PENTAIR

FAIRBANKS NIJHUIS™

MODEL 6900F

DEEP WELL TURBINE PUMP

INSTALLATION, OPERATION AND MAINTENANCE MANUAL

NOTE! To the installer: Please make sure you provide this manual to the owner of the equipment or to the responsible party who maintains the system.

Part #FM-03-514 | © 2013 Pentair Ltd. | 08/21/13

INTRODUCTION

The following instructions should be read carefully before starting to install a deep well turbine pump. They are based on many years of experience in the field and if the instructions are followed, no trouble should be experienced in the installation and operation of the pumping unit.

DESCRIPTION OF EQUIPMENT

The Fairbanks Nijhuis™ line of vertical turbine pumps has been designed to meet a wide variety of operating conditions efficiently and economically. This has led to the four major pump types manufactured and sold under Figure Nos. 6922, 6927, 6972 and 6977. It is necessary to know the salient features of the various types represented by these Figure Nos. to install, operate and service the pumps correctly.

The essential differences will be found in the way the lineshaft and bearings are installed and lubricated and in the type of impeller (or runner) used in the pump assembly and corresponding differences in bowl castings to work with the different impellers.

Figure numbers are used as a code to describe the various types of pumps.

The first two digits, 69 , identify the unit as a vertical turbine pump. Thus for the Figure 6922 pump, the third digit "2" stands for the pump having enclosed type impellers. The fourth digit "2" says that the lineshaft is enclosed in a so-called "shaft enclosing tube", which supports the lineshaft bearings, conducts the lubricating oil to the bearings and keeps the fluid pumped from getting into the bearings.

For the Figure 6977 pump, the third digit "7" denotes a pump with semi-open impellers. The fourth digit "7" describes a pump driven by open lineshaft which is supported at five- or ten-foot intervals by a revolvable rubber bearing held in position by a bearing retainer which is supported between adjacent sections of discharge column. The fluid being pumped serves as a lubricant for the bearings.

Understanding this code makes it easy to tell from the Fig. No. the type of pump under consideration as shown in the table below:

Figure No.	Type of Impeller	Type of Lineshaft Support & Lubrication
6922	Enclosed Impeller	Enclosed Lineshaft Oil Lubricated
6927	Enclosed Impeller	Open Lineshaft Water Lubricated
6972	Semi-Open Impeller	Enclosed Lineshaft Oil Lubricated
6977	Semi-Open Impeller	Open Lineshaft Water Lubricated

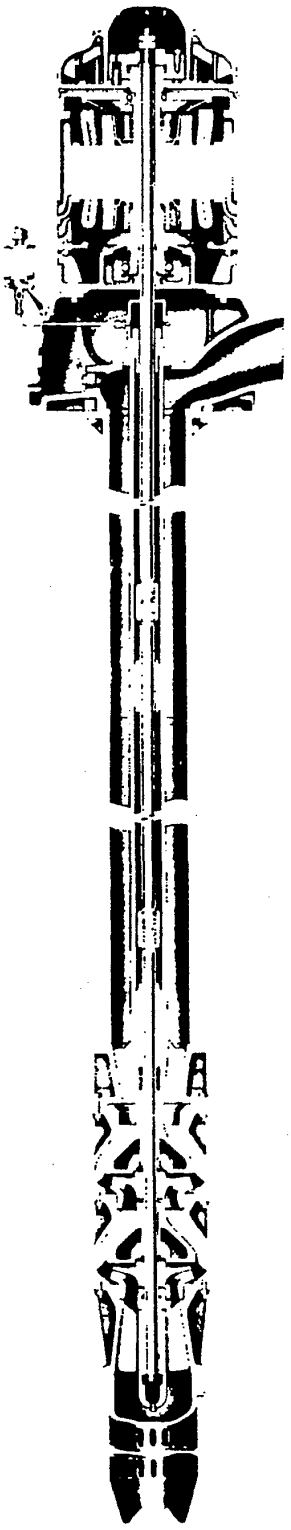
The Fig. 6922 and Fig. 6977 pumps are the basic types, and the other two are optional modifications to meet specific job requirements.

These instructions also apply to the installation of Fig. 6962 and Fig. 6967 (Mixflow Propeller) well pumps.

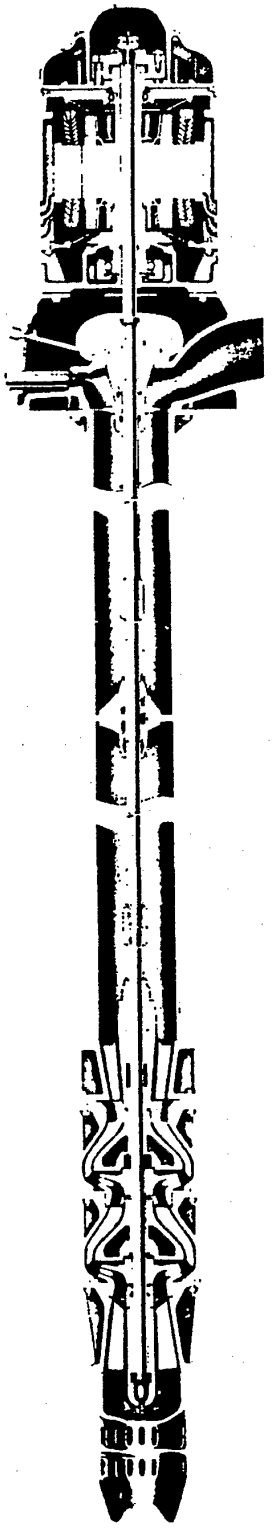
CALIFORNIA PROPOSITION 65 WARNING:

WARNING:

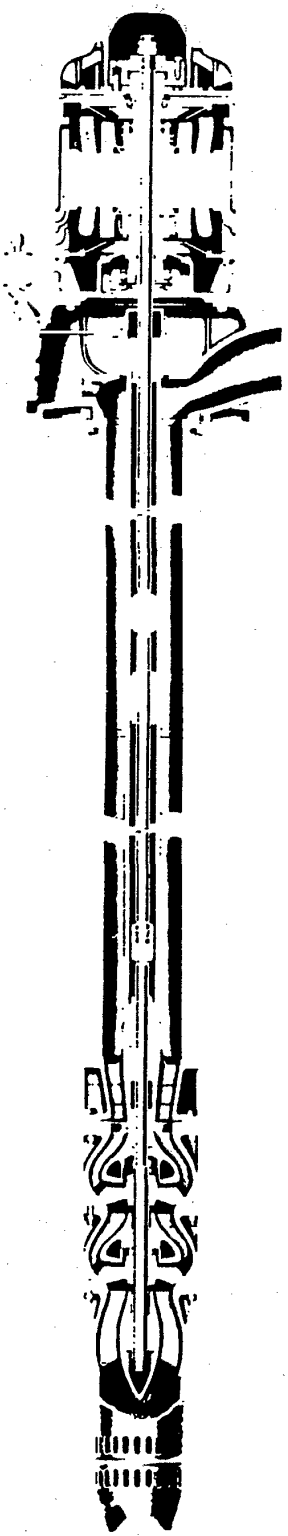
This product and related accessories contain chemicals known to the State of California to cause cancer, birth defects or other reproductive harm.



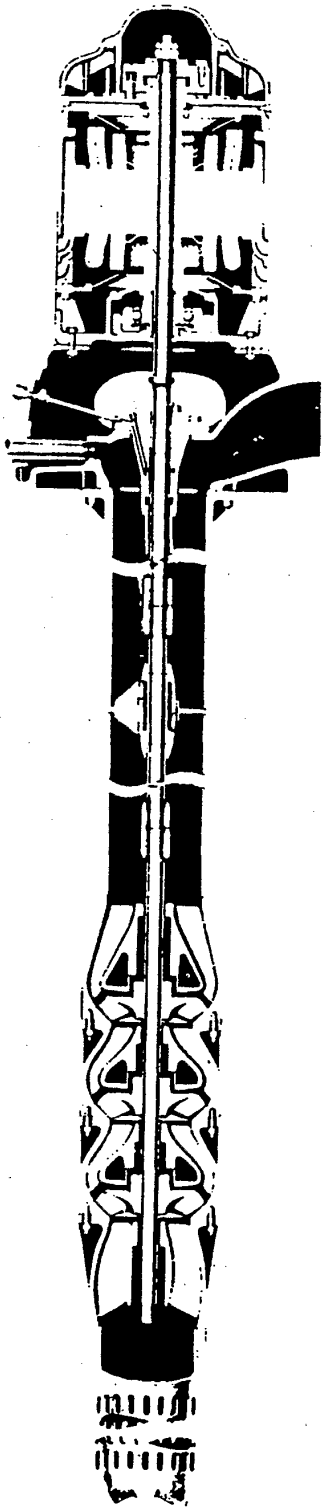
Illus.1 - The Fig. 6922 enclosed impeller oil lubricated deep well turbine pump.



Illus.2 - The Fig. 6927 enclosed impeller water lubricated deep well turbine pump.



Illus.3 - The Fig. 6972 semi-open impeller oil lubricated deep well turbine pump.



Illus.4 - The Fig. 6977 semi-open impeller water lubricated deep well turbine pump.

Preliminary Precaution

Examine the well carefully before starting installation. If not already known, make sure the well is of ample diameter and depth and sufficiently straight to receive the pump. If in doubt about straightness of well, caging and plotting is recommended. The pump should not be installed with the strainer closer than 3 to 5 feet from the bottom of the well.

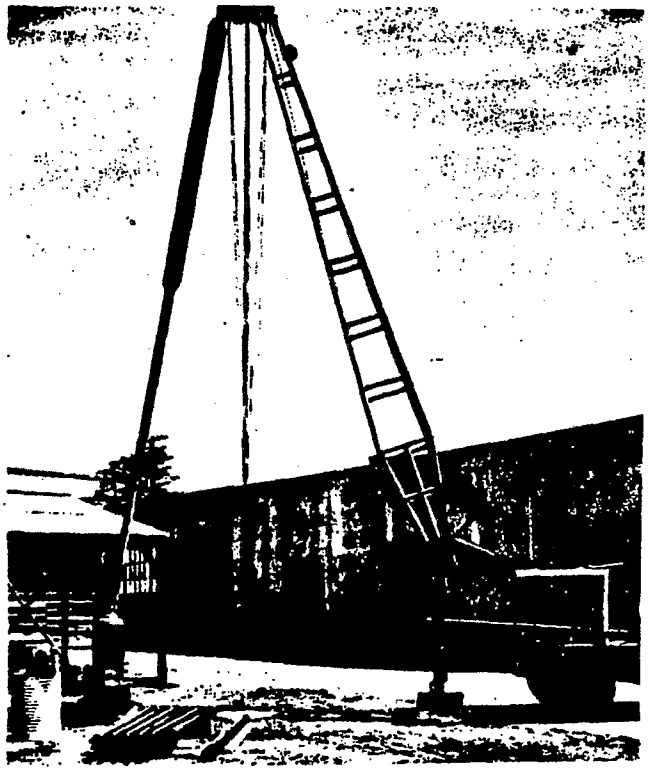
Examine the well for oil. All oil or oil emulsion on the surface of the water should be thoroughly dipped out and finally mopped with a burlap swab to remove all of the oil. This is absolutely necessary in order to avoid distributing the oil over the walls of the pump column and discharge piping. In a domestic pressure system or municipal water supply system the passage of oil into the piping could create costly damage. Oil is also injurious to rubber bearings when used in the pump.

Derrick

Use a permanent derrick, temporary tripod, or a portable derrick of sufficient strength and rigidity to lift the total weight of the pump safely. The derrick or tripod should be of sufficient height, depending on size of turbine to be handled, to allow the load hook to be raised about 18 feet above the foundation so that 10-foot sections of column pipe and shaft can be handled with ease.

Hoist

The hoisting equipment must consist of suitable chain blocks or a pair of wire rope blocks, a sufficient length of extra flexible steel cable, and an all-metal windlass. Chain blocks should have a working range in excess of 12 feet so that the 10-foot column pipe can be hoisted to the proper height, and the hand chain should be long enough to be operated from the ground. The metal windlass furnishes a much more convenient hoist. The load hook should have a good, easy working swivel and be truly centered over the axis of the well. When well is slightly out of plumb it may be necessary to shift the hoist as the pump assembly becomes progressively longer on installation. For heavy pumps and deep settings, the installation equipment must be stronger and heavier in proportion. Calculate the weight of pump parts to be handled and provide equipment that has a nominal safety factor of at least 6, taking into account the age and condition of the hoisting equipment. ALWAYS WORK SAFELY.



Illus. 5 - Arrangement of component pump parts for orderly assembly and installation.

Tools

The necessary tools consist of wooden clamp blocks, steel column lifting clamps with bail, or preferably an approved type of pipe elevator, all of proper size to fit exactly the outside diameter of the column. Chain tongs, pipe wrenches, ordinary wrenches and mechanic's tools usually used in this class of work should be provided.

Foundation

The pump foundation should be substantially built to carry the weight of the entire pump, full of water, and rigid enough to withstand and prevent any vibration. If the pump is mounted on the middle of a timber or I-beam span across the pit, make these extra heavy to prevent spring action; also brace them laterally to prevent side motion. On belt-driven installations, where pump

is mounted on beams over a pit, drive should always be installed parallel to beams, never at right angles. Where possible, the pump foundation should be constructed of concrete mixed as follows: One part cement, two parts sand and four parts gravel, with sufficient water to make a stiff mortar, well mixed. The area of the base of the foundation should be at least 3" larger all around than diameter of pump head base plate; but on deep, heavy settings the foundation should be engineered for safety and be large and deep enough so that the load per square foot of concrete does not exceed ordinary foundation standards.

A recessed opening must be provided in the foundation large enough to permit the column flange of the discharge head to enter without contact, plus clearance to align pump in well. Certified prints can be furnished on request giving the necessary dimensions.

Preliminary Inspection

Uncrate the parts and inspect carefully to be sure nothing was damaged in shipment, especially the box of crated shafting. If any part has been damaged or broken in shipment, please report immediately to the factory and to the transportation company involved, with full particulars. Lay out the column pipe and bowl assembly on suitable timbers, with the coupling ends toward the well.

From this point the specific instructions will vary according to the type of pump.

1. FIGURE 6922 & FIGURE 6972 PUMPS

A. DESCRIPTION

Complete Column Sections

Each complete column section is made up of a shaft, a shaft enclosing tube containing the necessary intermediate and connecting bearings and an outer column pipe, column spacer ring and column coupling. Column spiders are used at intervals of approximately 50 ft. to center the shaft enclosing tube in the column pipe.

Column Pipes

All column pipes are identical. The number of column pipes depends on the setting of the pump.

Shaft Enclosing Tubes

The shaft enclosing tubes for a given pump are identical with the exception of the top tube which extends through the pump discharge head. This tube is easily identified since it is threaded on the outside at the upper end to receive the tube tension nut. Generally the shaft tube connecting bearings are shipped separately, therefore it will be necessary to screw one in place at the upper end of each shaft tube when assembling the tube sections.

Shaft

The intermediate shaft sections are identical in length. The top section of shaft, however, is longer and the upper end is threaded and keyseated to receive the adjusting nuts and key.

B. PREPARATION

Handle Shafts Carefully

All shafts are carefully straightened and checked before shipment. HANDLE CAREFULLY as a bent shaft will cause friction, vibration and bearing trouble and in extreme cases may cause the motor to be overloaded and burn out. Check the shafting to make sure that it is straight. Do not lay shafts on ground or where they may be walked on or run over. KEEP THEM STRAIGHT.

