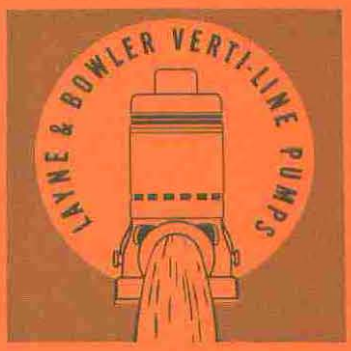
INSTALLATION & OPERATING INSTRUCTIONS

DEEP WELL TURBINE TYPE

Verti-Line PUMPS



Verti-Line
LAYNE AND BOWLER

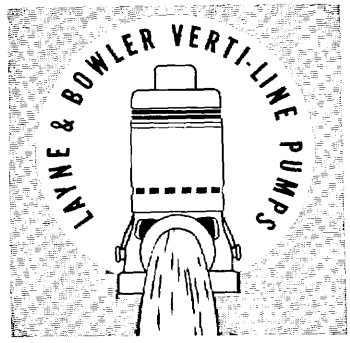
LAYNE AND BOWLER
A SUBSIDIARY OF THE AURORA PUMP
UNIT OF GENERAL SIGNAL
200 NO. PUENTE AVE., CITY OF INDUSTRY, CALIF. • P.O. BOX 1300, LA PUENTE, CALIF. 91749

ap
AURORA PUMPS

INSTALLATION & OPERATING INSTRUCTIONS

DEEP WELL TURBINE TYPE

Verti-Line PUMPS



Verti-Line
LAYNE AND BOWLER

LAYNE AND BOWLER
A SUBSIDIARY OF THE AURORA PUMP
UNIT OF GENERAL SIGNAL
200 NO. PUENTE AVE., CITY OF INDUSTRY, CALIF. · P.O. BOX 1300, LA PUENTE, CALIF. 91749

ap
AURORA PUMPS

YOUR LAYNE & BOWLER REPRESENTATIVE

Your Layne & Bowler Pump Serial No._____

Performance:_____GPM_____feet_____RPM

Construction:

_____discharge head.

_____feet of column assembly with

_____pipe_____enclosing tube and_____shaft.

_____stage_____bowl assembly.

_____feet of_____suction pipe.

_____strainer_____.

_____H.P._____V._____phase_____cycle

_____vertical hollowshaft electric motor

or _____right angle gear drive

gear ratio_____rotation_____

or other type drive as described:_____

_____

or horizontal driver as described:_____

_____

Remarks:_____

_____

_____

_____

Your Layne & Bowler Representative has complete parts detail information on this pump. When requesting data give pump serial number.

YOUR WELL LOG

Date drilled_____total depth_____

Inside diameter and length of upper casing_____inches x_____feet

Inside diameter and length of lower casing_____inches x_____feet

Distance from top to and length of perforation or screen:

(A)_____feet &_____feet (B)_____feet &_____feet

(C)_____feet &_____feet (D)_____feet &_____feet

Standing water level when drilled_____feet

Well test when drilled_____GPM_____feet;

_____GPM_____feet;_____GPM_____feet.

Water level record:

Date	Standing W.L.	Water Level at	GPM

Sand pumping or bailing record:

	Sand Level			Sand Level	
Date	Before	After	Date	Before	After
(a)_____			(d)_____		
(b)_____			(e)_____		
(c)_____			(f)_____		

A good well performance record is the
foundation to properly rebuild your pump.

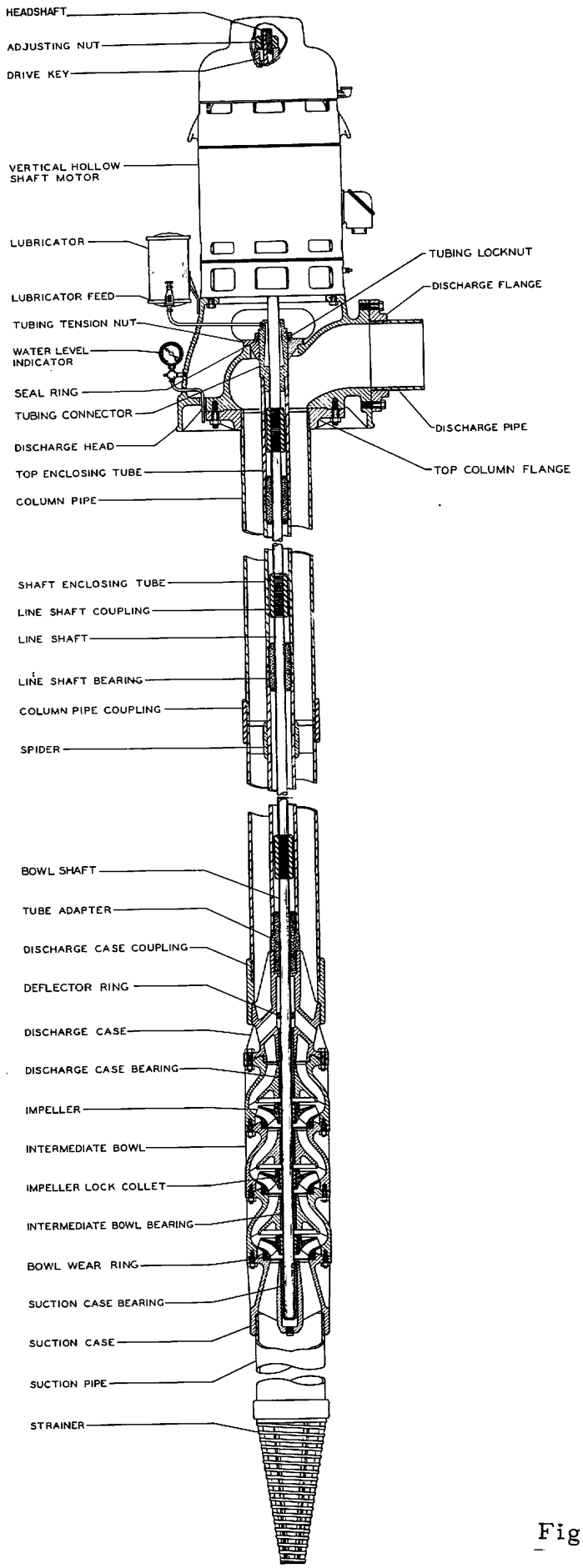

HEADSHAFT
ADJUSTING NUT
DRIVE KEY
VERTICAL HOLLOW SHAFT MOTOR
LUBRICATOR
LUBRICATOR FEED
TUBING TENSION NUT
WATER LEVEL INDICATOR
SEAL RING
TUBING CONNECTOR
DISCHARGE HEAD
TOP ENCLOSING TUBE
COLUMN PIPE
TUBING LOCKNUT
DISCHARGE FLANGE
DISCHARGE PIPE
TOP COLUMN FLANGE
SHAFT ENCLOSING TUBE
LINE SHAFT COUPLING
LINE SHAFT
LINE SHAFT BEARING
COLUMN PIPE COUPLING
SPIDER
BOWL SHAFT
TUBE ADAPTER
DISCHARGE CASE COUPLING
DEFLECTOR RING
DISCHARGE CASE
DISCHARGE CASE BEARING
IMPELLER
INTERMEDIATE BOWL
IMPELLER LOCK COLLET
INTERMEDIATE BOWL BEARING
BOWL WEAR RING
SUCTION CASE BEARING
SUCTION CASE
SUCTION PIPE
STRAINER

Fig. 1

INSTRUCTIONS FOR THE INSTALLATION AND CARE OF LAYNE & BOWLER DEEP WELL TURBINE PUMPS

The satisfactory operation of a deep well turbine pump is dependent upon careful and correct installation of the equipment. Because of variations in installation requirements, the following instructions must of necessity be rather general in tone. The installer must use sound judgment to adapt the methods outlined to the conditions existent for each particular installation.

The general assembly of a Layne & Bowler deep well turbine pump is shown in Fig. 1 with the component parts properly identified. This nomenclature will be used as a reference throughout these instructions.

Close-coupled vertical turbine pumps are usually shipped completely assembled, and proper instructions for the handling of this type of machine will accompany the shipment. For deep well turbine pumps, as described in this booklet, the bowl unit and discharge head are assembled at the factory, while the inner column and the eduction pipe are shipped as components for jobsite assembly as suggested in the following instructions.

