft, a sleeve slidable on said shaft spacing said impeller and said propeller and operatively connected to said propeller, said impeller, propeller and sleeve forming a slidable assembly on said shaft, abutment means on said shaft for properly positioning said assembly on said shaft relative to said throat ring, registering keyways in said shaft, impeller, and impeller sleeve, a T-shaped key seated in said keyways and underlapping said impeller and impeller sleeve, and an adjustable nut on said shaft for thrusting said assembly against said abutment means.

11. In a pump assembly having an inlet passageway, a drive shaft extending through said passageway, a pump impeller on said shaft, a propeller on said shaft, a spacer sleeve on said shaft between the impeller and propeller, a key slidable relative to the shaft drivingly connecting said sleeve and impeller, and means for axially adjusting the impeller, sleeve and propeller on said shaft to thereby adjustably position the impeller and propeller in said passageway.

12. A shaft-impeller-impeller sleeve-propeller assembly adapted for use in a centrifugal booster pump having an extended inlet, which assembly includes a driving shaft, an impeller, an impeller sleeve and a propeller slidable on said shaft as an assembly, registering keyways in said shaft, impeller and impeller sleeve, a key seated in said keyways, a finger on said propeller, said sleeve having a slot for receiving said finger to connect the sleeve and propeller for co-rotation, and means on said shaft for holding the assembly thereon in driven relationship.

RUSSELL R. CURTIS.