Inspect Threads

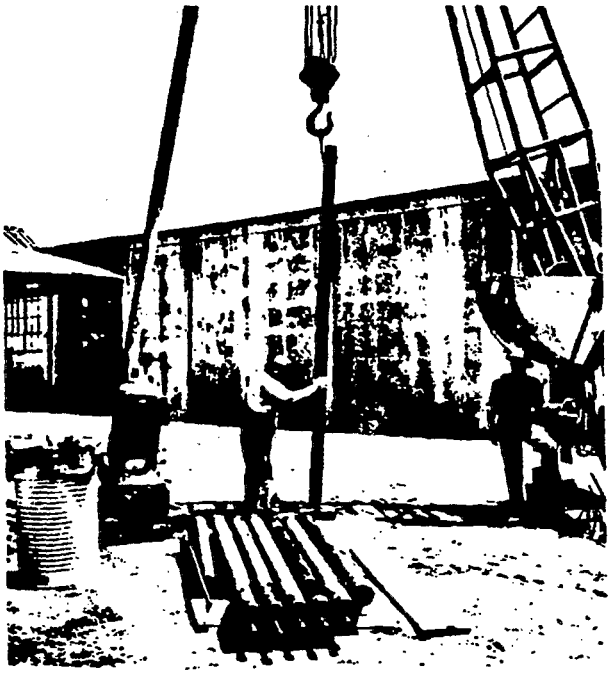
Clean and check all threads, including column, column coupling, shaft, shaft coupling, tube and tube connectors. If the threads on any of the column, oil tube or shaft sections have been crossed or otherwise damaged, this section should be replaced to avoid trouble in installing. Threads should be cleaned with a wire brush and a good solvent. They should then be wiped with a clean rag. Dirt in threads can cause misalignment or vibration in the pump.

C. INSTALLATION

Strainer and Suction

Set the pipe clamps over the well and open up wide enough for the suction pipe and strainer to pass through. Screw the strainer into the suction pipe coupling, raise it and lower into the well through the opening in the clamps. On some sizes of suction pipe the strainer is welded directly onto the lower end of the suction pipe, thus it is handled as one piece. Clamp the suction pipe at

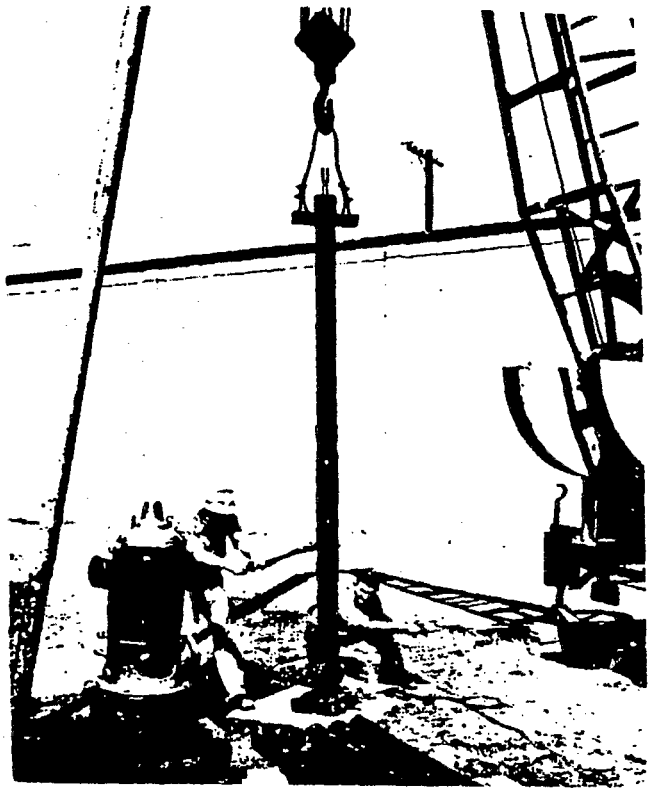
least 2 feet below the coupling end so that the pressure of the clamp will not distort the threads.



Ill. 6 - Lowering suction pipe and strainer into well.

Pump Bowls

Raise the pump bowls, suspend directly over the suction pipe and screw the bowl section on the suction pipe. Be sure the strainer and suction joints are tight. It is very important that these joints should be made up perfectly and butted, using a good grade of thread lubricant. If NO suction pipe is used, the strainer may be screwed into the suction bowl before raising the bowl assembly, provided there is enough head room, but care should be exercised to prevent damage to the strainer in raising the assembly to a vertical position. Lower the strainer, suction pipe and bowls into the well.

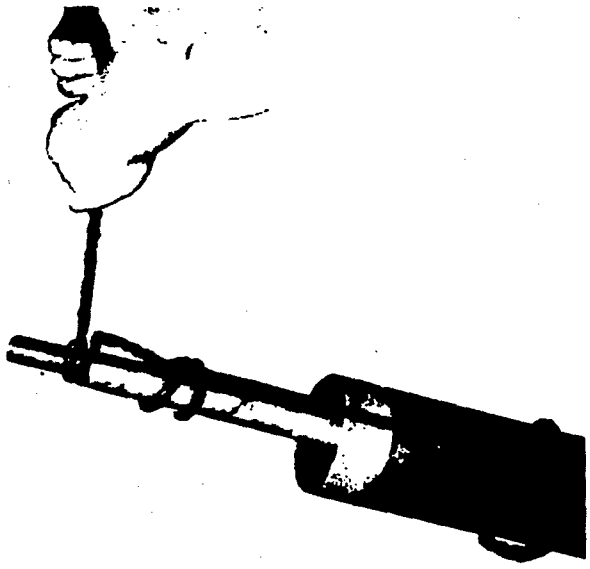


Ill. 7 - Screwing bowl assembly on to suction pipe.

Care should be taken in handling long turbine assemblies as it is possible to break the assembly by dropping or bumping.

Laying Out of Column, Tube and Shaft for Installation

When laying out the shaft enclosing tubes for installation, inspect them to be sure there is no dirt, packing material or other foreign material in the tube. Assemble the clean sections of tube and connector bearings into 10' lengths using one bearing for each piece of tube. All tubes are made up in 5' sections except the 1¼" and 1½" sizes for 2200 RPM and faster speed applications which require bearings at 3'-4" intervals. Coat the threads of the connector bearings with Permatex #2 before screwing them into the tube sections. Be sure to work the Permatex into the threads and maintain the coating. Be careful to avoid getting any Permatex into the oil grooves in the bearings." Make certain of uniform tight metal to metal contact of tube ends when assembled.



Ill. 8 - Method of properly hitching rope on column, tube and shaft to permit "tailing in" the column section without damage.

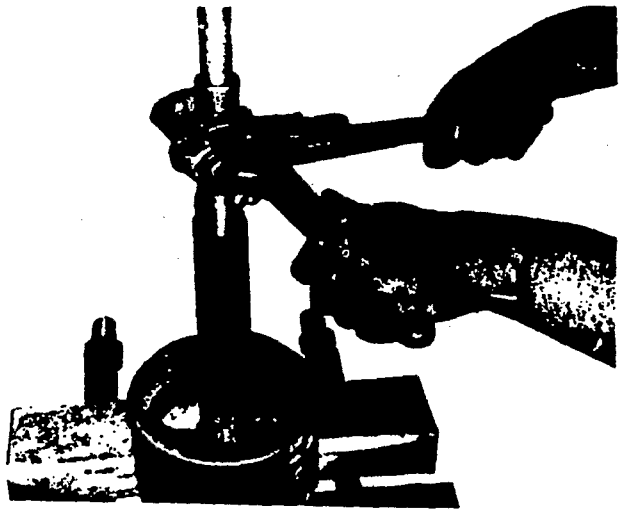
Wipe the shaft clean and check threads for damage. Install a coupling on each length of shaft. Insert the shaft through the tube assembly with the coupling end opposite the connector bearing. Check the inside of column pipe for any foreign matter, cleaning it if necessary, and insert the tube and shaft assemblies through the column pipe with the connector bearing on the tube assembly on the same end as the column coupling. Assemble all sections of column, tube and shaft in this manner.

Discharge Column Sections

Attach the elevator to the coupling end of the column section. Take a hemp rope and throw a timber hitch around the column pipe about 3 feet from the other end, a clove hitch around the tube and another clove hitch around the shaft. Then raise the column, tube and shaft into place above the well, as shown in Illustration 17. The drive shaft should never be allowed to project over 10" or 12" below end of column pipe due to danger of bending. It is necessary for one man to hold the rope at the lower end of the column pipe to see that column pipe threads are not damaged as the section is being raised. A soft board should be laid out for the end of the column pipe to slide in on so that it will not strike rocks, concrete, beams or foundation and damage the threads.

Making Up Shaft Couplings

Examine and clean all threads carefully; paint with a good thread lubricant before screwing together; then wipe off excess lubricant after making up shaft joints. Screw the ends of the shaft together to butt solidly in the middle of the coupling. NOTE: All shaft threads are left-hand.



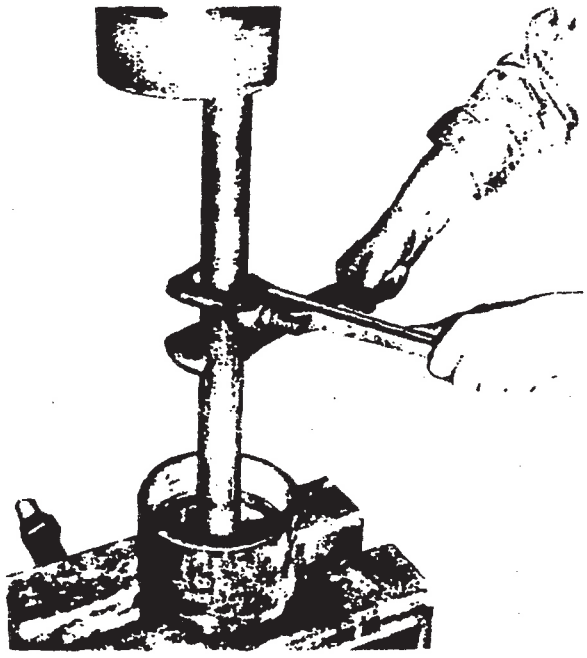
Ill. 9 - Method of making up the shaft joint.

Make sure that the shaft ends are solidly butted together but do not use undue force in tightening. Wrenches should not be needed except for the last small fraction of a turn to make the joint snug. If force is required, look for damaged or dirty threads. Forcing threads may cause misalignment of the coupled shaft.

Connect the drive shaft and coupling to the pump shaft. Remove any burrs left by wrenches after tightening shaft joint. DO NOT ALLOW METAL FILINGS TO DROP INTO PUMP, TUBE OR BEARINGS.

Making Up Shaft Enclosing Tube

Clean threads on the discharge bowl top bearing and coat them with Permatex #2. Pour two or three tablespoonsful of light ice machine oil or equal over the end of the pump shaft allowing it to run down into the bearing. This practice should also be followed in assembling intermediate tubes. DO NOT USE MORE THAN THIS AMOUNT OF OIL IN EACH 10' SECTION. Screw the shaft enclosing tube onto the upper bowl bearing. It should not be necessary to use a wrench until the last fraction of a turn when securing the joint tightly. Excessively tight tube threads indicate dirty or damaged threads. Make certain that the joint obtained is uniformly tight, metal to metal all around. Left-hand threads are used on all Fairbanks Nijhuis™ tubes.



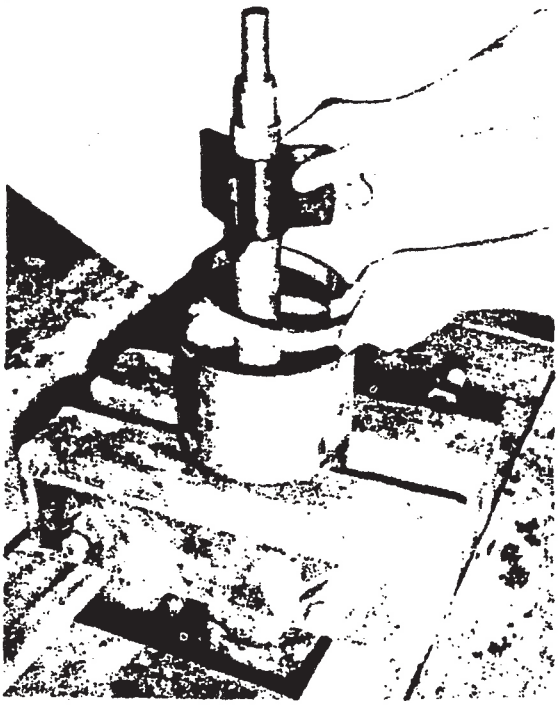
Ill. 10 – Method of tightening tube joint.

Attaching Column Pipe to Bowl Assembly

Paint the end of the column pipe with a good grade of thread lubricant. Lower the column pipe, screw it into the top bowl and tighten the joint securely. Column pipe threads are right-hand.

If two sets of elevators are used, the wooden column clamps can be tightened finger-tight and the column lowered until the elevator rests on the clamps. If only one elevator is used and the column is supported by friction clamps, it should be clamped not closer to the coupling than 2 feet to prevent possibility of distorting column pipe and coupling. Distortion will cause joint to bind and give the appearance of tight threads and pipe will not screw down properly.

Make up the intermediate joints in a similar manner, making certain to insert a column spacer ring, item #275 on Illustrations 15 & 16, between the ends of column pipe in the joint. The ends of the pipe will butt firmly on this ring.



Illus. 11 – Column spacer and black widow spider being inserted into the column joint.

Install Spiders

The column-tube spiders, item #276 on Illustrations 15 & 16, are to be installed at intervals of approximately fifty feet, dividing the total length of column into approximately equal spaces. Wet the spider with water and force it over the projecting end of the shaft tube and inside of the outer column. Do not use oil or oily substances as these may damage the rubber. It is not necessary to fasten the spider in place.

Flanged Column Pipe

Flanged column is handled in very much the same way as screwed column except that the joints are bolted together. Check the well diameter and make sure that the column flanges will fit in the well with at least 1/4" clearance all around.

The flanged column pipe should be stacked conveniently near the hoist. Both flanges of a length of column pipe are machined alike, so it makes no difference which ends bolt together. Before raising the column pipe into place the drive shaft and enclosing tube should be placed in the column pipe and snubbed with a rope hitch, as described under screwed column. Handle carefully to prevent damaging the tube and drive shaft. In some sizes the 10-foot bottom joint of column will be found to screw into the discharge bowl. In such cases, after the bottom shaft and tube have been made up onto the projecting pump shaft and tube connector bearing (as directed under making up of joint shafts), the bottom column is screwed into the discharge bowl to butt and made up tight. If this first joint is flanged and bolted, clean the centering shoulders and contact surfaces in both the discharge bowl and column flange, and place together. Usually no gasket is necessary, but on some very deep settings involving high pressures a sheet copper gasket is provided to insert between the contact ring of the flanges. In some cases stud bolts are used, and these are already screwed into the bowl flange. But if separate bolts are used, insert them up from the bottom of the pump flange. Tighten these bolts very evenly all around. Bolted flanges must be tight enough to support the weight of pump assembly as well as to withstand the water pressure head. Use thread lubricant on stud and bolt threads.

Use the same type of pipe elevators that are used for screwed column. The wooden clamp blocks must necessarily be released and removed each time a joint is lowered into the well, then again clamped onto the next column above. Because the elevator may be in the way of putting in the flange bolts when the column is resting at the well flange collar, it is advisable to insert bolts in the holes in the flange before raising the column and let the elevator rim come up against them, thus holding them in place. This procedure must leave wrench room.