PRELIMINARY PRECAUTION

Examine the well carefully before starting installation. Make sure sand has not covered the perforated sections of the well. If not already known, determine that the well is of ample diameter and depth, and is sufficiently straight to receive the pump. If in doubt about straightness, caging and plotting is recommended. The pump should not be installed with the strainer closer than four or five feet from the bottom of the well.

INSTALLATION EQUIPMENT

Although portable derricks or tripods are sometimes used, a properly designed pump setting rig is recommended, similar to that shown in Fig. 2. It must be possible to erect the crown block to a height so that the load hook will permit the handling of either ten foot column sections or twenty foot column sections as required by the pump components. This will require a load hook position of approximately eighteen feet and

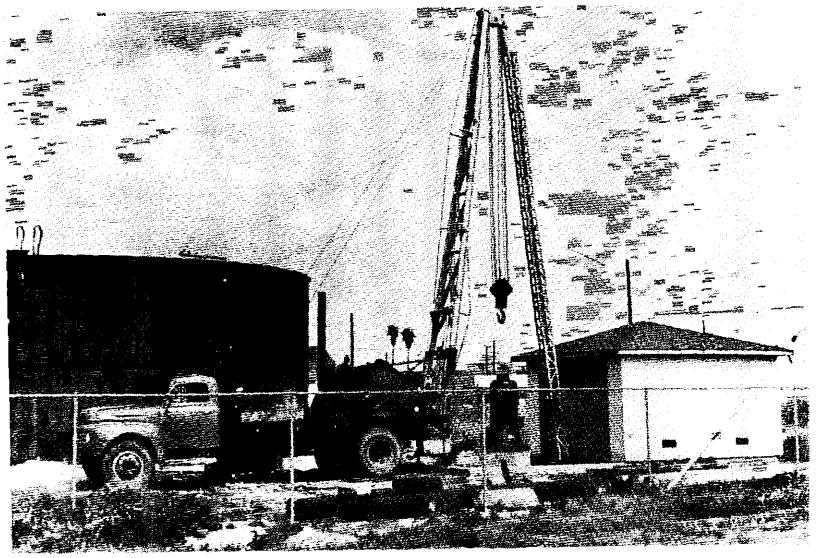


Fig. 2

twenty eight feet, respectively, in order to handle the parts with ease.

The hoisting equipment will of course depend upon the type of tripod or rig in use. In any case, the equipment should have sufficient strength and power to provide a minimum factor of safety of at least six. Obviously, for heavier pumps and deeper settings, installation equipment must be stronger and heavier in direct proportion.

The load hook itself should be of the safety type with a good, easy working swivel and should be truly centered over the axis of the well. When the well is slightly out of plumb, it may be necessary to shift the crown block as the pump assembly becomes progressively longer on installation and displaces laterally with respect to the well head.

Regardless of the type of lifting equipment or the type of pumping equipment, the primary rule during installation must be SAFETY FIRST.

The following miscellaneous tools are suggested but may be varied to suit the individual installation:

Wooden friction blocks or steel clamps
Steel column lifting elevators of approved type and of proper size for the pump column.
Cable sling approximately 10 feet long of adequate size for the loads involved.
Two chain tongs
Two medium size pipe wrenches
Twelve foot length of 3/4 inch rope
Ordinary set of mechanics tools

A good grade of pipe joint compound must be available for thread and tube faces to facilitate assembly and possible future disassembly. As the installation progresses, all threads should be cleaned thoroughly with a wire brush and the compound applied with a paint brush. Gasoline, distillate or kerosene should also be at hand for cleaning purposes. One gallon of lubricating oil should be provided for each 100 feet of pump column to be installed; this should be S.A.E. #10 mineral oil with proper additives or a good turbine oil such as Standard Oil O.C. Turbine Oil #9.

PUMP FOUNDATION

A suitable pump foundation should always be provided, preferably of solid concrete construction. If this is not practical, adequate beams or timbers may be used.

The pump foundation should be built to carry the weight of the entire pump full of water and should be rigid enough to withstand and prevent any vibration. If the pump is mounted on beams, the beams should be heavy enough to prevent spring action between the spans, also with lateral bracing to prevent side motion. On belt driven installations, where pump is mounted on beams over a pit, drives should always be installed parallel to the beams, NEVER AT RIGHT ANGLES.

A preferred 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 mix. The area of the base of the foundation should be at least 6 inches larger on all sides than the pump head base and should be governed by allowable soil loadings. On heavy, deep setting pumps, the foundation should be engineered for safety and should be large and deep enough so that the load per square foot of concrete does not exceed ordinary foundation standards.

UNLOADING AND PREPARATION FOR INSTALLATION

Refer to the assembly drawing which is included with these instructions and become thoroughly familiar with the construction of the pump before attempting to assemble, install, dismantle, or do any repair work on the unit. During all steps of unloading and installation, care must be used to prevent strains from being imposed upon the pump parts which might cause bending or misalignment of the column, enclosing tube, or shafting.

Uncrate the parts and inspect carefully to be sure nothing was damaged in shipment. Check in detail the condition of the 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. Confirm all verbal understandings by letter.

Extreme care must be taken in handling and installing all parts, particularly the shafting and tubing. These parts are all precision machined for proper alignment and, if dropped, sprung, or mistreated in any way, misalignment and poor performance will undoubtedly result. Parts which are too heavy to be lifted from the transporting car or truck should be skidded carefully to the ground so as to prevent injury. Never drop such parts directly from the carrier to the ground. Never use crates in which parts are shipped for skids.

Lay out the column pipe and bowl assembly on suitable timbers or staging, Fig. 3, to keep all material out of the dirt. Coupling ends should be located toward the well. Clean all threads thoroughly and coat with joint compound as installed. The

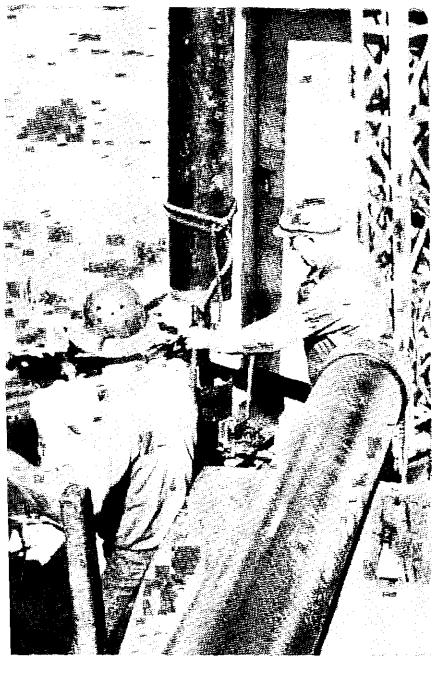


Fig. 3

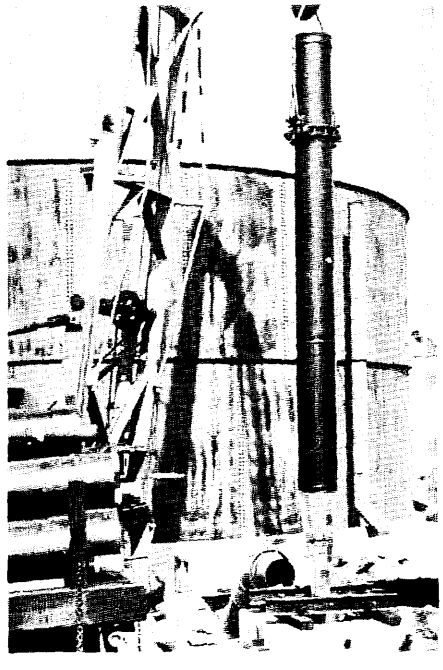


Fig. 4

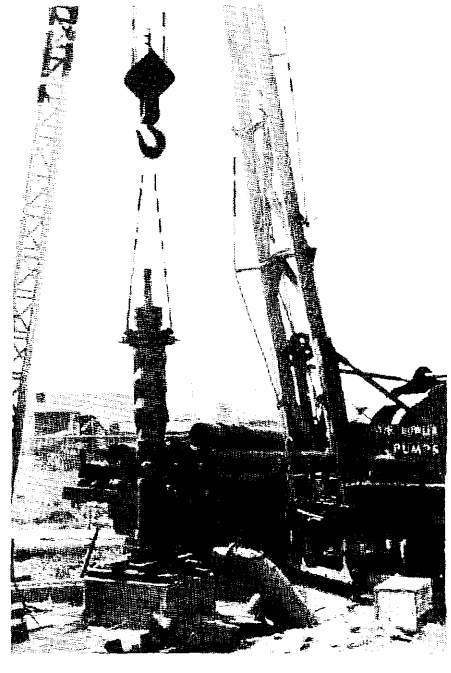


Fig. 5

inner column assembly consisting of tubing, shafting, and lineshaft bearings will have been preassembled at the factory into proper lengths to match with the column pipes. Tube faces should be inspected to see that they are free from burrs or nicks and wiped clean. The sections of tubing which have been assembled at the factory should be checked for tightness by the installer at the jobsite. Examine lineshafting to make sure that it is straight, care being taken not to bend the shafts or to damage the threads. Do not lay shafting lengths on ground or where they may be walked on or run over. KEEP THEM STRAIGHT. They must be placed upon the timbers and all rust preventative oil or slushing compound should be washed off with gasoline, distillate, and solvent. Each joint of shafting is handled and inspected carefully at the factory before shipping. Therefore, exercise great care in jobsite handling because, due to its length, a shaft can easily be sprung or bent. Any length that is bent should not be used. Keep shaft and tube ends covered until they are ready to be installed.