Flanged Column Joint

Lower the suspended column and guide the flange so that the centering shoulders will slip down over the projecting half of the column spacer. Be careful not to damage these fine finished surfaces. Let the weight of column pipe rest on the flange and put on the bolt nuts. Tighten very evenly all around, first lightly setting up opposite bolts, then applying greater torque all around until all bolts are tightened evenly. It is advisable to provide a torque wrench which indicates exactly the amount of foot-pound torque applied to each bolt. These bolts should be drawn up very tight - enough to carry the weight of the parts and water load, plus the load due to the pressure head. It is now ready to receive the column spacer and the next section of column and shaft.

Repeat the procedure until all column and shaft has been installed including the top column and top shaft.

Non-Corrosive Enamel Column

In installing column that has been treated with non-corrosive enamel, special attention should be given to the cleaning of the threads in the coupling and on the column pipe. The butt end of the pipe also should be scraped clean. Care should be taken to prevent damage to the enamel by the chain tongs. Before lowering into the well, joints should have any broken places in the enamel painted over with the non-corrosive enamel which is furnished with the pump.

Installation of Discharge Head

Remove the driver from the discharge head, if these have been shipped assembled. Then remove the column flange from the head and screw it onto the top column pipe. Place the gasket which has been provided on the flange, first making sure that the mating surfaces of the flange and the head are free of dirt and paint. Raise the head into position and

lower it over the shaft and oil tube. Bolt up tightly. If all joints have been made correctly, the shaft projection for the motor should be correct.

Tube Tension Nut & Fittings

After the discharge head has been installed, before setting the driver in place, slip the enclosing tube head adaptor gasket (Item #329 on Illustration 12) and enclosing tube head adaptor (Item 381.1) over the top shaft into place and fasten them down securely with the cap screws furnished. Insert the two packing rings furnished (Item #382) with the end joints of the respective rings about 180° apart. The packing will be forced into the tube threads, making a water-tight seal, when the top tube tension nut is put in place and tightened down. Slide the top tube tension nut over the top shaft, with the centering fit and packing gland projection on the lower side, and run it down on the tube threads to force the packing into place. BE SURE TO GET ALL OF THE PACKING DOWN INTO THE POCKET. Tighten the tension nut down securely.

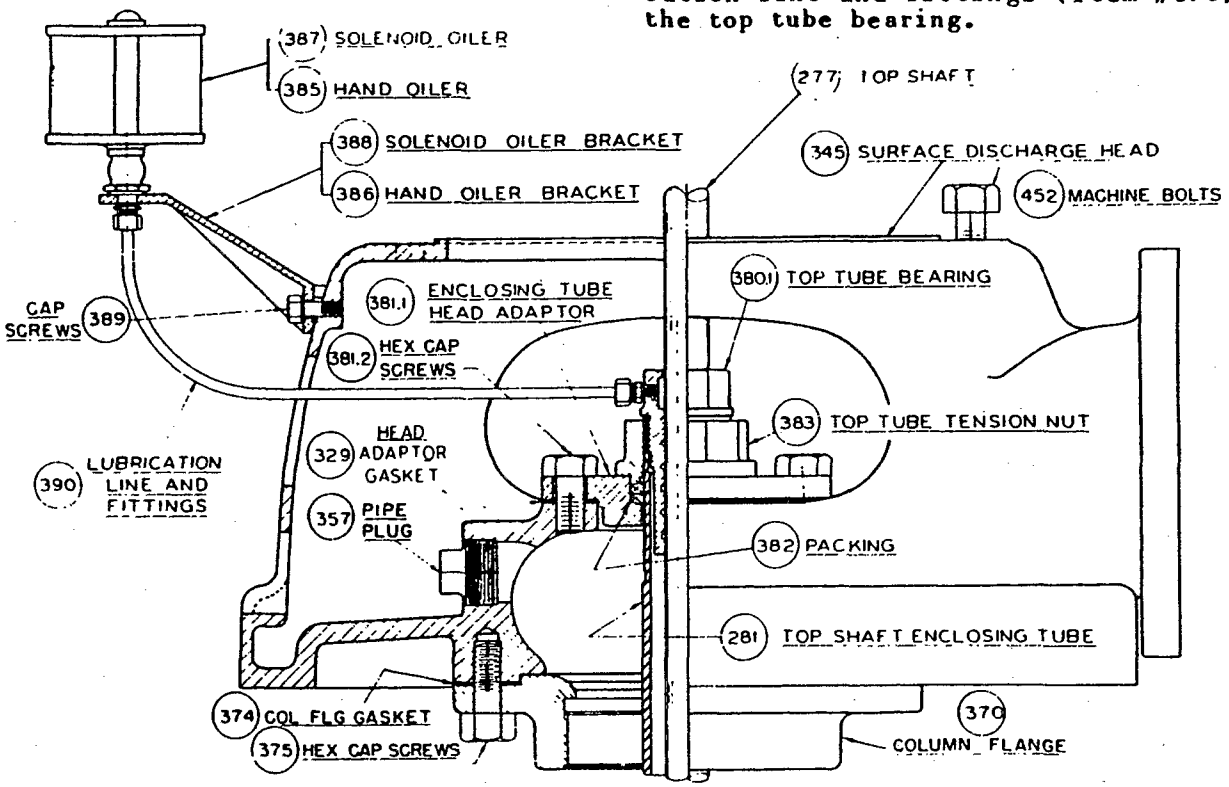
Put the top tube bearing (Item 380.1) down over the top shaft. Coat the threads with Permatex #2 and assemble it to the top tube. Fill with oil to the level of the lubrication line connecting port using the same grade of oil which is to be used to lubricate the pump when in operation.

NOTE: The tension nut should be tightened sufficiently to insure that all the enclosing tube is supported from the surface discharge head and further that the bottom tube is set in slight tension. Proper tensioning is accomplished by noting the gradual increased resistance to turn the tension nut and when tension in the bottom tube is achieved it suddenly becomes harder to tighten the tube. Proper tube tension is readily evident to the experienced installer, but for those less familiar with this operation it will occur when the top tube has been raised approximately $.03 \times \left(\frac{\text{Ft. of Setting}}{100}\right)^2$ inches.

Example: 300 ft. setting the approximate distance to raise the top tube is

$$.03 \times \left(\frac{300}{100}\right)^2 = .270 \text{ inches.}$$

After the tube has been properly tightened, attach one end of the lubrication line and fittings (Item #390) to the top tube bearing.



Ill. 12 - Sectional Illustration of Head-Adaptor Type Tube Tension Nut Construction.

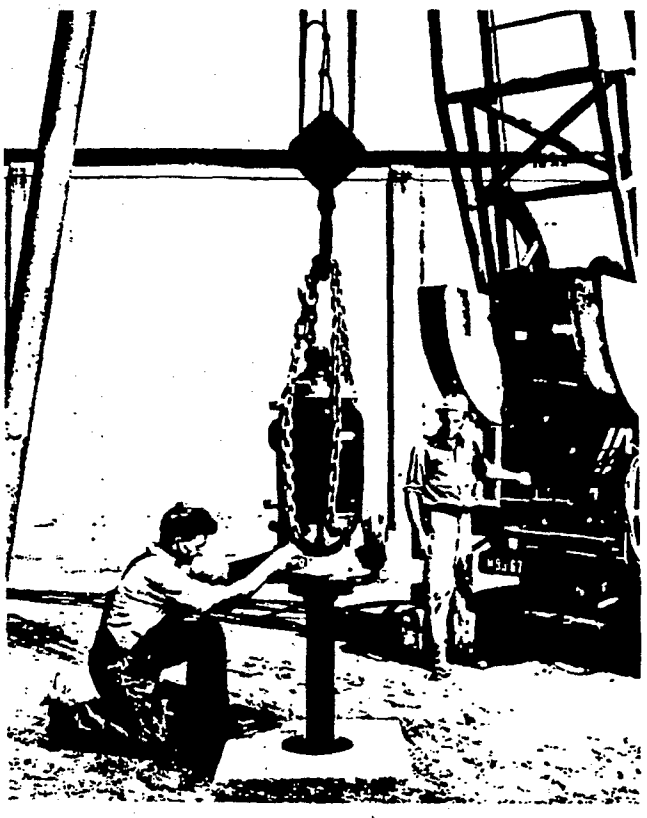
Installation of Hollow Shaft Motor

Remove motor cover, take out drive plate and replace cover. With the cover in place, tighten the eye-bolts and use these for lifting the driver only. Do not use eye-bolts for lifting the motor, head and pump combined. Raise the driver above the top shaft hanging plumb, and lower carefully, guiding the top shaft through the hollow shaft of the driver, being very careful to avoid the possibility of resting the weight of the driver on the shaft and bending it.

(Refer to page 24 if another type of driver is being used)

To Lower Complete Pump

For lifting the entire pump to lower the head onto the foundation, pass a double sling of chain or steel cable through the hand holes in the discharge head, and have the sling pass on each side of the top shaft to balance strain on the head. See Illustration 14.



Ill. 14 - View shows how the hitch should be made on head when lowering pump and head into well.

Aligning Turbine Pump Head

The pump head should be supported on the foundation in a position with respect to the column pipe so that the top shaft will center perfectly in the clearance space at the top of the driver. If the well has an inclination away from the vertical so that the discharge column is not in a plumb position, the head should be supported so that the top shaft will operate on the same inclination as the discharge column. Never level a pump head on the foundation with a spirit level.

The alignment of a Unidrive motor, right angle gear drive or combination drive head can be easily checked at the top of the hollow shaft. There is a slight clearance between the top shaft and the inside of the hollow shaft. To have perfect alignment, the top shaft must stand exactly and freely in the center of the hollow shaft. If the shaft stands off to one side, the condition can be corrected by using metal shims under the edge of the base plate on the opposite side, thus aligning the head so that the top shaft will stand in the center.

At this point it is well to check the top shaft for straightness by assembling the drive plate, lifting shaft and impellers with the adjusting nut and turning the rotating parts by hand 180° from their first position. Then, when nut and drive place are again removed, the top shaft will center in the hollow shaft as before if it is straight. Should this check show the top shaft to have become bent, it should be removed and straightened or replaced before operation of the pump is attempted.

After aligning, raise the pump off the foundation without disturbing the shims, spread a thick bed of soft cement grout and let the head down again in the same position, squeezing out the surplus cement until it rests on the shims. Check the alignment of the top shaft again, and if in proper position with cement set, tighten down the foundation bolts. Assemble the drive plate on over the top shaft and insert the key and screw on the adjusting nut.

Oiling System

The lineshaft or series bearings are lubricated from the top of the unit by means of a separate oil line connected from a sight feed oiler to the enclosing tube sealing nut or top tube bearing.

Solenoid Oiler

If desired, a solenoid oiler may be used on a motor-driven pump to feed the oil to the shaft bearing. The solenoid opens and closes a needle valve automatically. The leads from the solenoid should be connected across the secondary side of the starting switch so that as soon as the current is on the solenoid is energized, raising the needle valve and allowing the oiler to function. If no oil flows from the lubricator after the current is turned on, the needle valve should be inspected as foreign matter may have clogged the opening.

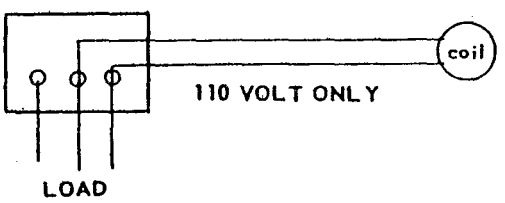
ELECTRICAL INFORMATION FOR INSTALLATION OF ESSEX MODEL 377 SOLENOID OILER

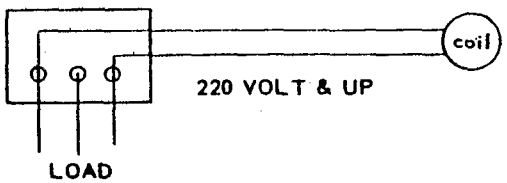
Check voltage to be sure that coil has the same voltage as the equipment on which it will be used. Coil voltage should show plainly on the coil housing. Incorrect voltage will result in failure of lubricator to open or in damage to coil.

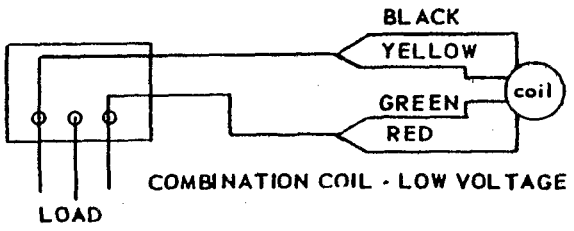
For all single voltage coils connect the two leads from the coil to any two leads on the load side of the magnetic starter or to any two leads at the motor. The diagrams at left illustrate how this may be done.

Combination voltage coils with four leads are wired in series for higher voltage or in parallel if used with the lower voltage. For example, if a coil marked 220/440 V 60 cy. is used in a 220 volt 60 cycle circuit, join the black and yellow leads and connect to one motor lead or to one lead on the load side of the starter or switch. Join the green and red leads and connect to one of the other motor leads or to one of the other leads on the load side of the starter or switch.

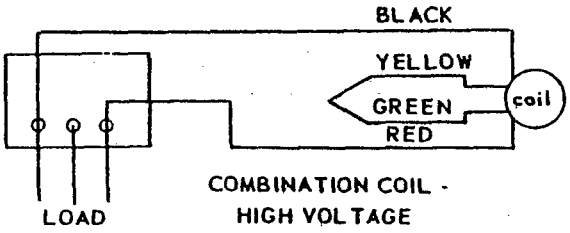
For installations in 440 volt 60 cycle circuits join the green and yellow leads in a dead-end splice and connect the black and the red leads to the motor or the load side of the starter or switch.







COMBINATION COIL - LOW VOLTAGE



COMBINATION COIL - HIGH VOLTAGE

Impeller Adjustment - Fig. 6922 Pumps

To adjust the impellers on the enclosed impeller turbine pump, turn the adjusting nut to raise the impellers to their extreme upper position. This position can be determined by rotating the motor drive plate by hand while tightening the adjusting nut down. When the plate (not the wrench) can no longer be turned by hand the impellers are in the extreme upper position. Back the adjusting nut off one full turn plus an additional amount necessary to line the nearest set screw hole with the top shaft keyway. Insert the set screw in this hole and lock the nut in position.

Impeller Adjustment - Figure 6972 Pumps

Start with the impellers resting solidly on the bowl seats by backing off the adjusting nut. Screw down the adjusting nut with a wrench to take up the weight of the shaft and pump parts until the impellers just barely clear the bowl seats and the drive hub at the top of driver can be turned freely by hand. Note carefully the position of adjusting nut at the point where the hub first can be turned freely. Refer to Impeller Adjustment Chart shown on page 20 which indicates the number of faces of the hexagonal adjusting nut to raise the impellers to the proper running position for known conditions. See the expalantion and example accompanying the Impeller Adjustment Chart. When the proper adjustment has been made, turn the adjusting nut to a position where the nearest set screw hole is in line with the keyway. Insert set screw and tighten.

In cases where a new well is being developed or where the well delivers considerable sand, it may be advisable to screw down the adjusting nut more than indicated by the chart to give greater clearance between the impellers and bowl seats so that the edges of the impeller vanes will not become worn during the development period. If the well does not make sufficient water to supply the pump to its rated capacity, the delivery of the pump can be reduced to meet the capacity of the well by this same method of raising the impellers. This method of reducing the capacity is usually more efficient than throttling the pump discharge, both from the standpoint of power used and pump wear.

II. FIGURE 6927 & FIGURE 6977 PUMPS

A. PREPARATION

Line Up Column & Shafting

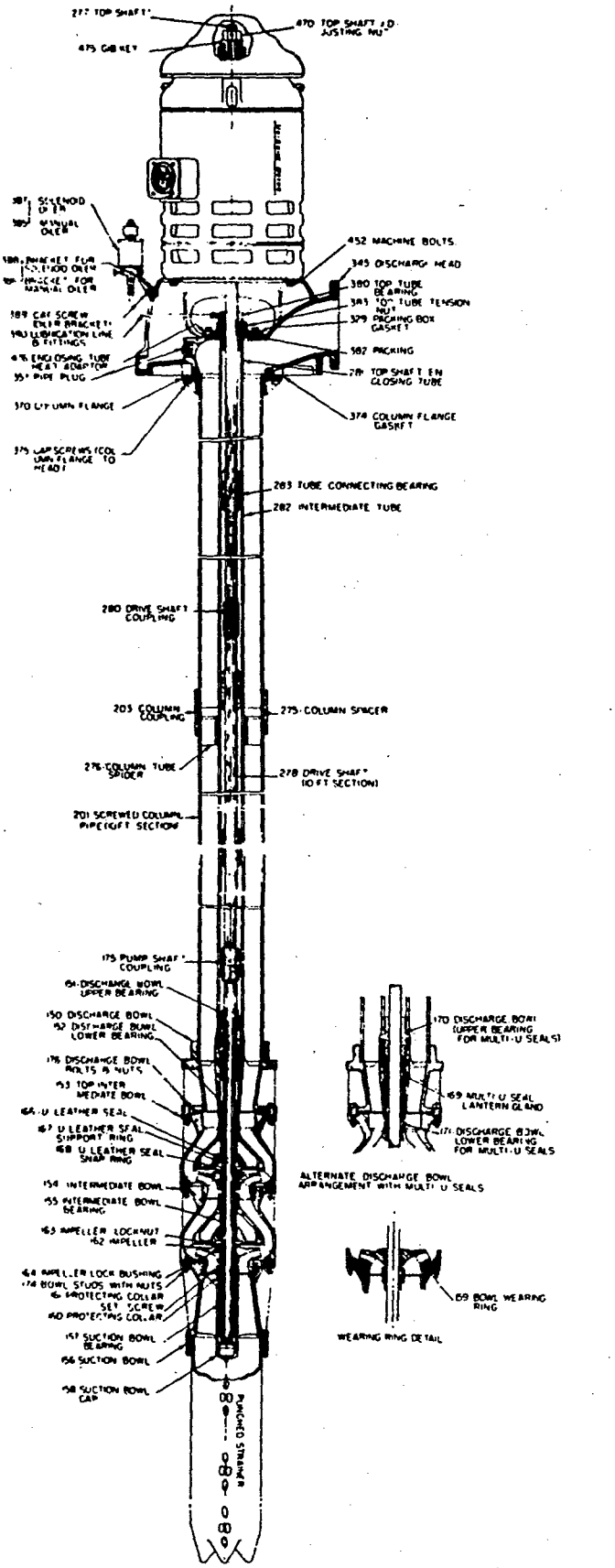
Clean the threads on the column pipe after removing thread protectors. Clean the column coupling threads thoroughly. Stack column pipe on blocks to keep it out of the dirt. Keep sand and grit off the threads.

Next, clean the shaft threads thoroughly. The shaft couplings will be found in the carton with the bearing retainers. Assemble a shaft coupling to each intermediate shaft. (NOTE: Some of these pumps are equipped with step couplings to connect the pump shaft to the bottom shaft when the two shafts are of different diameters. Be sure to assemble the step coupling to the correct shaft.) Always put the coupling on the end of the shaft farthest from the sleeve.

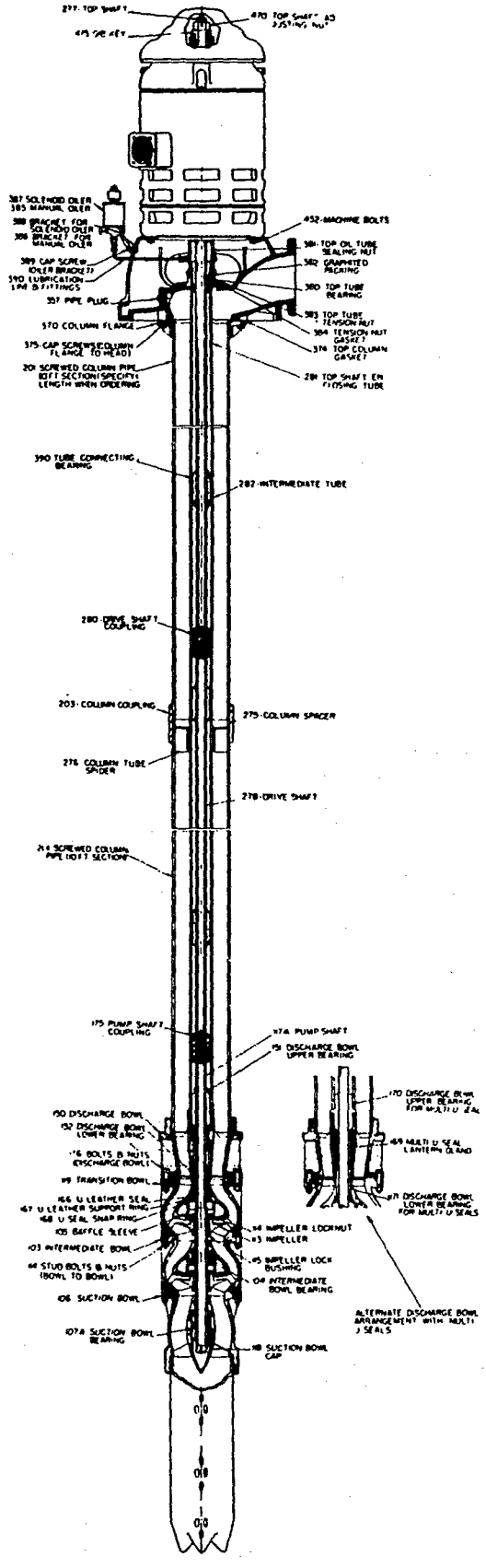
For pump speeds greater than 2199 RPM, all column sections are 5' long with 10' shaft sections with the exception of the bottom shaft which is 5' long. For pump speeds less than 2199 RPM, intermediate sections of column and shaft are 10' long, the bottom column and shaft are 5' long and the top column is 5' long.

Shaft and Bearing Retainers

Put the shaft with couplings through the column pipe with the shaft coupling on the end opposite the column coupling. The column will be clamped and hoisted at the coupling end. The shaft couplin will protect the shaft threads duri



Ill. 15 - Sectional Illustration of Fig. 6922 pump giving parts numbers for ordering repairs and showing Head-Adaptor Type Tube Tension Nut Construction.



Ill. 16 - Sectional Illustration of Fig. 6972 pump giving parts numbers for ordering repairs and showing Flanged Nut Type Tube Tension Nut Construction.

hoisting operations. If the shaft coupling is installed on the top end of the shaft (nearest the sleeve), it will have to be removed before the bearing retainer can be put in place.

The bearing retainers are best left in the shipping carton until they are to be installed. They should then be installed. They should then be inspected to make sure that (1) the bearing turns freely in the retainer, (2) there is no foreign matter such as waste, shredded paper or excelsior in the bearing or retainer pocket, (3) the threads are clean and undamaged and (4) NO OIL OR GREASE IS ON THE RUBBER BEARING.

B. INSTALLATION

Strainer and Suction

Set the pipe clamps over the well and open up wide enough for the suction pipe and strainer to pass through. Screw the strainer into the suction pipe coupling, raise it as shown in Illustration 6, and lower into the well through the opening in the clamps. On some sizes of suction pipe the strainer is welded directly onto the lower end of the suction pipe, thus it is handled as one piece. Clamp the suction pipe at least 2 feet below the coupling end, so that the pressure of the clamp will not distort the threads.

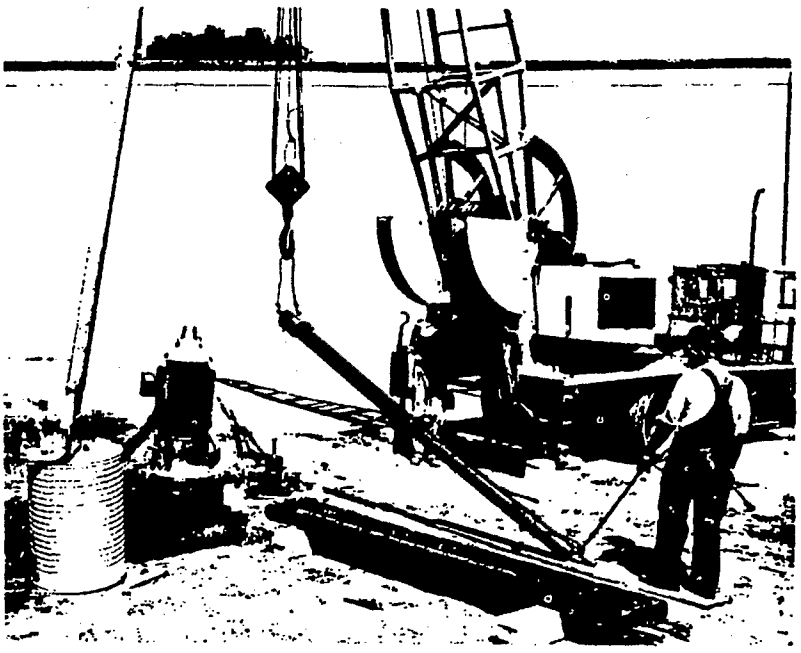
Pump Bowls

Raise the pump bowls as shown in Illustration 7, suspend directly over the suction pipe and screw the bowl section onto the suction pipe. Be sure the strainer and suction joints are tight. It is very important that these joints should be made up perfectly and butted, using a good grade of thread lubricant. If no suction pipe is used, the strainer may be screwed into the suction bowl before raising the bowl assembly, provided there is enough head room, but care must be exercised to prevent damage to the strainer in raising to a vertical position. Lower the strainer, suction pipe, bowls and bottom column into the well. If two sets of elevators are used, the wooden column clamps can be tightened finger-tight and the column lowered until the elevator rests on the clamps, as in Illustrations 17 & 18. If only one elevator is used and the column is supported by friction-clamps, it should be clamped not closer to the coupling than 2 feet to prevent possibility of distorting column pipe and coupling. Distortion will cause joint to bind and give the appearance of tight threads, and pipe will not screw down properly.

When the 5-foot bottom column, bottom shaft and bearing retainer are not shipped assembled to the bowls, they should be so assembled before installation, providing the derrick is high enough to handle the two together. If the derrick is not high enough, the bowls should be raised separately by means of a lifting nipple or chain hitch, then clamped safely at the well top. Follow directions outlined in paragraphs relating to making up shaft joints and making up column pipe. Care should be taken when handling long turbine assemblies as it is possible to break assembly by dropping or bumping it.

Discharge Column Sections

Attach the elevator to the coupling end of the column section. Take a hemp rope and throw a timber hitch around the column pipe about 3 feet from the end away from the well, and a clove hitch around the shaft, and then raise the column and shaft into place above the well, as illustrated in Illustration 17.



Ill. 17 - Showing correct method of "tailing in" column and shaft. This prevents possibility of bending shaft or damaging column threads.

Drive shaft should never be allowed to project over 10" or 12" below end of column pipe due to danger of bending. It is necessary for one man to hold the rope at the lower end of the column pipe to see that column pipe threads are not damaged as the section is being raised. A soft board should be laid out for the end of the column pipe to slide in on so that it will not strike rocks, concrete, beams or foundation and damage the threads.

Lineshaft Bearing Retainer

The bearing retainer is placed over the projecting end of the lineshaft with the bearing retainer cap downward and screwed into the column coupling down tightly against the end of column pipe below (use hollow spanner wrench provided with shipment) before starting to screw the next column pipe into the coupling. Threads are right-hand. The shaft should now stand up freely in the center of the bearing retainer without binding against the side. If the shaft bears heavily to one side and the bearing retainer is not cross-threaded, the column and shaft should be pulled up again, removed and inspected for misalignment. Never continue with the installation if the shaft does not center freely at the bearing retainer. This indicates a misaligned column pipe or crooked shaft, which will eventually cause trouble.

Making Up Shaft Couplings

Examine and clean all threads carefully; paint with a good thread lubricant before screwing together; then wipe off excess lubricant after making up shaft joints. Screw the ends of the shaft together to butt solidly in the middle of the coupling. NOTE: All shaft threads are left hand. Make sure that the shaft ends are solidly butted together, but do not use undue force in tightening. Wrenches should not be needed except for the last small fraction of a turn to make the joint snug. If force is required, look for damaged or dirty threads. Forcing threads may cause misalignment of the coupled shaft.

Column Pipe

Lower the column pipe. Apply lubricant to the threads and screw up tightly with chain tongs. Be absolutely sure that column joints butt solidly, metal to metal. Be careful in starting threads to prevent getting them crossed. In tightening the column pipe joints, place one set of tongs on the coupling and another on the column pipe. Use feet and hands as shown in Illustration 18.

Ill. 18 - Showing proper method of tightening column coupling. By properly attaching chain tongs, the column pipe will not be dented or damaged.

Hoist enough to loosen the column clamp, and lower the pump into the well slowly, and again clamp the column pipe below the next coupling. The upper end of the shaft is now swinging freely in the column. Here the shaft can again be checked for straightness. Screw the bearing retainer into place in the column coupling, with bearing retainer cap downward. Repeat this procedure and precaution through the entire length of discharge column.

Flanged Column Pipe

Flanged column is handled in very much the same way as screwed column, except that the joints are bolted together. Check the well diameter and make sure that the column flanges will fit in the well with at least 1/4" clearance all around.

The flanged column pipe should be stacked conveniently near the hoist. Both flanges of a length of intermediate column pipe are machined alike, so it makes no difference which ends bolt together. Before raising the column pipe into place the drive shaft should be placed in the column pipe and snubbed with a rope hitch as described under screwed column. Handle carefully to prevent damaging the drive shaft. In some sizes the 5-foot bottom joint of

column will be found to screw into the discharge bowl. In such cases, after the 5-foot shaft has been made up onto the projecting pump shaft (as directed under making up of shaft joints), the 5-foot bottom column is screwed into the discharge bowl to butt and made up tight. If this first joint is flanged and bolted, clean the centering shoulders and contact surfaces in both the discharge bowl and column flange, and place together. Usually no gasket is necessary, but on some very deep settings involving high pressures a sheet copper gasket is provided to insert between the contact ring of the flanges. In some cases stud bolts are used, and these are already screwed into the bowl flange. But if separate bolts are used, insert them up from the bottom of the pump flange. Tighten these bolts very evenly all around. Bolted flanges must be tight enough to not only support weight of pump assembly, but also to withstand water pressure head. Use thread lubricant on stud and bolt threads.

Use the same type of pipe elevators that are used for screwed column. The wooden clamp blocks must necessarily be released and removed each time a joint is lowered into the well, then again clamped onto the next column above. Because the elevator may be in the way of putting in the flange bolts when the column is resting at the well flange collar, it is advisable to insert bolts in the holes in the flange before raising the column and let the elevator rim come up against them, thus holding them in place. This procedure must leave wrench room.

Bearing Retainer for Flanged Column

The bottom 5-foot column flange is now resting on the elevator, and the bottom 5-foot shaft projects up into the center of it. The bearing retainer has a smooth finished rim which fits into the centering shoulders of the two opposite flanges and is held tightly clamped by the strongly bolted flanges. Place the bearing retainer on over the projecting end of drive shaft with the bearing retainer cap downward. Place it carefully into the annular centering recess on the column flange. The retainer rim forms a centering ring for the column pipe flanges and also forms a gasket for the flange joint. Raise the next 10-foot flanged column pipe, with its length of drive shaft supported inside by a rope hitch, over the lower end of flanged pipe, as shown in Illustration 17. Examine for nicks to be sure flange will seat perfectly on full surface.

Making Up Shaft Couplings

Follow the same directions as previously set out herein.