All other parts should be cleaned and laid out on a clean surface in the order in which they will be used. Check against the packing list to be sure that none are missing.

Insert each length of intermediate shafting into the assembled enclosing tubes if they were not already shipped this way. Then insert this assembly into the column pipe sections. Place with the projecting lineshaft bearing pointed toward the well.

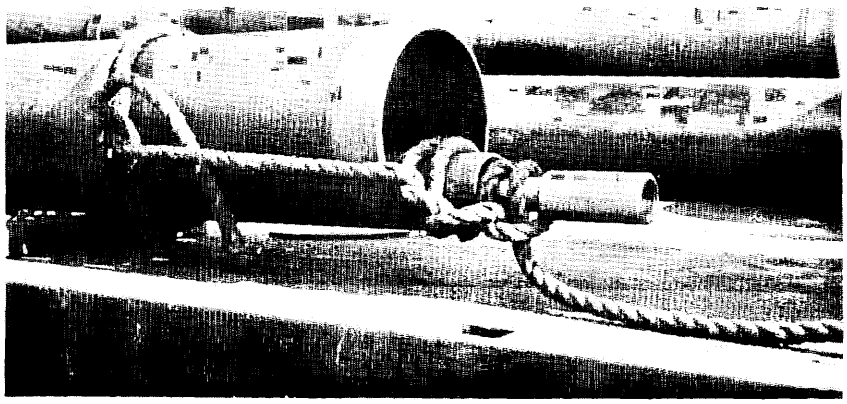


Fig. 6

INSTALLING PUMP

Set the pipe clamps over the well and open up wide enough for the suction pipe and strainer to pass through. Raise the suction assembly as shown in Fig. 4 (also see Fig. 7 for elevator support) and lower into the well through the opening in the clamps. Clamp the suction pipe at least 2 feet below the coupling end so that the pressure of the clamp will not distort the threads. Take care while raising the suction assembly into a vertical position to insure that the strainer (if supplied) is not damaged during this operation.

Examine the bowl assembly carefully. Make sure that the bowl assembly discharge case coupling is tightly butted in place and that all stage connecting nuts have been taken up securely. Examine the bypassports in the discharge case to make sure that they are either properly open or properly closed as suits the particular installation. For oil lubricated pumps, they should be open.

Raise the pump bowl assembly as illustrated in Fig. 5, suspend directly over the suction pipe and screw the bowl unit onto the pipe, making a tight joint with the threads. If no suction pipe is used, the strainer may be screwed into the suction case before raising the bowl assembly, but care must be taken to prevent damage to the strainer while raising to a vertical position.

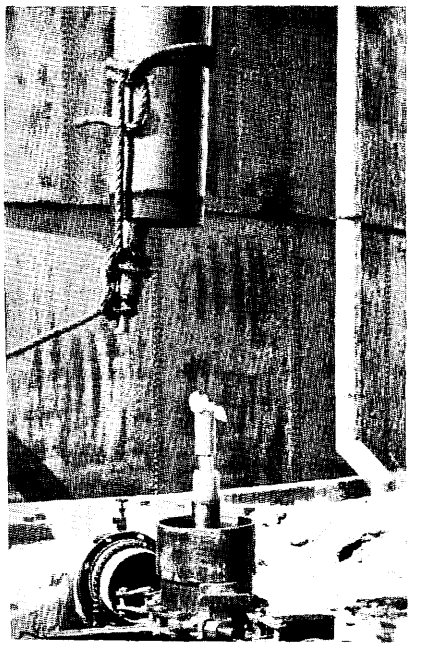


Fig. 7

Raise the unit and remove clamps from suction pipe, then lower the strainer, suction pipe, and bowl assembly into the well as shown in Figs. 4 and 5. If two sets of elevators are used, the column clamps can be tightened and the assembled unit lowered until the elevator rests on the clamp, Fig. 7. Remove the shaft protector tube which is assembled to the tube adapter at the top of the bowl assembly. Clean and inspect all exposed threads and faces. CAUTION: Under no circumstances may the bowl assembly be lifted or handled by the pump shaft.

Certain installations require a change in tube size due to shaft and tube limitations at the top of the bowl assembly. Therefore, in selecting the first section of inner column to be assembled to the bowl unit, select the joint having the tube that fits the discharge case tube adapter.

Attach the elevators to the column pipe immediately below the column coupling. Use a hemp rope and throw a timber hitch around the pipe about one foot from the thread end away from the well, a double half hitch around the tubing, and a double half hitch around the shaft on top of the threads to prevent slipping. This is illustrated in Figs. 6 and 7. A comparison of these two illustrations will show that the shaft coupling may be placed either on the downward end of this shaft or the upper end of the shaft already in the well. Although either method is acceptable, it is preferred that the shaft coupling be on the length of shafting already in the well as in Fig. 7 so that the shaft is lowered into a coupling much the same as the pipe joint is made.

Hoist the column section into place above the well as illustrated in Fig. 7. It will be necessary that the free end of the tail rope be held taut to prevent slipping on the shaft. A soft board or pipe dolly should be laid out for the end of the column pipe to slide in on, so that threads will not be damaged as a section is being raised. Clean all threads and inspect shaft and enclosing tube faces to be sure that there are no burrs or dirt adhering to the faces. Paint shaft and tube threads with thread lubricant. Inspect and clean shaft coupling (in boxed parts) and assemble it as described. Lower the parts and couple the shaft, remembering that the shaft thread is left hand. Make sure that the shaft ends are solidly butted together but do not use undue force in tightening. See Fig. 8. Lock shafts lightly with two small Stillson wrenches, using one wrench on the shaft coupling and the other on the shaft just above the thread. Wrench handles should be parallel when final tightening is made to

Fig. 8

prevent pulling shaft off center. If available, it is even better practice to use a shaft wrench rather than the pipe wrench. Do not allow coupling to ride up on "last scratch" or imperfect thread. Both shafts should show the same amount of threads above and below the coupling, indicating that the shaft butt is in the exact center of the coupling. If force is required, look for damaged or dirty threads. Forcing threads may cause misalignment.

Lower the enclosing tube, and thread it onto the tube adapter, tightening with a pipe wrench or small chain tong. These are right hand threads. On following tube sections, two wrenches or small chain tongs should be used, one holding the lower tube stationary and the other to tighten the upper section into place onto the projecting lineshaft bearing.

It is advisable to stuff sacking into the discharge case or lower section of column pipe while assembling shaft and tube. This will prevent dropping foreign material, tools, or parts into the pump. If something is dropped into the pump, it must be removed before continuing installation. This could require returning everything to the surface, and it can thus be seen that some form of cover is indicated. Remove sacking or cover before making up the pipe joint.

Lower the column pipe. Clean the threads, apply lubricant, and screw up tightly with chain tongs, making absolutely sure that column joints butt solidly, metal to metal. Start threads carefully to prevent cross threading. In tightening the column pipe joints, place one set of chain tongs on the coupling and another on the column pipe. Do not depend on friction clamps to hold the lower section for tightening. These threads are also right hand. See page 16 for airline attachment if one is furnished.

Raise the entire unit sufficiently to remove the holding clamp. Lower the assembly until the elevator clamp again rests on the friction blocks, as shown in Fig. 7.

Remove the lineshaft bearing from the projecting oil tube and pour into the tube not more than one-half pint turbine oil as described earlier in the manual. Replace the lineshaft bearing using half the bearing threads, allowing half the lineshaft bearing to project out of the tube to connect with the next joint. At this time, the position of the tubing in the column pipe should be observed so as to make sure it is centered. If all is centered properly at this time, proceed with the installation of the next column section. Repeat this installation procedure on all additional sections.