Flanged Column Joint

Lower the suspended column and guide the flange so that the centering shoulders will slip down over the projecting half of the retainer rim. Be careful not to damage these fine finished surfaces. Let the weight of column pipe rest on the flange, and put on the bolt nuts. Tighten very evenly all around, first lightly setting up opposite bolts, then applying greater torque all around until all bolts are tightened evenly. It is advisable to provide a torque wrench which indicates exactly the amount of foot-pound torque applied to each bolt. These bolts should be drawn up very tight - enough to carry the weight of the parts and water load, plus the load due to the pressure head. When this joint of column is lowered the shaft should project truly centered in the column pipe. It is now ready to receive the bearing retainer and the next column and shaft.

Repeat the procedure until all column and shaft has been installed up to the 5-foot top column and head shaft.

Non-Corrosive Enamel Column

In installing column that has been treated with non-corrosive enamel, special attention should be given to the cleaning of the threads in the coupling and on the column pipe. The butt end of the pipe also should be scraped clean. Care should be taken to prevent damage to the enamel by the chain tongs. Before lowering into the well, joints should have any broken places in the enamel painted over with the non-corrosive enamel which is furnished with the pump.

Top Column and Discharge Head

The top column pipe section is always a 5-foot length, but the top column shaft is of sufficient length to extend through the driver to form the head shaft. Remove the driver from the discharge head if they have been shipped assembled.

The packing box is generally shipped attached in the discharge head but should never be left in this position while installing the head over the top shaft. Remove the packing box from the head and it will be found that the lower end is threaded for the standard pipe thread on the stilling tube, which is packed in

the accessory box and properly labeled "Assembly Packing Box and Stilling Tube". Screw stilling tube into packing box. Install the top shaft.

The discharge head, less the driver and the packing box, is assembled to the top pipe and lowered over the top shaft and the column joint made up tight. Use care to prevent the head from being lowered onto the projecting end of the top shaft as so doing may bend or kink the shaft.

To Lower Complete Pump

It is now necessary to lower the entire unit into the well so that the discharge rests on the foundation.

For lifting the entire pump, less the driver and packing box assembly, pass a double sling of chain or steel cable through the hand holes in the discharge head and have the sling pass on each side of the top shaft to balance the strain on the head. See Illustration 14.

See that packing box gasket is in place on the packing box flange of the discharge head. Now slip the packing box assembly over the top shaft and into position on the head. Slip the water slinger on over the shaft into place above the packing gland, but do not locate until after the pump has been adjusted. Remove the gland nuts and lift up the packing gland. Set the packing (shipped in separate container) into the packing box, staggering the joints. Packing rings should be just long enough so that when they are placed around the shaft there is a small gap between the ends. The width of this gap will depend on the shaft size. It should be about 1/16" on 3/4" shaft up to 1/4" on 2-15/16" shaft. If necessary, trim the ends of the rings to make the packing fit as described.

Installation of Hollow Shaft Driver

Remove motor cover and take out drive plate. Tighten the eye-bolts when provided and use these or the lugs in the top motor mounting for lifting the driver only. Never use the eye-bolts or lugs for lifting the motor, head and pump combined as they are not designed to support the complete weight of the pumping unit. Raise the driver above the top shaft, plumb it, and lower carefully, guiding the top shaft through the hollow shaft of the driver, being very careful to avoid resting the weight of the driver on the shaft and bending it.

Aligning Turbine Pump Head

The pump head should be supported on the foundation in a position with respect to the column pipe so that the top shaft will center perfectly in the clearance space at the top of the driver. If the well has an inclination away from the vertical so that the column is not in a plumb position, the head should be supported so that the top shaft will operate on the same inclination as the discharge column. Never level a pump head on the foundation with a spirit level.

The alignment of a Unidrive motor, right angle gear drive or combination drive head can be easily checked at the top of the hollow shaft. There is a slight clearance between the top shaft and the inside of the hollow shaft. To have perfect alignment, the top shaft must stand exactly and freely in the center of the hollow shaft. If the shaft stands off to one side, the condition can be corrected by using metal shims under the edge of the base plate on the opposite side, thus aligning the head so that the top shaft will stand in the center.

At this point it is well to check the top shaft for traightness by assembling the drive late, lifting shaft end impellers with the adjusting nut and turning the rotating parts by hand 180° from their first position. Then, when nut and drive plate are again removed, the top shaft will center in the hollow shaft as before, if it is straight. Should this check show the top shaft to have become bent, it should be removed and straightened or replaced before operation of the pump is attempted.

After aligning, raise the pump off the foundation without disturbing the shims, spread a thick bed of soft cement grout and let the head down again in the same position, squeezing out the surplus cement until it rests on the shims. Check the alignment of the top shaft again, and if in proper position with cement set, tighten down the foundation bolts. Assemble the drive plate on over the top shaft, and insert the key and screw on the adjusting nut. See Illustration 19.

Ill. 19 - Adjusting the semi-open type impellers for proper running clearance on the bowls. Raise the pump shaft with the adjusting nut until the shaft turns freely. Then raise the impellers as directed under impeller adjustment.

Impeller Adjustment - Fig. 6927 Pumps

To adjust the impellers on the enclosed impeller turbine pump, turn the adjusting nut to raise the impellers to their extreme upper position. This position can be determined by rotating the motor drive plate by hand while tightening the adjusting nut down. When the plate (not the wrench) can no longer be turned by hand the impellers are in the extreme upper position. Back the adjusting nut off one full turn and lock with the set screw.

Impeller Adjustment - Fig. 6977 Pumps

The impellers are now resting solidly on the bowl seats. Screw down the adjusting nut with a wrench to take up the weight of the shaft and pump parts until the impellers just barely clear the bowl seats and drive hub at top of driver can be turned freely by hand. Note carefully the position of the adjusting nut and the point where hub first can be turned freely. Refer to Impeller Adjustment Chart shown on page 20, which indicates the number of faces of the hexagonal adjusting nut to raise impellers to the proper running position for known conditions. See explanation and example accompanying the Impeller Adjustment Chart. When the proper adjustment has been made, turn the adjusting nut to the position where the nearest vertical hole in the adjusting nut aligns with a tapped hole in the motor coupling hub. Insert the cap screw and tighten.

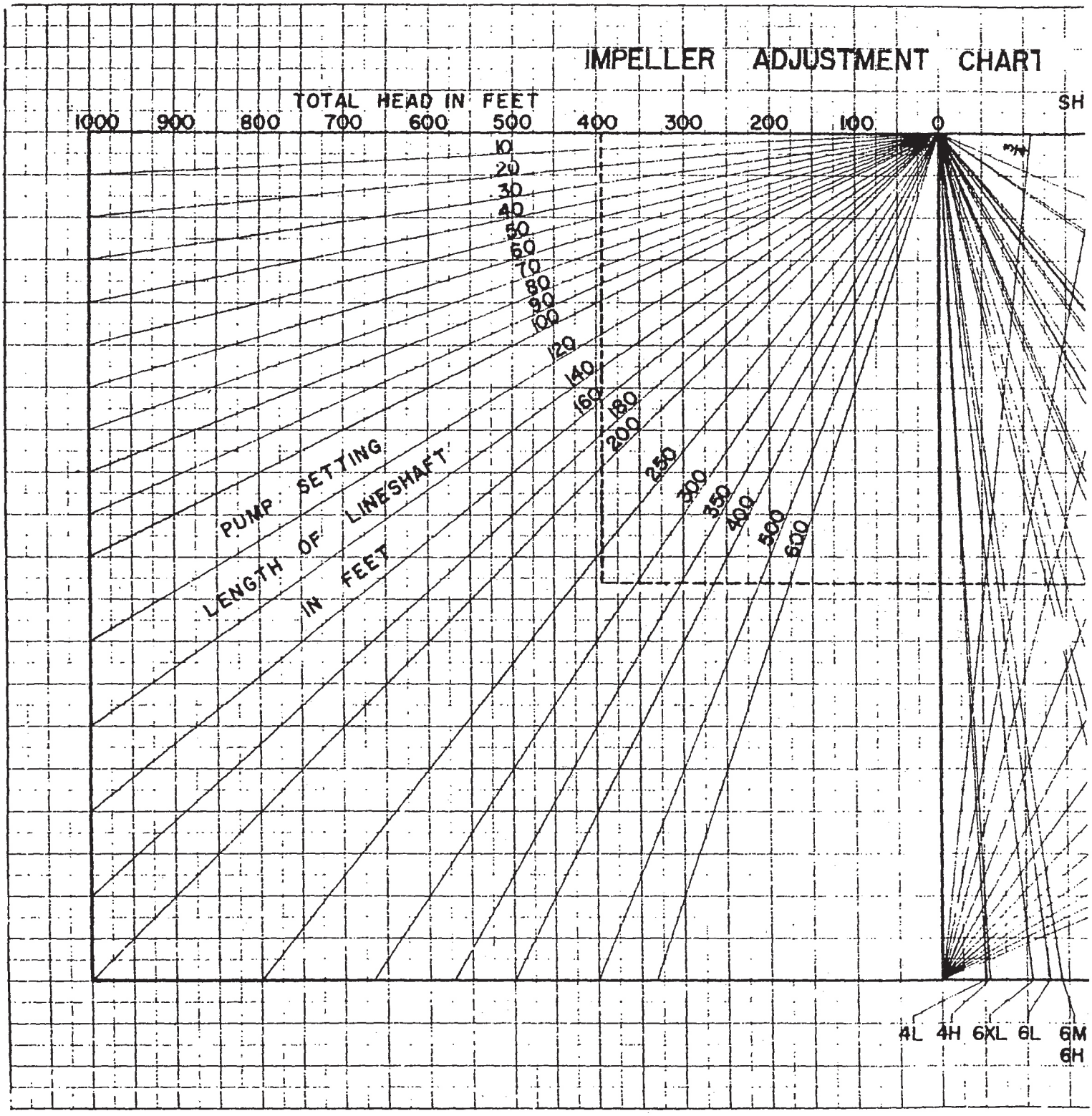
In cases where a new well is being developed or where the well delivers considerable sand, it may be advisable to screw down the adjusting nut more than indicated by the chart so that the edges of the impeller vanes will not become worn during the development period. If the well does not make sufficient water to supply the pump to its rated capacity, the delivery of the pump can be reduced to meet the capacity of the well by this same method of raising the impellers. This method of reducing the capacity is usually more efficient than throttling the pump discharge, both from the standpoint of power used and pump wear.

Impeller Adjustment -- Fig. 6962 and Fig. 6967 Pumps

The impellers for this type of pump will be subject to a special method of adjusting, different from that applying in general to turbine pumps.

The bowl seats for this pump are inclined and the impeller vane must run close to the bowl seat in order to obtain best performance. However, it is injurious to the pump, and usually to the motor, to run the impellers adjusted too low. Therefore, great care must be exercised in adjusting them.

Run the adjusting nut at the top shaft down to the drive sleeve and tighten until the impellers just clear the bowl seat, i.e. until the drive clutch can be turned by hand. When the impellers clear at all points the clutch turns easily and no drag will be felt. After locating this point as accurately as possible raise the impellers approximately 1/16" for settings up to 50 feet of column. For each additional 10 feet of column length raise the impeller an additional 15/1000 of an inch or approximately 1/64".



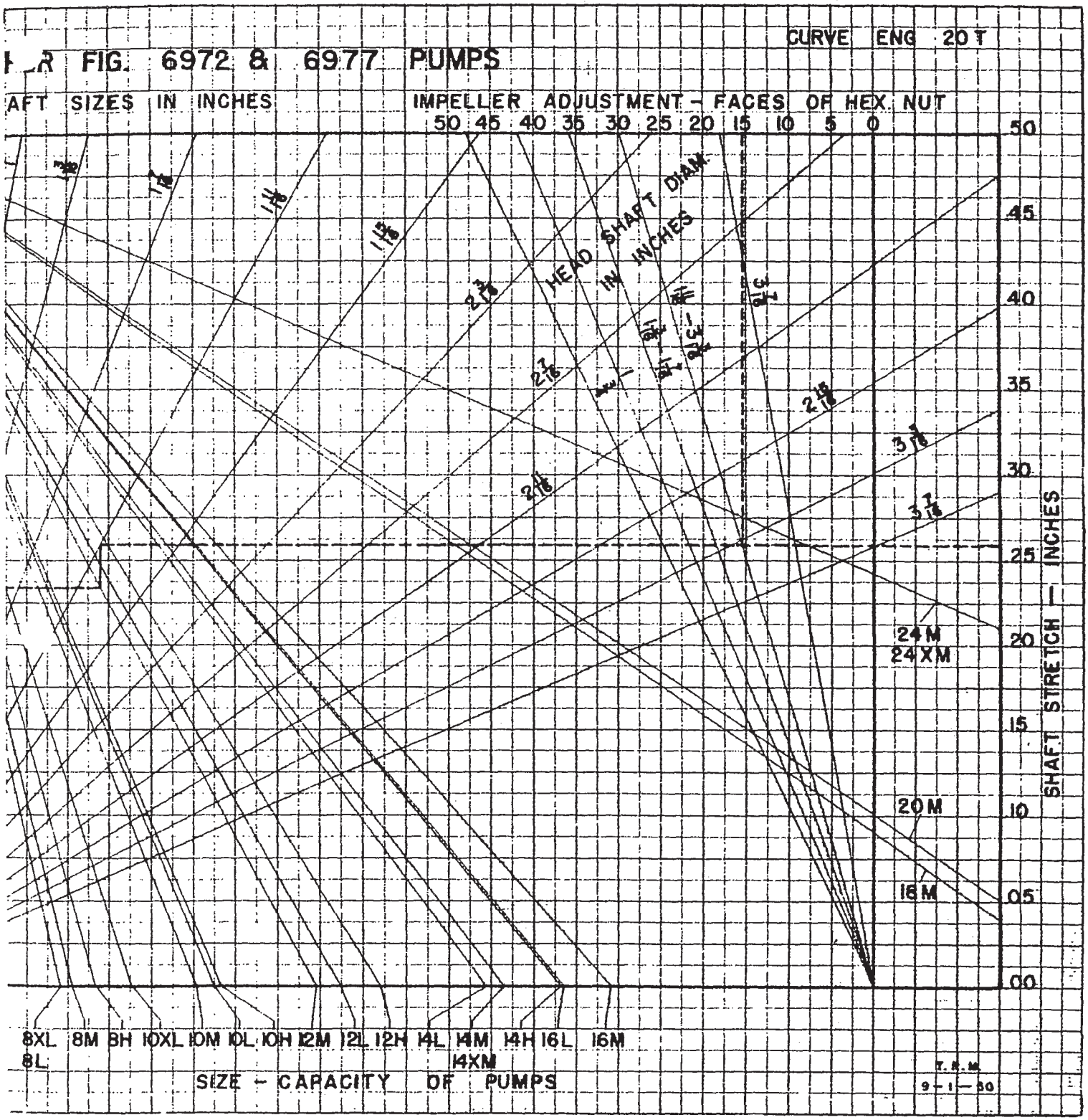
Impeller Adjustment

) determine impeller adjustment by this chart of any Fairbanks Nijhuis™ 172 or Fig. 6977 Deep Well Turbine perating under average conditions, lowing items must be known:

a) The total head against which the pump is or will be pumping, including heads above and below.

(b) The pump setting - the length of drive shaft.

(c) The size-capacity of pump.



(d) The full diameter of shaft.

(e) The full diameter of the head shaft at the adjusting nut threads.

To use this chart normally, read from left to right. In applying the known items to the various value lines always move in straight lines parallel to background lines, either vertically or horizontally, never follow the diagonal lines.

Take the example worked out on the chart in dotted lines:

(a) Total head 394 ft.

(b) Pump setting 270 ft.
(c) Size of Pump - T6 - 12" MC
(d) Size of shaft - 1-11/16"
(e) Size of head shaft - 1-11/16"

Beginning at the upper left scale, "Total Head", locate a point at 394 ft. Follow down to the "Pump Setting" lines, vertically, find 270 ft. at two-fifths the distance between 250 and 300. From this point follow horizontally to the intersection with the 12" MC "Pump Size-capacity" line. Turn and follow vertically (either up or down), in this case, up to the intersection with the 1-11/16" "Shaft Size" line. Turn and follow horizontally to the 1-11/16" "Head Shaft Diameter" line. From this intersection turn and follow upward to the horizontal scale on the upper right and there read the "Impeller Adjustment" in number of faces of the hexagon adjusting nut. In this case the number is 15-1/2 faces or 2 complete turns of the nut plus 3-1/2 faces over. In such cases where the point found is a fraction of a face, take the next largest full face, so in this example the proper, lowest, adjustment would be 16 faces or 2-2/3 turns of the nut.

The finding of the proper starting point in making the impeller adjustment is most important. Before starting to count the required number of faces for the proper running clearance, the impellers must first have been lifted off the bowl seats to a point where they just barely clear without actual contact. On some installations this point may be hard to find, but it must be determined accurately for best results.

The adjustment given in this example should place the impeller as close as possible to the bowl seat, without actual contact when the pump is operating against the given head and the lineshaft has become stretched due to the hydraulic thrust or the impellers. This is the proper adjustment for obtaining the highest efficiency. Whenever the head conditions change, the new adjustment must be determined from the chart and readjusted accordingly. If after applying the result of the chart reading to some particular pump installation, when operating at the given head, the impellers give indications of rubbing slightly on the bowl seats, the pump should immediately be stopped and the impellers raised a face at a time until the exact clearance for that setting has been found.

On the other hand, if this adjustment does not provide the full rated capacity of the pump at the measured head, the pump should be stopped and impellers lowered one face at a time until the lowest possible adjustment is secured without the impellers rubbing.

Packing Gland

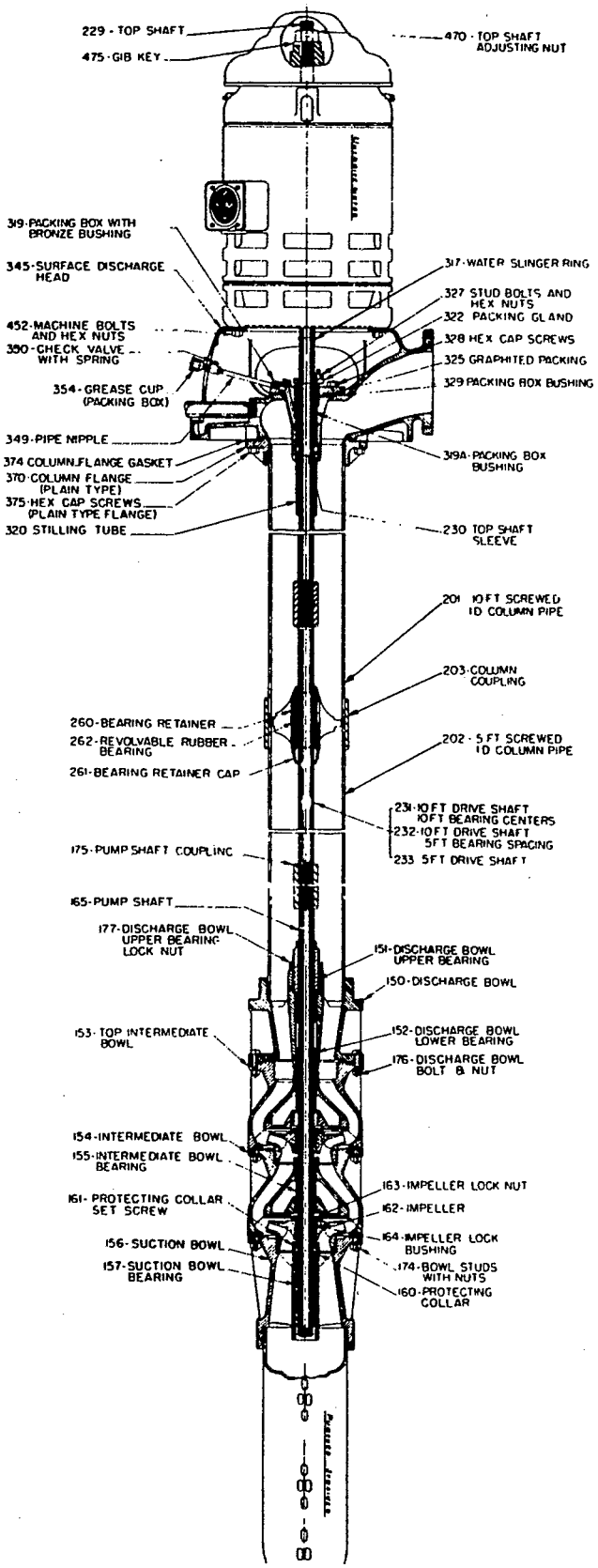
In starting the pump the first time after installation or after completely repacking the stuffing box, tighten the gland only thumb-tight until after the pump is in operation; then tighten further with a small wrench if necessary, lightly, until there is only a very slight trickle of water to keep the packing lubricated. If the gland starts to leak, tighten it promptly. When the gland is screwed clear down, back it off and add a ring of packing. If the pressure cannot be held in this manner, remove the old packing and repack with Pomona Packing. If necessary, substitute a good grade of square-braided graphited flax, hemp or asbestos fibre packing, such as No. 234 Garlock or equal. Give the packing gland grease cup one or two turns each time the pump is started, or at least twice a day if the pump is operating continuously or automatically.

Prelubricating Water Tank for Pumps With Open Discharge

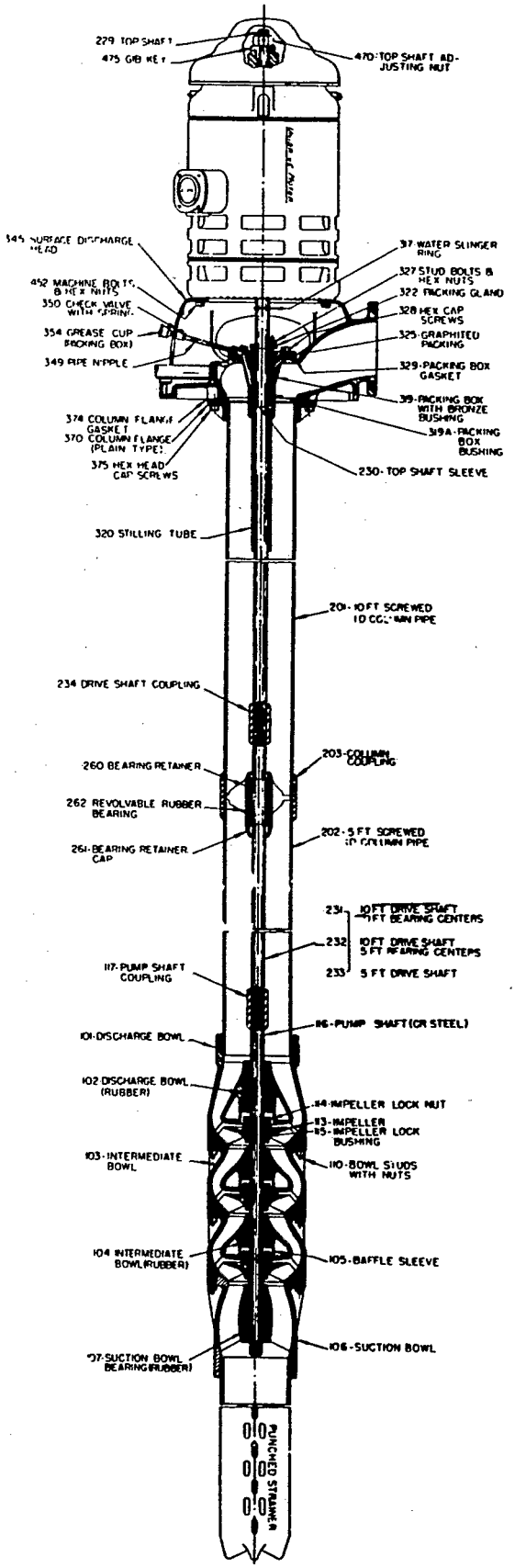
Set the water tank in a suitable location with the outlet at least on the level with the inlet on the pump head, but higher if convenient. Connect to the pump head with the fittings provided, and fill with clean water. At all times before starting the pump allow at least half a tank of water to run down the column to lubricate the bearings. Leave the valve open and let the prelubricating water flow until the water from the pump has reached the surface, then allow the tank to refill before closing the valve. If the pump discharges directly at the surface, a butterfly valve must be placed in the line and an artificial head created for a short period after starting so that the prelubricating tank can be refilled.

For Pumps Discharging Under Pressure

If the plant is to be connected for automatic operation and there is a permanent supply of water under pressure available, a line can be connected from the supply to the prelubricating tank fitting, and a small stream of water allowed to run into the discharge column at all times when the pump is not in op-



Ill. 20 - Sectional Illustration of Fig. 6927 pump giving parts numbers for ordering repairs.



Ill. 21 - Sectional Illustration of Fig. 6977 pump giving parts numbers for ordering repairs.

eration. If water under pressure is not available for this type of prelubrication, an automatic electric solenoid valve prelubricator must be installed. If the pump discharges into a closed line or through a check valve so that the air in the discharge column has not a ready means of escape, an air relief valve must be installed. Otherwise the air from the discharge column will blow back through the prelubricating tank and prevent the prelubricating water from flowing while the pump is getting started. The air relief valve also prevents air being blown into the pipe line.

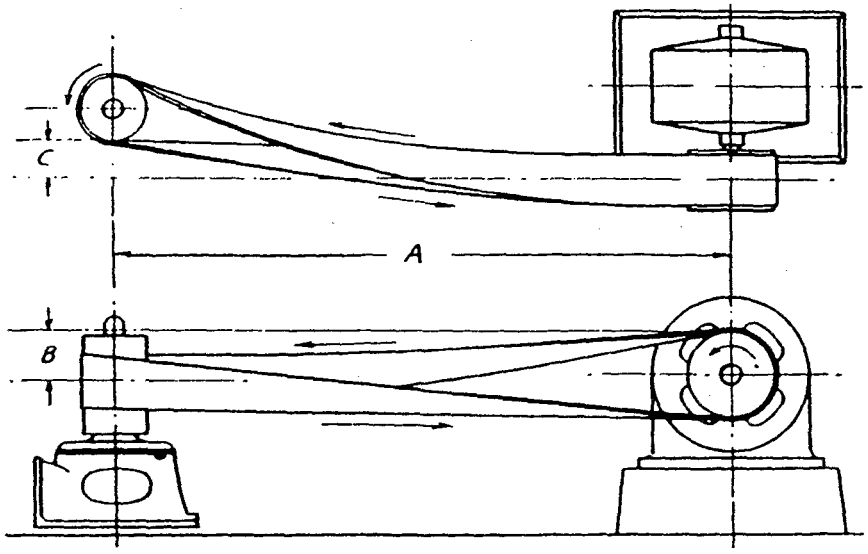
III. OTHER INSTALLATION INSTRUCTIONS APPLYING TO ALL FOUR TYPES OF PUMPS

Flexible Coupling Head

On all flexible coupling heads used with vertical drives the upper half of the flexible coupling which goes on the drive shaft is provided with one or more set screws which engage directly on the shaft of the driver. This coupling must slide up and down on the shaft easily so that it can be raised to allow access to the adjusting nut. When installing a flexible coupling head the motor should be placed in a position with a space of 1/16" between the flexible coupling upper and lower halves, and the set screws tightened down just sufficiently to make a mark on the motor shaft. Raise the motor, remove the half coupling from the motor shaft and, using a half-round file, strike a flat spot on the motor shaft at the point where set screw engages. This will allow the set screw to form a better grip on the shaft and prevent the burrs thrown up by cut of the set screw from binding flexible coupling to the motor shaft so that it cannot be easily removed.

Belted Head

The belted head can be installed and the pump adjustment made in a manner similar to that described for the Unidrive head. A belt-driven discharge head must be securely anchored to the foundation and braced to withstand side pull of the belt. The pull of the belt may be at any angle with respect to the discharge of pump, but foundation must be built to withstand the belt pull in that direction. Never have belt pull at right angles to cross beam supports; the pull should be parallel with the beams.



Ill. 22

QUARTER TURN BELT DRIVES
The Chart at Left Contains Useful Data for Lining-up the Pulleys For Quarter Turn Drives

OFFSET OF PULLEY
Motor Drive B = 3/4" For Each Foot of A
Motor Drive C = 1/6 The Width of the Belt
Engine Drive B = 3/4" For Each Foot of A.
Engine Drive C = 1/6 The Width of the Belt.

BELT SPEEDS
Belt speeds of 3000 to 4750' per minute are recommended as good practice with 4000' per minute as the most economical. Speeds in excess of 5000' per minute are not practical.

Airline

If an airline is to be installed, use 1/4" galvanized or black pipe and install in the well before setting the head on the foundation; this line should be at least the same length as the discharge column, but may even be put down below the bowls. Never install airline so that the lower end will come too near the end of the suction pipe. Be sure to measure the exact length accurately from the lower end of airline to some predetermined reference point on the pump head. A hole is provided in the discharge head through which the airline may be brought. The pressure gauge is located on the head at the surface.

IV. OPERATION AND MAINTENANCE

Head Bearing Lubrication

Most thrust bearings are lubricated by a positive circulation of oil through the bearings, which are mounted in a sealed oil reservoir. Fill the oil reservoir through the filler cup. There is a mark on the side of each cup indicating the proper oil level. Fill the reservoirs to this mark only while the driver is standing idle. Do not add more oil when the driver is running. During operation the oil is being pumped up through the bearings, which may lower or raise the level in the oil cup. This gives a false indication, but there is sufficient oil going through the bearings. Always check the oil level when the driver is standing idle. If oil is added to bring it up to indicator level while the driver is running, when the driver stops oil being pumped through the bearings will drop down into reservoir and may cause it to overflow the oil level tubes. Oil may also flow over the oil sleeve onto the motor windings. When working on the head bearing assembly or replacing the ball bearings, the oil in the reservoir should be completely drained first. Before replacing the new bearings the oil reservoir must be thoroughly flushed out with gasoline and thoroughly dried before refilling.

Where grease lubricated bearings are used, follow the instructions of the driver manufacturer. These instructions are usually supplied on a metal plate attached to the driver.

Non-Reverse Ratchets

In order to operate properly, the non-reverse pins must be kept clean and free of all oil or grease. Oil or grease on the pins will become gummy and cause them to stick and so prevent them from dropping into the ratchet slots to top reverse rotation of the motor. The small holes in the periphery of the drive hub are NOT oil holes and must NEVER be used as such. These holes merely serve as air relief holes to permit the non-reverse pins to operate freely in their pockets.

Oil

In actual practice oil gets dirty and a gradual accumulation of fine particles of dirt will injure the fine polished surfaces of the ball bearings as the oil is pumped through them. Driver bearing oil should be changed at least once every six months of operation. In dusty outdoor service the oil may be changed every three or four months of continuous operation. In many cases where the pump is only used three or four months during the pumping season, then an oil change just before the season starts is sufficient to keep the bearing lubrication in good condition.

A paraffin base, non-emulsifying, light motor oil, SAE 10 or SAE 20 may be used for head bearing oil. For right angle gear drives use the oil specified by the manufacturer.

Cooling Head Bearings

The smaller drives have the thrust bearings cooled by air circulation and need no attention except to see that the oil is at the proper level.