Layne & Bowler turbine pumps are furnished with "black widow" spiders as enclosing tube supports, which must be installed in the discharge column. It is considered good practice to locate one spider approximately twenty feet above the bowl assembly and one spider approximately twenty feet below the discharge head. The balance should be placed at staggered spacings from 30 to 40 foot intervals through the rest of the column length. Using irregular spacing as described will tend to eliminate any tendency toward resonance or harmonic vibration. The black widow spider should slide over the enclosing tube and force down two or three inches into the top of the open end of the column pipe.

The top column pipe section is generally shipped without couplings on either end and will be marked as to its position in the pump. It is equipped with two lifting

pads near the upper end of the pipe and the elevators should be assembled under the lifting pads to pick up the pipe.

The shaft enclosing tube to be assembled in the top column assembly will usually consist of three sections, one of which is a standard five foot joint. The other two are shorter lengths of tube. The length of the tube connector for the top of this tube section has been established to provide about three inches of adjustment at the head.

The top lineshaft may also be of a different length than the standard 10 foot joints. It will usually have been designed to terminate at a predetermined point with respect to the face of the top column flange.

For this reason, a careful check should be maintained throughout the column installation to determine that the shaft and tubing projections remain reasonably constant at each joint. At the last column joint before the final 10 foot section is installed, the shaft and tube extension from the pipe butt must be measured. See Fig. 9. The standard projections are 14 inches for the shaft (B) and 6 inches for the tube (A).

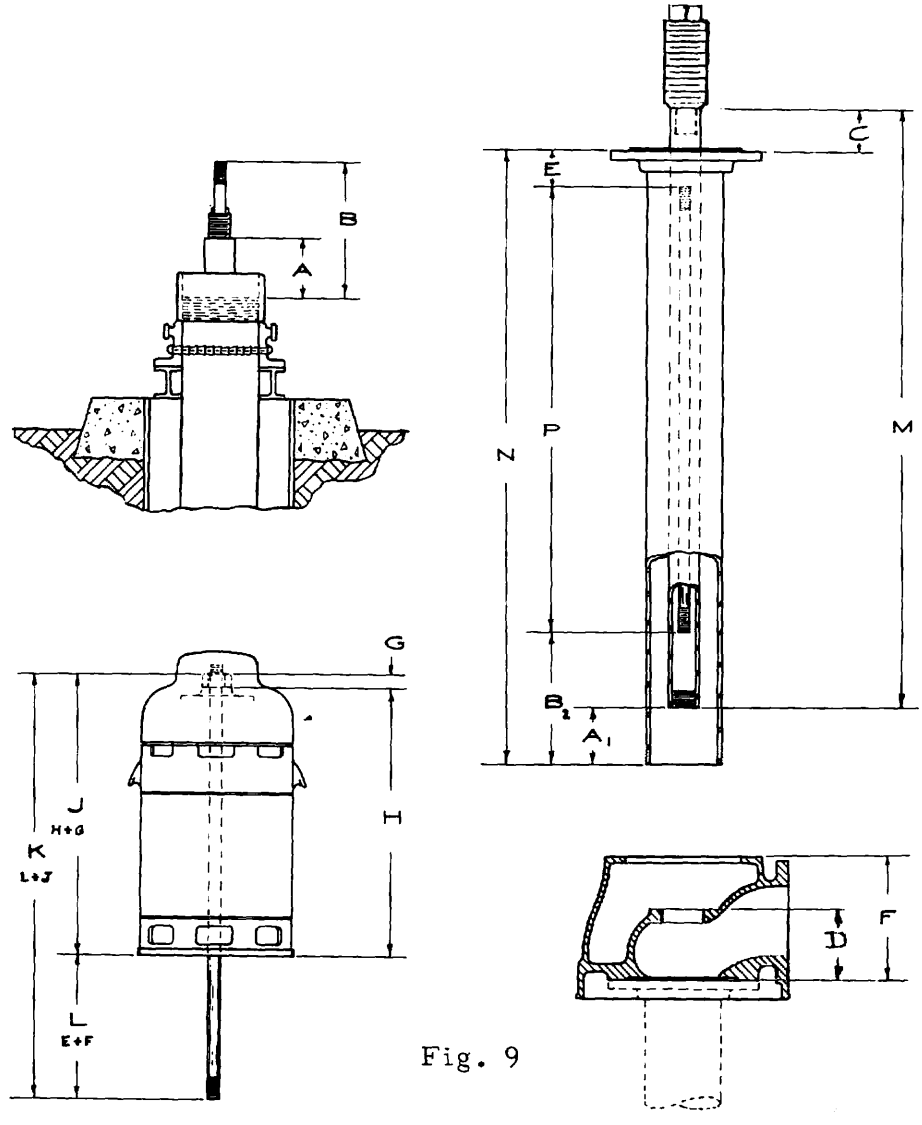


Fig. 9

If the tube has been reduced anywhere in the column, the tubing projection should be 7 inches. At this point of measurement, the tube projection should not be more than 1-1/2 inches from the above figure; that is, from 4-1/2 inches to 7-1/2 inches if there is no tube reduction in the column; or from 5-1/2 inches to 8-1/2 inches if there is a tube reduction. If the tube projection does not fall within these figures, THE TUBE WILL NOT MAKE UP PROPERLY AT THE TENSION NUT. If this is the case, before the last section of tube is installed, the short topmost piece of tubing must be replaced with a section of suitable length, selected to bring the position of the tubing back within tolerance.

Similarly, and still with reference to Fig. 9, the proper shaft projection must be verified as follows:

1. Measure and add the lengths of K, P, and B.
2. Measure and add the lengths of N, H, and F.
3. Subtract Item 2 from Item 1 and make sure the difference leaves sufficient thread for the adjusting nut G, yet will not interfere with driver canopy.

Make up the top lineshaft and the headshaft, inserting the connected joints into the assembled shaft enclosing tube. Put this assembly into the top column pipe and connect to the pump as if it were an intermediate section of column assembly, except that the pipe will not have a coupling at the top. The long tube connector should be made up as a tubing joint over the headshaft before the discharge head is set down. This is to permit the use of backup tongs on the tube while making a tight joint with the connector. If a lock collar is furnished, it should be assembled on the connector at this time, but the setscrews should be left loose.

The top column flange will be shipped loosely assembled to the discharge head. Remove the nuts attaching the flange to the head and remove the flange from its position in the bottom of the head, taking care to protect the gasket during this operation. The top column flange may now be threaded on the top end of the top column pipe as the pump hangs in the well. To facilitate turning the flange, two long bolts may be inserted through flange holes so that a bar may be used to tighten the flange onto the pipe. As in any pipe joint, it is important that the top pipe make a solid butt against the shoulder of the flange. Clean the face of the flange and put a light even coating of grease on the machined surface. Place the gasket very carefully upon this surface.

Remove the tube tension nut from the discharge head assembly and raise the head so that it may be lowered over the headshaft to a position just above the top column flange. Clean the machined face on the underside of the discharge head and coat the under part of the head with a light coating of grease if the head is to be grouted in place. This will prevent the head from sticking to the grout.

Lower the discharge head into position carefully to avoid bumping the projected shaft and tube. Make sure the column connecting flange is well seated and tighten the nuts on the studs. See Fig. 10. It is important that the flange face seats against the mating face of the head securely and that the centering register is engaged. Do not allow the head to sit on the centering register as this will misalign the top of the entire assembly. See page 16 for connection of airline at discharge head.

Fig. 10

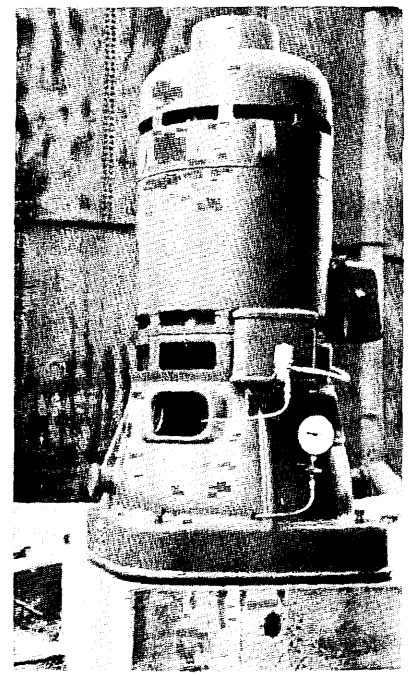


Fig. 11

Examine and clean the threads, bore, and face of the tube tension nut. Apply thread lubricant to the threads and lower the tube tension nut into position. It may be necessary to remove the pipe bushing and plug from the oil ports at the top of the tube connector to do this.