If the pump drive is provided with a water cooling system for the thrust bearing, the regulating valve should be adjusted so that the water feels cool to the hand when leaving the bearings. This can be checked by removing the plug from the tee or overflow and feeling the water. If the pump discharges at the surface so that there is not sufficient pressure to keep water flowing in the cooling coil, water must be brought in from some permanent outside source of pressure. If a source of pressure is not available, then cut out a disc of galvanized sheet metal the diameter of the outside of the discharge flange and drill bolt holes so that the disc can be placed under the flange. Then cut a circular hole in the disc 20 to 30 percent smaller in diameter than the inside

of the discharge pipe. The hole in the disc should be of such size that it will create a pressure of about 2 feet on the cooling coil, and thus keep up a constant circulation. Any greater pressure created will be a waste of head and power. Cut and try the size of opening to obtain the proper results.

If the well delivers excessive sand, a cooling coil filter screen should be provided and must be inspected frequently to keep it clean.

Adjust Oiler for Fig. 6922 & Fig. 6972 Pumps

Check the lubricator feed and see that it is free from foreign matter and that the oil will flow freely. Allow oil to run down the tubes for a few minutes before unit is started.

Oil Lubrication of 4", 6", 7" & 8" Fig. 6922 & Fig. 6972 Pumps Operating at Over 1800 RPM

The lineshaft or series bearings are lubricated from the top of the unit by means of a separate oil line connected from a sight feed oiler to the cap on top of the oil tube. This oiler should be set to deliver approximately 18 to 20 drops per minute for every 50 feet of column, but after approximately 5 hours operation this amount may be cut to 5 or 6 drops per 100 ft. setting with one extra drop for each 50 feet additional column.

GRADE OF OIL

The lineshaft bearings should be lubricated with a high grade mineral oil having a viscosity similar to an SAE 10 or SAE 10W. The oil may contain oxidation and rust inhibitors but NO DETERGENTS. Detergents react harmfully with treated parts in the pump. This class of oil is generally classified as a light ice machine oil.

Oil Lubrication of All Fig. 6922 & Fig. 6972 Pumps Operating at 1800 RPM or Less

The lineshaft or series bearings are lubricated from the top of the unit by means of a separate oil line connected from a sight feed oiler to the cap on top of the oil tube. On a new pump the oiler should be set to deliver about 14 to 16 drops per minute to the top bearing for every 50 feet of column length. After approximately 5 hours operation the amount may be cut to 5 or 6 drops per 100 ft. setting, or less with one extra drop for every 50 feet of additional column. In no case are more than 10 drops per minute required.

Operate Counter-Clockwise When Looking Down on Pump Head

Most pump heads are equipped with non-reverse ratchets so that the pump can be operated only in the proper direction. Try rotation before connecting if there is no non-reverse ratchet. When an electric driven job is connected and ready to start, close the starting switch for only an instant to check the rotation of the motor. If the pump rotates counterclockwise, the plant is ready for operation. If instead it rotates clockwise or merely backs up against the ratchet and does not rotate, the connections must be changed. On a three-phase motor interchange any two of the leads at the starter or switch and try again. On a single-phase motor reconnect the leads in accordance with instructions on the name plate.

Overload and Single Phase Protection

The overload relay in the starting switch must be carefully set at the time of installation if the motor is to get the proper protection. The overload relay on most starters, if properly adjusted, will give the motor complete protection. The only way to be sure that the relay is properly adjusted is to set it just as low as it will stand without "kicking out" the motor after several hours of running. After this setting is found it is usually safe to increase the setting of the relay 10 to 15 percent higher so that it will always stay put under normal conditions and only "open" with from 15 to 20 percent overload. The relay should never be set higher than 10 to 15 percent above minimum setting so as to provide ample motor protection in case of "single phasing".

In following this recommendation for relay setting, it is assumed that the motor is not normally carrying an overload because, if such is the case,

the overload relay may already be "set up" plenty high to take care of the "normal running overload" and, therefore, any higher setting might jeopardize the safety of the motor. Most 40° motors above 10 HP rating will ordinarily function satisfactorily with a 10 percent overload, but it is not advisable to make a practice of this. On a motor already overloaded 10 percent, if relays are set 10 percent to 15 percent higher, this would mean a 25 to 30 percent overload protection above normal full-load current.

Reconnecting Motor

Most Unidrive motors have nine leads brought into the terminal box so that the motor can be easily connected in the field from 220 volts to 440 volts or vice versa.

In case it is necessary to reconnect the motor, remove the terminal box, disconnect all nine leads and reconnect, referring to the instruction plate beside the terminal box for directions. Be sure to connect exactly as directed.

CAUTION: Do all soldering work with an iron and not with a torch. A torch will carbonize the insulation and carbon is an electric conductor.

Motor Troubles

Motor troubles are quite infrequent. When they do occur and repairs are actually required, ascertain the name of the motor manufacturer from the name plate and be sure to secure the services of the authorized representative of the motor to be repaired, as work done by others voids all guarantees and responsibility of our agents and ourselves. All motor manufacturers' offices, all of our offices, distributors and agents are always anxious to be of assistance. Motor must not be returned to Pomona or Stuttgart Works for servicing without specific instructions from factory.

Starting Fig. 6927 & Fig. 6977 Pumps

Each time the pump is started check the oil level in the head oil cups. Give the packing gland grease cup one turn. Then open the prelubricating tank valve and allow one-half tank of water to flow into the discharge column. Start the pump, leaving the prelubricating valve open until water is delivered to surface and the tank is refilled. If the plant is controlled automatically, provide automatic prelubrication.

Impeller Adjustment

The adjustment of the impeller clearance is a very particular operation. When it is necessary to readjust the impellers, read carefully the section of the installation instructions pertaining to your particular type of pump before attempting the readjustment.

Electrical Troubles

When trouble occurs in the motor or control apparatus, test should be made by a competent electrician. It is not necessary to call a pump service crew with rigging to check for electrical trouble. If motor runs too hot, check all of the electrical connections in the starter, in the switch and connecting lines. A loose connection will allow the motor to single phase and "burn out".

Failure to Start

If the motor does not start when the switch is closed out but makes a humming noise, open the starter immediately. This is due to one of four causes: (A) Drive shaft is locked in some manner. Try to turn by hand or with a wrench. (B) Motor is getting only single-phase current. Check the voltage at the top of the service switch for dead line and at the bottom of the service switch for blown fuses, using two 110-volt lamps in series for 220 volts, or four 110-volt lamps in series for 440 volts. If any of the lines are dead above the switch, call the power company. If any of the fuses are blown, replace them.

As stated above, a polyphase induction motor will not start up on a single-phase current, but if a fuse blows or the line goes single phase while the motor is in operation, the motor will probably continue to operate but will run at reduced speed and will get very hot. If it is operated for any length of time on a single phase, it will burn out. The equipment guarantee does not cover motor troubles due to single phasing.

(C) Motor connections are not right for line voltage. For example, a 440-volt motor connected on a 220-volt service line.

(D) Starter contactors are burned.

Motor Overheating

Most motors are rated at 40° C.

rise at full load on 60-cycle current, but will operate with no danger to the windings at a rise of 50° C. above surrounding temperature. If the motor seems too hot, get an electrician to make a temperature test with thermometers. Overheating may be caused by: (A) Low voltage of service line. (B) Improper setting of impellers. (C) Loose connections in starter or switches.

Starter Trouble

In case of trouble with the starter, refer to the instructions sent with the particular make of starter being used.

Determination of Water Level

The "airline" method is an effective and simple method of determining the water level in a well. It involves the use of an altitude gauge and a small pipe line of a known vertical length, extending below the water level. The airline is installed with the pump, but not attached to it, and should reach at least to the top of the bowls. The vertical distance from the bottom of the airline to the top of the base of the pump head should be accurately measured at the time of installation and a permanent record made of it. Usually it is marked on the gauge dial. The altitude gauge, calibrated in feet of water, is connected to the top of the airline.

This gauge will indicate the pressure in the airline. When air is forced into the airline by means of a tire pump the gauge pressure will increase until all the water has been expelled. When this point is reached the gauge reading becomes constant, and this is the pressure necessary to support a column of water equal to that forced out of the airline. The length of this water column is equal to the amount of submergence of the airline.

The distance from the base of the pump head to the water level in the well is found by subtracting the length submerged from the total vertical length of airline from top of base plate The following example illustrates the method:

Length of airline,	100 ft.
Maximum maintained gauge reading	24 ft.
Distance from pump to water,	76 ft.

If the length of airline used is the vertical length from the pump head base, the above calculation will be correct regardless of the location of the altitude gauge at any point above. If a pressure gauge is used and reads in pounds, multiply the guage reading by 2.31 to convert to feet To obtain accurate, dependable readings the altitude or pressure gauge must be calibrated or of known accuracy. Also, the airline length must be accurately known and must not have air leaks.

Checking Water Level

Check the water level in the well occasionally when the pump is in operation. The pump bowls should be submerged at all times. If water level drops below the bowls, more discharge column should be added. In no case should the pump be operated after the water draws down to the strainer and the pump breaks suction.

Developing New Wells

When a pump is first started in a new well, it is frequently the case that a large quantity of sand is delivered and the capacity of the well is not up to that of the pump. In this case the impellers should be raised above the normal operating position, as indicated in the installation instructions. This will decrease the capacity of the pump and decrease the abrasion on the vane edges due to the sand. If it is necessary to further reduce the capacity of the pump to meet well conditions, this can be done by means of a gate or butterfly valve in the discharge line. The pump should not be operated at a greatly reduced capacity longer than necessary, because the water velocity in the pump and column will be so low that the sand will not be carried out, and the pump parts and bearings will be unduly worn. The amount of sand pumped from the well can be reduced by using a comparatively large suction pipe.

V. PUMP BOWL REPAIRS

A. FIGURE 6922 & FIGURE 6927 ENCLOSED IMPELLER PUMP BOWLS

Dismantling

Should it be necessary to take the pump apart for repairs, the discharge connection and the top bowl should be removed. This will expose the top of the impeller and the bronze lock nut locking the taper sleeve in place. This nut should be loosened and the taper sleeve driven downward. This will release the impeller, permitting it to be removed. Then remove the intermediate bowl. This operation is repeated to re-

move additional stages.

Reassembling

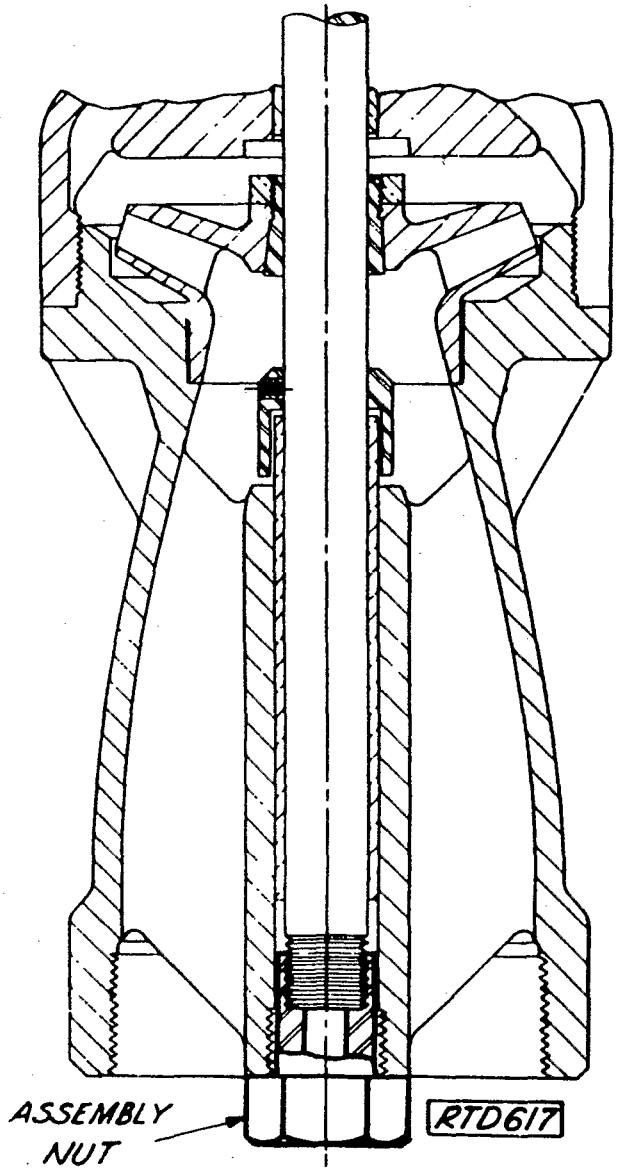
Extreme care must be used in reassembling the parts in order to maintain the correct impeller spacing in the bowl assembly. To accomplish this, the impeller shaft must be held in place firmly until the assembling has been completed. For this purpose a special assembly nut is required similar to that shown in Illustration 23. Screw the impeller shaft into the assembly nut until the bottom of the shaft butts solidly against the bottom of the threaded hole in the assembly nut.

Sand Collar

Then slip the shaft with nut attached through the bottom pump bearing until the shoulder under the head of the nut rests firmly against the end of the bearing. Slip the sand collar over the end of the shaft, down against the bottom bearing as far as it will go, and lock it in place with the hollow-head set screw.

First Impeller & Lock Bushing

Support the outer end of the pump shaft in a horizontal position. First slip on the tapered impeller bushing. It



ASSEMBLY OF TAPER
LOCK IMPELLER

Ill. 23

is a close fit and must be slightly spread apart to slip on easily. Take a thick screwdriver or make a suitable wedge tool to drive into the cut on the bushing. Spread only sufficiently to allow easy entrance over shaft. Slide the bushing back, large end first, next to the bowl, keeping it about 3/8" to 1/2" from the end of the bowl center hub. When the wedge is removed, file any burrs off the split in the bushing. Next, with the impeller neck toward the bowl, slip the impeller over the outer end of the shaft and over the tapered impeller bushing. Now slip on the lock nut with the symbol side toward the impeller and screw it on the bushing by hand.

NOTE: When securing an impeller in place in this way the BUSHING DOES NOT SLIP ON the shaft but rather the IMPELLER WILL SLIP "IN" over the bushing when the lock nut is drawn up tight. Allowance must be made for this before starting to tighten up the lock nut.

After the lock nut is in its final position, it should be locked in place by using a small punch and upsetting the nut into the narrow slot in the taper sleeve. Next, assemble the first intermediate bowl. The succeeding impellers and bowls are attached in the same manner. It will be readily seen that if the shaft is not solidly held in position, the attaching of more than one impeller would pull those below it out of position due to the taper sleeve tightening first on the shaft.

Bottom Bearing Lubrication

After the pump is completely assembled, remove the assembly nut and fill the space with a good grade of lubricant similar to SAE No. 160 gear lubricant. Do not use fibre grease. The maximum amount should be used but no more than will permit the full up-and-down movement or clearance of the shaft. After filling with grease, screw the suction bowl cap in place solidly.

Precautions for Rebuilt Pumps

On an old pump that has been taken apart several times, the impeller bore becomes enlarged and will fit loosely over the bushings. In this case, take brass shim stock .003" thick and cut out a shim, slightly curved, to fit around the bushing. Hold it in place over the bushing and assemble the impeller over the shim in the regular way. Sometimes it may require two thicknesses of shim to set up the impeller properly on the taper bushing. A good way to hold the shim in place while slipping on the impellers is to take a strong string, wrap a turn around the shim and hold tight by the outer ends.