Engage the tubing threads and tighten with a tube tension nut wrench until the weight of the tube is well supported. Adjust the tube tension by stretching the tube 1/8 inch per 100 feet of tubing, or approximately 1-1/2 turns of the nut on 2 inch and smaller tubing or 1 turn of the nut on 2-1/2 inch and larger tubing per 100 feet of setting. Put thread lubricant on the capscrews, place them in the tension nut, and thread them firmly in position in the discharge head assembly.

If a lock collar has been furnished, back it down the connector far enough to insert the packing ring. Then screw the collar up on the connector till it butts against the tension nut. Back the collar off slightly till the setscrews line up with the first keyway in the connector. Tighten setscrews securely, reaching through opening in the head.

The packing ring may now be laid in place in the chamfer in the top of the tension nut around the connector. Care must be taken to see that the ring remains properly seated as the tubing lock nut is assembled and tightened with the chamfered face down. Tightening the lock nut for the last two or three turns may be accomplished with a spanner wrench or by tapping the nut using a block of wood and a hammer. Never tap the nut around with a metallic object. The tubing joint is now complete and the pipe bushing and plug may be reassembled in the oil ports in the position most convenient for the oil line from the reservoir.

Examine the oil reservoir and oil feed line, making sure that they are clean. Connect up the lubricating system as illustrated in Fig. 11. Fill the oil reservoir, using oil as described earlier. Adjust the lubricator valve to permit oil to drop at a rate of approximately one drop per second. On solenoid operated lubricators,

turn the solenoid valve upside down permitting oil to flow before the power is available. This will insure an adequate supply of oil at each bearing for the first start.

Lower the pump to the foundation. The lifting lugs on the sides of the discharge head will support the weight of the complete unit. Never lift the pump with the lifting lugs on the driver.

Take off the driver canopy and remove the drive coupling at the top. It is advisable to stuff sacking in any openings in the driver frame to prevent material from falling into the driver. Raise the driver over the headshaft and lower carefully onto the discharge head. The headshaft can be bent if forced to one side or if bumped by the driver, so extreme caution is required. Insert and secure driver attachment capscrews.

COMPLETION AT SURFACE

In aligning the pump, do not plumb the discharge head and motor. It is necessary to align the pump with the well. To do this, adjust the height of four corners of the discharge head with leveling screws if furnished or by driving metal wedges under the corners of the head until the top shaft is centrally located in the driver hollowshaft.

Make a neat and stiff mixture of Portland cememt grout. Raise the discharge head a few inches and coat that portion of the concrete foundation which will support the pump head with a coating of grout. Be certain the wedges or the leveling screws have not been changed during this operation. Lower the head into the position from which it was moved allowing the grout to be squeezed out. Check again to make sure the headshaft is still centered in the hollowshaft and trowel the grout squeezed out from under the discharge head. Grout may be troweled under the head without raising it if there is sufficient room between base and foundation.

Check the oil levels or amount of grease in the driver bearings. Do not add grease without first opening the grease relief plugs, as the high pressure may ruin the grease seals. In general, lubrication instructions will be furnished with the driver and these instructions should be followed implicitly.

On electric motor driven units, connect the motor terminals to leads from the starter panel. Since the majority of electric motors will be furnished as dual voltage machines, it is important that the proper connections be made to suit the voltage of the power source. Therefore, check the power source and the motor instruction nameplate for the proper method of connecting motor terminals.

Make sure that the headshaft will not drag on the bore of the hollowshaft. Buzz start the motor by switching it very quickly on and off, observing for proper rotation and inspecting to see that it spins freely and is in balance. The motor must run counterclockwise when viewed from the top. If the rotation is clockwise, interchange any two motor connections on three phase motors. On single phase motors, follow the manufacturer's instructions. After reconnection, again buzz start the motor to check rotation. Make absolutely sure that it is counterclockwise before connecting it to the pump.

Slide the drive coupling over the headshaft into place on the driver. It should have a sliding fit and should be firmly seated in its proper position on top of the driver without any tendency to hang up as it is lowered or rotated. It must sit perfectly flat and without cocking. File, dress, and scrape, if necessary to obtain the proper assembly. Remove the coupling.

Try the drive key in the headshaft keyway and in the coupling keyway. Make sure that this is also a sliding fit. Reassemble coupling in place on driver and insert key. Do not force the key in place. Dress the key NOT THE KEYWAY until a free --not loose--fit has been obtained. The top of the key must be below the adjusting nut seal when in place.

Thread the adjusting nut onto the headshaft, remembering the left hand threads, and raise the lineshaft until all its weight if on the nut. This is determined by the "breaking free" of the impellers. That is, with a slight lowering (1/6 turn) of the adjusting nut, the impellers are felt to drag on the bowl seal rings. This is the lowest adjustment point. Mark this point, adjusting nut to driver coupling.

FIRST OPERATION

Raise the shaft and impellers one full turn of the adjusting nut for each 100 feet of total head. Lock the nut in place with the lock screw. See that the pump turns freely by hand or with a wrench on large pumps. Make sure that an adequate supply of oil is running to the bearings. Buzz start the pump as before by pressing the start button and immediately pressing the stop button. With an engine or other type of driver, just let the unit get up to speed and release the power. This will tighten all of the shaft joints. Do not run the pump without again checking the impeller adjustment.

Remove the adjusting nut lock screw and lower the impellers to the original break free adjustment. Make sure this has not changed or, if it has, find the new break free point and punch mark the nut and driver coupling for future reference.

Raise the impellers with the adjusting nut until they just drag on the upper faces of the bowls. Lower the impellers one half turn of the adjusting nut. Lock the nut in place and again make sure that the unit spins freely by hand.

The pump should be operated with open discharge so that the water can be observed. If the total design head is more than one and one half times the setting, add a valve so that the additional head may be obtained by throttling.

Make sure the oil reservoir is full and the lubricant is still flowing freely into the enclosing tube. Then start the pump. It is important that the water flow be observed and the sand content checked. With a glass, keep sampling the flow and do not shut the pump off as long as the sand content is more than one percent, unless absolutely necessary. Often the flow will clear itself of sand within ten minutes. As soon as the flow has cleared up, stop the pump and let it sit idle for a few minutes before starting again. Repeat this starting and short run operation four or five times, the sand content of the water permitting. Be sure oil continues to flow freely to the

pump during running and idle time. It may be found necessary to apply a small amount of oil from an oil can at the point where the shaft emerges from the tubing in the discharge head. This should only be necessary during the first few minutes of operation.

After logging about one half hour running time with clear discharge, shut the pump off and turn the solenoid valve right side up. Complete the electric connections to the valve and again start the pump. Adjust the flow on the manual lubricator to about 30 drops per minute and operate at this flow rate for the first 20 operating hours. Unless a solenoid control is furnished, shut off the manual lubricator during the idle periods. After running the twenty hours, reduce the oil flow rate to an amount between 8 and 10 drops per minute.

PERMANENT PUMP ADJUSTMENT

The perihedral seal on enclosed impellers provides two sealing surfaces. The cylindrical seal or skirt on the lower end of the impeller is generally adequate for most installations. This is the simplest to adjust and should be used as the only seal, unless it becomes badly worn.

After the pump has been operated with the impellers well up in the bowls and the pumping of sand reduced, readjust the runners to use the cylindrical seal. Again determine the break free point and raise the impellers one turn of the adjusting nut per 100 feet of total pumping head.

If, after a period of time, the cylindrical seal has become worn, the wear compensation feature of the perihedral seal can be brought into use. The seal under these conditions is established between the upper or horizontal face of the bowl seal ring and the lower horizontal face of the impeller shoulder. Adjust the pump to the break free point. Raise the impellers a distance equal to the shaft elongation which may be determined by calculation or by checking the elongation chart. Raise the shaft further 1/6 to 1/3 turn of the adjusting nut. Run the pump and, by checking the power and/or capacity, determine that the capacity has been increased. Make a record of the power and capacity and stop the pump. Lower the impellers an amount not to exceed 1/6 turn and start the unit again. If the faces of the seal are rubbing, a slight vibration will be felt. A moderate increase in power and capacity indicates the impellers are not dragging. An increase in power without increase in capacity indicates these faces are rubbing. Under these conditions, if the power increase is moderate and vibration slight, the impellers will rub free after a short period of time. This type of operation will probably be characterized by a fluctuation in power such as might be shown with an ammeter. If the pump vibrates obviously and the power increase is great, raise the impellers until the condition is relieved.