B. FIGURE 6972 & FIGURE 6977 SEMI-OPEN IMPELLER PUMP BOWLS

Dismantling

To dismantle a pump, clamp the assembly by the suction bowl. Screw an assembly nut on the lower end of the pump shaft and draw it up tight. Begin with the discharge bowl. On screwed bowls find the locking pins and drill out with a 5/32" drill. Remove the bowl. Remove the impeller lock nut. Take a bushing or some sharp shoulder collar that will fit close on the shaft and slide it against the end of the tapered bushing. Take a suitable length of pipe and shove it over the shaft, up against the collar. With a few sharp blows, either by end jabs of the pipe alone or with a sledge hammer on the end of the pipe, the impeller can be jarred loose from the bushing without damaging the threads. Insert the wedged tool in the bushing, cut and spread apart enough to remove. In dismantling a pump to repair and reassemble again, it is advisable to mark the parts so they will be reassembled in the same manner as found.

Replacing Bearings

Remove the old bearing and clean out the bowl pocket, thoroughly scraping out any rust or scale which may have formed on the surface. Then wash both the pocket in the bowl and the outside of the bearing with benzine, or some other high-grade cleaning fluid, and allow to dry completely. NEVER USE ORDINARY GASOLINE AS THIS DRIES VERY SLOWLY AND LEAVES AN OILY FILM.

Using a small, stiff brush, apply a light coat of the POMONA RUBBER BEARING CEMENT, which is furnished with the bearings, to both the bowl pocket and the bearing sleeve. Press the bearing sleeve into the pocket immediately and wipe up the excess cement. The bearing sleeve must be pressed into the pocket quickly while the cement is still wet. If the cement is allowed to dry too much, it will roll up under the sleeve, causing it to bulge and bind the shaft.

The POMONA RUBBER BEARING CEMENT which is furnished for this purpose is highly inflammable and evaporates very quickly. The cover should be kept pressed tightly on the can until every-

thing is in readiness, then the work of cementing the bearing into the bowls should be quickly done. POMONA RUBBER BEARING CEMENT is especially prepared for this use. DO NOT SUBSTITUTE!

The bearing sleeves are slightly larger than the bowl pockets and are to be pressed in. After they are pressed into place the shaft should just slip easily into place and turn freely. If the bearings bind on the shaft, take a cylindrical piece of wood a little smaller than the shaft, wrap a piece of sand paper or emery paper around it and lap the bearing out to the correct size.

Preparation for Assembly

With all parts on hand and checked, make sure that the pump shaft is the right length for required assembly.

Begin assembling the pump with the suction bowl. This should be held tightly in a vise or suitable clamp, in a horizontal position. Place a small amount of powdered graphite or talc in each bowl rubber bearing before slipping the bowl on over the shaft; this will lubricate the bearing during assembling and checking. The pump shaft is threaded at both ends, the suction bowl end being the shortest and with right-hand thread, the drive shaft end having left-hand thread. Insert the suction bowl end horizontally through the suction bowl from the bowl seat end. Provide a large nut to fit the thread and screw it on. The assembly nut should have a face large enough to set evenly against the bottom end of the suction bowl bearing hub. A washer or spacer may be necessary to provide for the proper pump shaft projection at the suction end.

First Impeller & Lock Bushing

Support the outer end of the pump shaft in a horizontal position. First slip on the tapered impeller bushing. It is a close fit and must be slightly spread apart to slip on easily. Take a thick screwdriver or make a suitable wedge tool to drive into the cut on the bushing. Spread only sufficiently to allow easy entrance over shaft. Slide the bushing back, large end first, next to the bowl, keeping it about 3/8" to 1/2" from the end of the bowl center hub. When the wedge is removed, file any burrs off the split in the bushing. Next, with the open vanes toward the bowl seat, slip the impeller over the outer end of the shaft and over the tapered impeller bushing. Now, slip on the lock nut with the symbol side toward the impeller and screw it on the bushing by hand.

NOTE: When securing an impeller in place in this way the BUSHING DOES NOT SLIP ON the shaft, but rather the IMPELLER WILL SLIP "IN" over the bushing when the lock nut is drawn up tight. Allowance must be made for this before starting to tighten up the lock nut.

Securing of First Impeller

Screw on the lock nut by hand or by using a very light wrench, then move the impeller and bushing toward the bowl seat until the end of the vanes clears the bowl seat, about 3/32" on pumps with 1-1/4" shaft and under. On larger size pumps, 1/8" clearance is necessary. Screw up the lock nut tight until the end of the impeller vanes touches snugly on the bowl seat. When the impeller is getting very close to the bowl seat, test it by tapping very lightly with a small hammer or metal object. When it is up snug against the bowl seat it will sound dull, whereas it will ring clear before it touches the bowl. NEVER FORCE AN IMPELLER UP AGAINST THE BOWL SEAT by force of the lock nut. A little experience will tell how much clearance to allow in order to have the tapered bushing and lock nut screw up tight just as the impeller gets snug on the bowl seat.

The first impeller should be forced tight against the bowl seat to make sure that the assembly nut on the end of the shaft is properly seated, but subsequent impellers should only be shoved up as instructed. Care should be taken, in placing the impellers against the bowl seats, to exert the same light pressure on each so that they will all have the same clearance on the bowl seat when the assembly nut is removed. If, however, impellers do not have equal clearance on the bowl seats, the performance of the pump will be impaired as it will be impossible to properly adjust the impellers. After the lock nut has been tightened, take a center punch or dull chisel and punch a burr on the impeller hub into a notch of the lock nut to prevent its working loose. In tightening up the lock nut it is best to use a spanner wrench made to fit the outside of the nut and notches. In the absence of a spanner wrench a Stilson or good grade of pipe wrench may be used. Care must be taken not to chew up the corners or damage the nut so it will not hold. It will pay to make a spanner with a handle length about 20 times the diameter of the pump shaft.

Additional Stages

Next put on the intermediate bowls. On sizes up to and including 10" HC (except 10" XLC) the bowls are screwed together. On 10" XLC, 12" pumps and larger, they are bolted together. On threaded bowls, slip the intermediate bowl over the end of the shaft. Take note that the rubber bearing fits properly. Clean the thread and apply a light white lead or pipe joint compound. Start screwing the bowl on by hand, then with a heavy chain tong, tighten up the bowl making sure that it screws against the shoulder evenly all around.

Discharge Bowl

When all intermediate bowls and impellers are in place, assemble the discharge bowl in the same manner.

Remove the assembly nut on the lower end of the shaft at the suction bowl and try turning the shaft. Check for end play. There should be from 1/4" to 3/8" on 8" or smaller pumps and 1/2" to 5/8" on larger pumps. The pump shaft and impellers should spin freely by hand at any position without interference or difficulty.

Threaded Bowls

After the entire pump has been assembled, drill a hole 3/16" (#14 drill) at the joint of the threads of each bowl. Drill only slightly deeper than the thickness of the threaded wall of the bowl, drive in the bowl lock pin, and expend well into the hole to lock the joint together.

Flanged Bowls

On flanged bowls, insert the studs into the threaded holes on the large end of the bowl. Apply light white lead compound and put the bowls together. Put on the nuts and draw each bolt up evenly and successively until very tight. Do not twist them off. Assemble the impeller up to bowl seat, as instructed above, and repeat until complete.

Precautions for Rebuilt Pumps

On an old pump that has been taken apart several times, the impeller bore becomes enlarged and will fit loosely over the bushings. In this case take brass shim stock .003" thick and cut out a shim, slightly curved, to fit around the bushing. Hold it in place over the bushing and assemble the impeller over the shim in the regular way. Sometimes it may require two.

Bottom Column

On reasonably short pump assemblies where the bottom 5 ft. section of column can be handled conveniently with the bowls, it should be assembled on the pump while it is still clamped in a horizontal position. First screw on the 5 ft. bottom shaft. Do not force shafts too tight together after they butt in the coupling. Shafts can very easily be thrown out of alignment by screwing them up too tightly in the couplings.

Provide a suitable, upright stationary object as an index alongside the outer end of shaft and rotate the shaft slowly by hand to check the alignment. If the outer end of the shaft runs out of true, this can be easily lined up by applying a slight pressure on the high side and giving a light hammer tap on the stressed side of shaft near the pump shaft coupling. Do not try too much at once. Unless shaft runs out more than 1/16" off center at the end, it is all right.

Screw on the 5 ft. column pipe and, as it is being screwed on, check the alignment of the pipe thread in the same manner. Do not install a bottom column pipe that does not line up true.

CAUTION

Due to the high speed at which the smaller size units may operate, and since most of the pumping unit is underground, extreme care must be used in assembling and installing it and thoroughly checking the entire installation before it is put into operation.

If, after the well has been drilled and cased, it is crooked, the water supply is doubtful, the water level has dropped or the water contains considerable sand, gravel or gas, the Fairbanks Nijhuis™ for whom the unit was purchased should be consulted before it is started.

Under no circumstances will the Company guarantee the pump against the effects of corrosion, erosion or electrolytic action, those being entirely beyond the control of the Company.

In case any unusual vibration appears when starting the unit, or if vibration develops later, the unit should not be continued in operation, but Fairbanks Nijhuis, or authorized repre-

sentative, should be requested to service the installation to place it in proper running condition.

If the above instructions are not followed or if the pump is operated without the proper submergence recommended by the Company, all guarantees are withdrawn and Fairbanks Nijhuis™ will not assume any responsibility for the proper operation of the unit or the life of any of its parts.

ANY CORRESPONDENCE PERTAINING TO YOUR FAIRBANKS NIJHUIS PUMPING EQUIPMENT SHOULD INCLUDE REFERENCE TO THE SERIAL NUMBER STAMPED ON THE PUMP NAMEPLATE, WHICH IS LOCATED ON THE DISCHARGE HEAD. THIS NAMEPLATE SHOULD NOT BE CONFUSED WITH THE NAME PLATE ON THE DRIVER, WHICH GIVES THE SERIAL NUMBER OF THE DRIVER ONLY.

Note: Refer to Page 13.

Upthrust

Occasionally on turbine pump installations with shallow settings and high heads, the initial force of the water going through the pumps causes a momentary upthrust greater than the down thrust.

When this is apt to occur upthrust devices are furnished by the Factory, preventing the pump and drive shafts from rising and causing damage at the point of coupling with the driver.

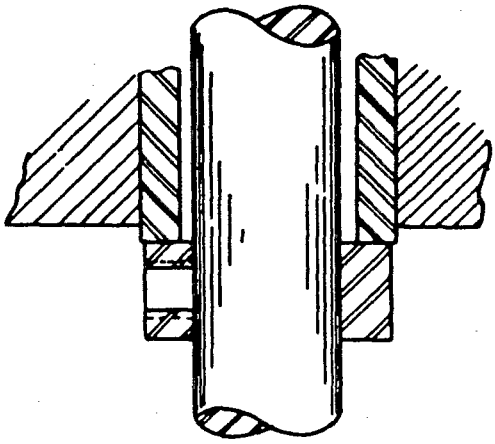
The methods vary with the driver, type and size of pump. When the device is attached to the top shaft it must be installed in the field per the following instructions:

Assemble Collar as Follows

Slide the Collar over the Shaft and fasten just above the Packing Box until Pump has been adjusted.

After Pump has been properly adjusted, raise Collar until it fits tightly against bottom of Hollow Shaft of Motor. Fasten in this position securely with Set Screws. (See Section).

CAUTION - Collar must be installed so that it cannot strike any stationary part of the Housing.



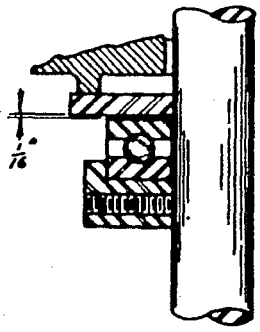
Assemble Thrust Bearing As Follows:

Place the bearing with snug fitting portion of inner race at bottom of retainer and pack grease around the balls.

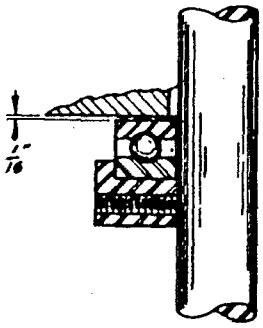
Slide the assembly over the shaft and fasten just above the packing box until pump has been adjusted.

After pump has been properly adjusted raise bearing assembly so that top of bearing is not more than 1/16" below lower mounting. Fasten securely with 3 set screws. (See Section "A").

When a thrust plate is furnished with bearing assembly follow same procedure as above, setting top of plate not more than 1/16" below lower mounting. (See Section "B").



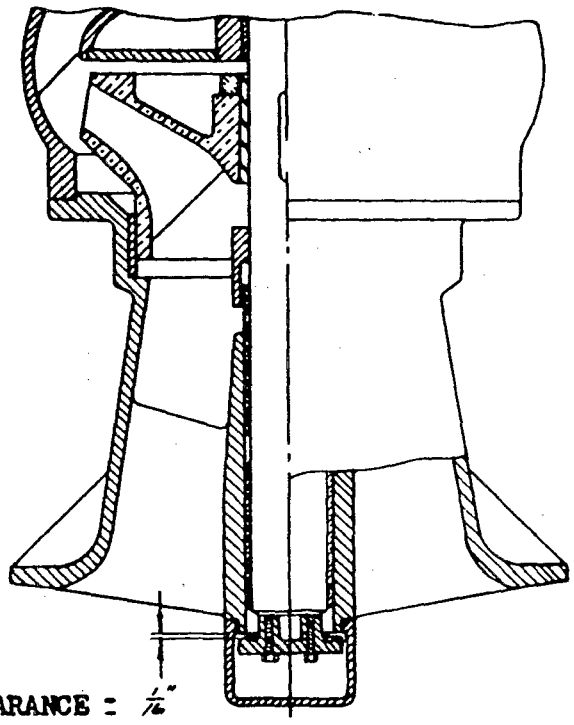
SECTION "B"



SECTION "A"

On large enclosed impeller type pumps where there may be some initial upthrust, a collar is bolted to the bottom of the pump shaft to prevent it and the drive shaft from rising.

The complete installation is made at the factory as shown below, and no adjustment need be made in the field.



CLEARANCE = 1/16"

Several bowl assembly units are now furnished with drive bushings (locking the impellers to the shaft), rather than lock nuts and lock bushings. When drive bushings are furnished, the following instructions for assembly and disassembly will apply:

ASSEMBLY

1. Clamp suction bowl in vise. Assemble pump shaft, suction bowl, assembly nut and spacer, if necessary, to obtain proper shaft projection.
2. Place impeller over shaft and down, resting evenly in bowl. Place impeller drive bushing over shaft and slide down into impeller. Secure with shaft drive weight. Make sure that drive bushing is tightly locked to impeller and shaft with the impeller touching bowl seat.
3. The remaining stages are assembled in the same manner as the first. The discharge bowl is attached last. If any bowls have been replaced, it will be necessary to drill holes for bowl lock pins in the new bowls at the thread joint. Use a 7/32" drill and drill only slightly deeper than the thickness of the threaded wall of the bowl. Drive in bowl lock pins at each joint so that they expand well into hole to lock the joint together.

DISASSEMBLY

1. Secure pump horizontally in vise, clamping on discharge bowl and supporting suction end with blocks or a jack stand.
2. Drill out bowl lock pin between suction bowl and first intermediate bowl and unscrew suction bowl using chain tongs. Loosen impeller drive bushing using shaft drive weight. Slide off impeller and impeller drive bushing.
3. Number each intermediate bowl so that they may be reassembled in the same order.
4. Remove remaining stages in the same manner, keeping impellers matched with the bowls which they came out of so that they may be reassembled in the same order. When the last stage impeller is removed, the shaft may be lifted out. Examine all parts for wear and deterioration and replace parts as required.
5. NOTE: Any repair pump using a mixture of lock nuts and drive bushings must have drive bushing impellers on bottom stages and lock nut impellers on top stages.

Disassemble pump from bottom for drive bushings and from top for lock nuts.