Semi-open impellers must be adjusted in the same manner as described above for the lateral faces of the perihedral seal. However, it must be remembered that, with semi-open impellers, accuracy of adjustment is much more important at the very beginning of operation inasmuch as there is no cylindrical seal.

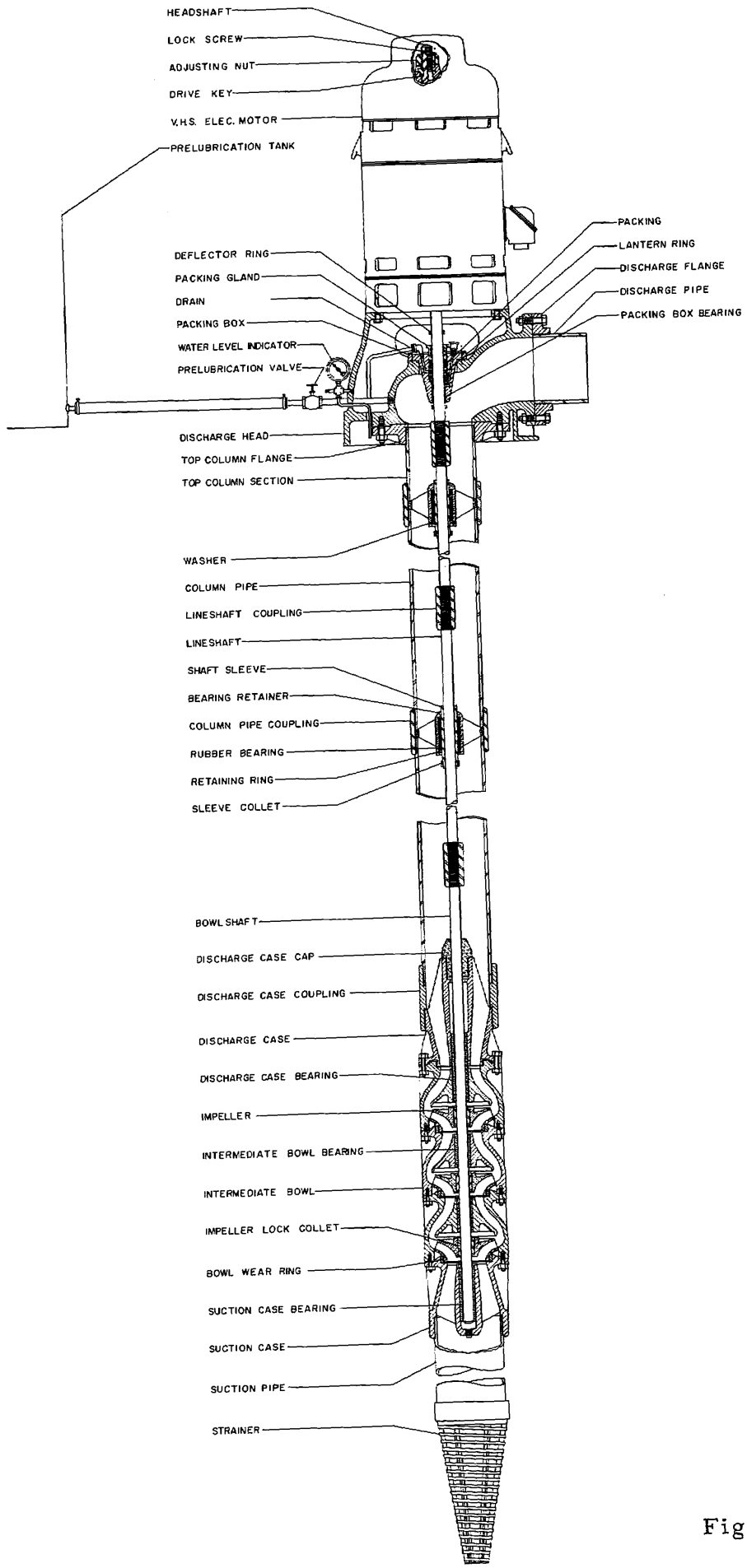

HEADSHAFT
LOCK SCREW
ADJUSTING NUT
DRIVE KEY
V.H.S. ELEC. MOTOR
PRELUBRICATION TANK
PACKING
LANTERN RING
DISCHARGE FLANGE
DISCHARGE PIPE
PACKING BOX BEARING
DEFLECTOR RING
PACKING GLAND
DRAIN
PACKING BOX
WATER LEVEL INDICATOR
PRELUBRICATION VALVE
DISCHARGE HEAD
TOP COLUMN FLANGE
TOP COLUMN SECTION
WASHER
COLUMN PIPE
LINESHAFT COUPLING
LINESHAFT
SHAFT SLEEVE
BEARING RETAINER
COLUMN PIPE COUPLING
RUBBER BEARING
RETAINING RING
SLEEVE COLLET
BOWL SHAFT
DISCHARGE CASE CAP
DISCHARGE CASE COUPLING
DISCHARGE CASE
DISCHARGE CASE BEARING
IMPELLER
INTERMEDIATE BOWL BEARING
INTERMEDIATE BOWL
IMPELLER LOCK COLLET
BOWL WEAR RING
SUCTION CASE BEARING
SUCTION CASE
SUCTION PIPE
STRAINER

Fig. 12

ADDITIONAL INSTALLATION AND OPERATING INSTRUCTIONS FOR OPEN LINESHAFT WATER-LUBRICATED PUMPS

For general procedure and tools of installation are essentially the same as that for oil lubricated pumps. Pump adjustment and operating are similar with the exception of the precautions noted below: See Fig. 12.

1. Do not install pumps without non-reverse ratchets or foot valves if the setting is greater than 50 feet.

2. When installing an open lineshaft pump as a replacement for an oil lubricated pump, all oil must be removed from the well. Do this by bailing and finally swabbing with sacking material. It is also advisable to wrap the strainer with one or two layers of non-waterproof wrapping paper. Tie this on with string. Do not use wire. The paper will prevent any residual oil from entering the pump as the bowl assembly enters the water. It should deteriorate in water after a few minutes so that it will slough off or pass easily through the pump upon starting without blocking the suction.

3. Bowl assembly discharge case bypass ports must be closed.

4. Install bearing retainers with open end down and make sure each rubber bearing operates on stainless steel sleeve or stainless steel shaft.

5. Before screwing the bearing retainer in place on each section of column, make sure the shaft stands in the center of the pipe or that a very slight pressure will center it. Do not force the shaft to center with the bearing retainer. If the shaft does not center in a given section, some part is out of alignment. Column pipe or shaft may not be butted properly, or shaft may be crooked. Check these possibilities removing the section if necessary. Do not install additional column and shaft until the shaft will center without forcing. Again check the projection of the shafting out of the pipe as each joint is assembled.

6. In selecting column pipe joints for their order of installation, note that top and bottom sections are identified as to proper location.

7. The lineshaft bearings must be prelubricated each time the pump is started. The manner of providing proper prelubrication varies with pump size and setting.

   (a) On small units a foot valve may be provided. Under these conditions, the pump must be prelubricated in a manner similar to that outlined below for the first start or any subsequent start after the column pipe has been emptied. Generally, however, after the first start, no further prelubrication is necessary. The foot valve, by keeping the column full of water, provides this prelubrication, unless leakage is permitted.

(b) On units installed to pump into a tank or reservoir, a 1-1/4 inch bypass around the discharge line check valve will provide sufficient prelubricating capacity. This 1-1/4 inch line can be controlled with a manually operated gate valve or with an electrically driven valve controlled by a time-delay relay switch. In starting the pump, allow the water to run through the prelubrication line a minimum of fifteen seconds, plus fifteen additional seconds for each 100 feet of setting. Let the prelubrication water continue to run until pumped water has reached the surface of the ground.

(c) On installations in which (a) does not apply and in which a supply of water as in (b) is not available, a prelubricating tank of sufficient capacity must be connected through 1-1/4 inch pipe to the discharge head. Flow control can be made manual or automatic as in (b). The minimum recommended tank capacity for various column sizes and settings is listed below:

	MAXIMUM SETTING		
MINIMUM TANK SIZE	25 Gallon	50 Gallon	100 Gallon
Column Size			
3	200 ft.	350 ft.	
4	150 ft.	300 ft.	
5	125 ft.	250 ft.	500 ft.
6	100 ft.	200 ft.	400 ft.
8		150 ft.	400 ft.
10		120 ft.	350 ft.
12		120 ft.	300 ft.
14		120 ft.	250 ft.
16		120 ft.	200 ft.

Open the valve from the tank and leave it open until the pumped water has refilled the tank. Do not start the pump until one half of the water in the tank has drained into the column pipe. Repeat the prelubrication each time the pump is started.

Instead of a tubing connection, an open lineshaft pump will usually be furnished with a packing box. This assembly should be removed from the discharge head to permit installation of head. The packing box may then be slipped carefully down over the headshaft into position, taking the usual precautions with the gasket. The packing box assembly may be shipped with packing in place. If not, or if it is ever necessary to repack, use the following instructions.

The packing housing itself has an extra deep packing chamber with a bushing below and a lantern ring to separate the packing stages. If die-formed rings are not used, the length of the ring should be such that the ends just meet when the packing is wrapped around the shaft. The joint in the ring should be located 90 degrees to 180 degrees from the joints in the rings above and below it in the box. The packing

may be flattened slightly to aid in starting it into the packing box. In packing a new pump before the driver is assembled, a short piece of pipe passed over the headshaft can be used to press the individual rings down into the box and tamp them firmly into place; this expedient is not possible after the driver has been installed, however. Insert three rings of packing into the packing chamber.

Before installing lantern ring, check to see that the port through the box has not been plugged by packing. This can be done by means of wire run through the drain port into the packing chamber.

The lantern ring may now be placed above the first three or four rings of packing. It is by means of this lantern ring that the pressure is relieved from the top rings of packing, any fluid seepage being returned to atmosphere or suction through the drain port and drain line tubing. Also, be certain to install the lantern ring with the #10-24 tapped holes facing upward as these are used in remvoing this part when repacking the box. Install two or three additional rings of packing as required, and then the packing flange. The packing flange nuts SHOULD NOT BE TIGHTENED AT THIS TIME.

When the drain line has been connected to the packing box, the motor may be assembled to the discharge head.

NOTE: Discharge heads with 8 inch register fit for the packing housing will require four rings of packing below and above the lantern rings.

AIRLINE INSTALLATION AND OPERATION

An airline submerged in well water provides the simplest method of determining the depth to the water. Copper, brass, or galvanized steel pipes are used.

To use an airline, it is necessary to know the exact length of the line from a reference point, generally the pump head base. The airline should extend at least to the bowl assembly. The length of column pipe is usually known and the distance to the top of the bowl assembly from the foundation is usually some multiple of ten feet. Mark a point on the bowl assembly or suction pipe if the airline is to extend to that depth. Measure the distance of the point below the lowest section of column and add it to the column length. This is the total length of airline.

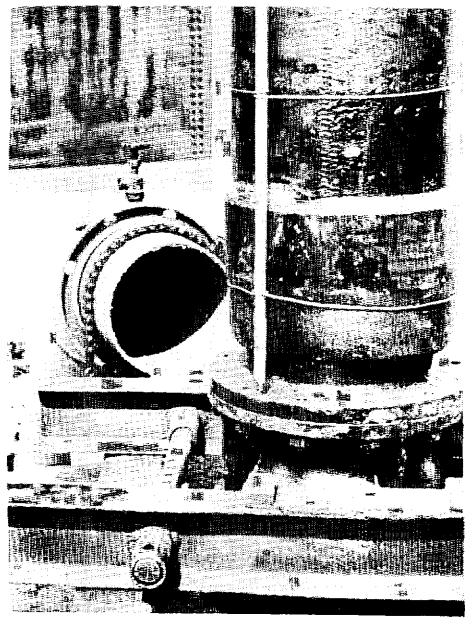


Fig. 13

While the suction pipe or the bowl assembly is in an upright position, secure the first section of airline to it, placing the lower open end on the mark. This may be done by banding, protecting the airline with hose at the clamping point; the airline is also sometimes secured with copper wire or heavy galvanized wire instead of bands or clamps. Fasten the line in place so that it will not slip downward as additional sections

are installed. See Fig. 13. It is recommended that the position of the end be marked on the column pipe as soon as each section is installed so that it can be noted if airline slips.

Add sections of airline in random lengths after the joints of column pipe have been installed and the pump is hanging from the hoist. Keep the airline outside of the elevators and fasten to the column pipe after removing the elevators at foundation level. Each joint must be made airtight to be effective, so use a thread sealing compound rather than a simple thread lubricant.

The last section of airline will have to be cut and fitted for length to match with the fittings furnished with the gauge and discharge head. Avoid hanging the weight of the airline on a fitting having its threads in a horizontal direction. For example, if the line is to hang from an elbow, support the elbow rather than the horizontal nipple just behind the elbow.

Mount the gauge and Schrader valve on the discharge head and connect the airline to it. This is shown in Figs. 10 and 11. It is generally good practice to remove the glass on the gauge and mark the length of airline on the dial for record purposes. It will also be helpful to add the date of the installation. If, at any subsequent time, an extension is added to the pump and the airline is extended also, the record on the gauge should then be brought up to date with the new length and the new date.

Gauges are of two types: altitude and direct reading. Each use the same values of pressure to determine the depth. By pumping the airline full of air through the Schrader valve, the air pressure recorded at the surface of the ground is equal (within small limits) to the depth of water over the end of the airline.

With an altitude gauge, this pressure is recorded directly on the gauge so that the depth to water is equal to the length of the airline minus the reading on the altitude gauge.

With a direct reading gauge, it is necessary to set the hand to a point on the dial equal to the length of airline. This must be done while there is no pressure on the gauge. Remove the Schrader valve core before making this adjustment. This gauge will read the distance to the water when the airline is pumped up. The hand will move away from the position equal to the pressure in the airline.

A periodic determination of water levels recorded together with hours of pump operation form a vital record of the well performance and changes. Well performance will vary or even deteriorate over a period of time and any required revisions in the pump can best be made from a good well record.

AIR RELIEF

Pumps operating on a closed pipeline system should have an air relief valve installed in the discharge line between the check valve and pump head. A simple swing check can provide this. Air must be admitted to the pump column when the pump is stopped and most of the air bled off when the pump is started. On pneumatic pressure systems, by locating the relief close to the discharge head, air can be trapped in the horizontal run of pipe to renew the air charge in the pressure tank.

DON'T

1. Don't pull the discharge piping to the head with the capscrews. Install the line so that the fasteners are used to prevent leakage only.

2. Don't hang the weight of the discharge line and fittings on the discharge head alone. Support the line by blocking or concrete saddles. Use a dresser type coupling wherever possible.

3. Don't start a pump while it is rotating in the reverse direction after having shut down. It is advisable to install a time delay relay on electric drives to prevent this. Non-reverse protection in the driver could also be a solution.

4. Don't put heavier than recommended heaters in a starter if the pump load begins to trip those furnished originally. These are protective devices. Contact your Layne & Bowler representative for assistance.

5. Don't add oil to driver while running.

6. Don't add grease to grease lubricated driver without removing relief plug.

7. Don't tighten shaft packing where provided except in easy increments, i.e., tighten the gland nuts part of a turn and let the pump run 10 minutes before tightening further. If leakage water is too hot to put on the hand, back the gland nuts off a little until the water cools, then tighten again. Gland nuts must be adjusted evenly so as to prevent cocking the gland forcing it against the shaft.

8. Don't forget that this equipment contains rotating parts. Use CAUTION when working near such parts to avoid injury.

MAINTENANCE HINTS

1 For pump lubrication, use a light turbine oil similar to Standard Oil O.C. Turbine Oil #9 or a good grade of mineral oil with proper additives having a viscosity equal to SAE #10.

2. Remove old oil from driver once a year. Flush with kerosene and refill. Follow manufacturer's instructions carefully as to method and type of lubricant.

3. Replace self-lubricated driver ball bearings in about five years. It is generally less expensive to replace these before they fail.

4. Replace all the shaft packing on open lineshaft pumps after maintenance has required the addition of two rings. Always let the packing box leak slightly at the top to add life to the packing.

OPERATION AT SHUTOFF HEADS

In the usual application of vertical turbine pumps, no harm will result from operation under conditions of static flow heads. However, not all installations are "usual" and, for this reason, consideration should be given to any unit which may be subjected to this usage. The following points should therefore be checked and resolved before putting the equipment into operation at or near shutoff heads.

1. Thrust bearing capacity must be adequate.

2. If prolonged operation at no flow is contemplated, the problem of heat dissipation may become acute since the entire shutoff horsepower is converted to heat in the available fluid.

3. For high pressure units, stresses at shutoff heads should be investigated. This information may be obtained from the factory upon request.

4. Certain impeller designs may have critical horsepower characteristics at low flows. Shutoff power requirements should be examined for driver overload.

5. It must be kept in mind that open lineshaft units depend upon pumped fluid for lubrication. Fluid temperatures, if raised excessively due to lack of flow, may impair lubrication efficiency.

To summarize, designs will easily accommodate most of the considerations listed above. However, to obtain the best possible application, the factory should be notified, at the time of order if operation at static flow heads will be a possibility, and this precaution must be observed to validate any warrantees.

TERMS AND CONDITIONS OF SALE

All orders shall be made out to Layne and Bowler Pump Company at City of Industry, California, and shall be subject to acceptance by us at City of Industry.

1. CONSTRUCTION AND LEGAL EFFECT. Our sale to you will be solely upon the terms and conditions set forth herein. They supersede and reject any conflicting terms and conditions of yours, any statement in yours to the contrary notwithstanding. Exceptions to any of our terms and conditions must be contained in a written or typed (not printed) statement received from you; we shall not be deemed to have waived any of our terms and conditions or to have assented to any modification or alteration of such terms and conditions unless such waiver or assent is in writing and signed by an authorized officer. No representation of any kind has been made by us except as set forth herein; this agreement conclusively supersedes all prior writings and negotiations with respect thereto and we will furnish only the quantities and items specifically listed on the face hereof; we assume no responsibility for furnishing other equipment or material shown in any plans and/or specifications for a project to which the goods ordered herein pertain. Any action for breach of contract must be commenced within one year after the cause of action has accrued. Our published or quoted prices, discounts, terms and conditions are subject to change without notice.

2. PRICES. Unless otherwise noted on the face hereof, prices are net F.O.B. our factory, and include standard Layne and Bowler Pump Company catalogue literature only. Service time of a factory-trained service man is not included and may be charged extra. The amount of any applicable present or future tax or other government charge upon the production, sale, shipment or use of goods ordered or sold will be added to billing unless you provide us with an appropriate exemption certificate. We may adjust prices to our prices in effect at time of shipment. Purchased equipment such as motors, controls, gasoline engines, etc., will be invoiced at prices in effect at time of shipment in accordance with pricing policy of manufacturer.

3. DEFECTIVE EQUIPMENT. Providing Purchaser notifies us promptly, if within one year from date of shipment equipment or parts manufactured by us fail to function properly under normal, proper and rated use and service because of defects in material or workmanship demonstrated to our satisfaction to have existed at the time of delivery, the Company reserving the right to either inspect them in your hands or request their return to us will at our option repair or replace at our expense F.O.B. our City of Industry plant, or give you proper credit for such equipment or parts determined by us to be defective, if returned transportation prepaid by Purchaser. The foregoing shall not apply to equipment that shall have been altered or repaired after shipment to you by anyone except our authorized employees, and the Company will not be liable in any event for alterations or repairs except those made with its written consent. Purchaser shall be solely responsible for determining suitability for use and the Company shall in no event be liable in this respect. The equipment or parts manufactured by others but furnished by us will be repaired or replaced only to the extent of the original manufacturer's guarantee. OUR OBLIGATIONS AND LIABILITIES HEREUNDER SHALL NOT BE ENFORCEABLE UNTIL SUCH EQUIPMENT HAS BEEN FULLY PAID FOR. PURCHASER AGREES THAT IF THE PRODUCTS SOLD HEREUNDER ARE RESOLD BY PURCHASER, HE WILL INCLUDE IN THE CONTRACT FOR RESALE, PROVISIONS WHICH LIMIT RECOVERIES AGAINST US IN ACCORDANCE WITH THIS SECTION. IN CASE OF OUR FAILURE TO FULFILL ANY PERFORMANCE REPRESENTATION, IT IS AGREED THAT WE MAY AT OUR OPTION REMOVE AND RECLAIM THE EQUIPMENT COVERED BY THIS AGREEMENT AT OUR OWN EXPENSE AND DISCHARGE ALL LIABILITY BY REPAYMENT TO THE PURCHASER OF ALL SUMS RECEIVED ON ACCOUNT OF THE PURCHASE PRICE. (THE FOREGOING OBLIGATIONS ARE IN LIEU OF ALL OTHER OBLIGATIONS AND LIABILITIES INCLUDING NEGLIGENCE AND ALL WARRANTIES, OF MERCHANTABILITY OR OTHERWISE, EXPRESS OR IMPLIED BY FACT OR BY LAW, AND STATE OUR ENTIRE AND EXCLUSIVE LIABILITY AND BUYER'S EXCLUSIVE REMEDY FOR ANY CLAIM OF DAMAGES IN CONNECTION WITH THE SALE OR FURNISHING OF GOODS OR PARTS, THEIR DESIGN, SUITABILITY FOR USE, INSTALLATION OR OPERATION.) WE WILL IN NO EVENT BE LIABLE FOR ANY DIRECT, INDIRECT, SPECIAL OR CONSEQUENTIAL DAMAGES OR DELAY RESULTING FROM ANY DEFECT WHATSOEVER, AND OUR LIABILITY UNDER NO CIRCUMSTANCES WILL EXCEED THE CONTRACT PRICE FOR THE GOODS FOR WHICH LIABILITY IS CLAIMED.

4. DELIVERY. Delivery, shipment and installation dates are estimated dates only, and unless otherwise specified, are figured from date of receipt of complete technical data and approved drawings as such may be necessary. In estimating such dates, no allowance has been made, nor shall we be liable directly or indirectly for, delays of carriers or delays from labor difficulties, shortages, strikes or stoppages of any sort, fires, accidents, failure or delay in obtaining materials or manufacturing facilities, acts of government affecting us directly or indirectly, bad weather, or any causes beyond our control or causes designated Acts of God or force majeure by any court of law, and the estimated delivery date shall be extended accordingly. We will not be liable for any damages or penalties whatsoever, whether direct, indirect, special or consequential, resulting from our failure to perform or delay in performing unless otherwise agreed in writing by an authorized officer.

5. OPERATING CONDITIONS AND ACCEPTANCE. Recommendations and quotations are made upon the basis of operating conditions specified by the Purchaser. If actual conditions are different than those specified and performance of the equipment is adversely affected thereby, Purchaser will be responsible for the cost of all changes in the equipment required to accommodate such conditions, and we reserve the right to cancel this order and Purchaser shall reimburse us for all costs and expenses incurred in, and reasonable profit for, performance hereunder. We reserve the right to refuse any order based upon a quotation containing an error. The provisions in any specification or chart issued by Layne and Bowler Pump Company are descriptive only and are not warranties or representations; Layne and Bowler Pump Company will certify to a rated capacity in any particular product upon request. Capacity, head and efficiency certifications are based on shop tests and when handling clear, fresh water at a temperature of not over 85°F. Certifications are at this specified rating only and do not cover sustained performance over any period of time nor under conditions varying from these.

6. SHIPPING. Unless you specify otherwise in writing, (a) goods will be boxed or crated as we may deem proper for protection against normal handling, and extra charge will be made for preservation, waterproofing, export boxing and similar added protection of goods; (b) routing and manner of shipment will be at our discretion, and may be insured at your expense, value to be stated at order price. On all shipments F.O.B. our plant, delivery of goods to the initial carrier will constitute delivery to you and all goods will be shipped at your risk. A claim for loss or damage in transit must be entered with the carrier and prosecuted by you. Acceptance of material from a common carrier constitutes a waiver of any claims against us for delay or damage or loss.

7. PATENT INFRINGEMENT. We will not be liable for any claim of infringement unless due to infringement by goods manufactured by us in the form in which we supply such goods to you and without regard to their use by you. If you notify us promptly of any such claim of infringement and, if we so request, authorize us to defend or settle any suit or controversy involving such claim, we will indemnify you against the reasonable expenses of any such suit and will satisfy any judgment or settlement in which we acquiesce, but only to an amount not exceeding the price paid to us for the allegedly infringing goods. If an injunction is issued against the further use of allegedly infringing goods we shall have the option of procuring for you the right to use the goods, or replacing them with non-infringing goods, or modifying them so that they become non-infringing, or of removing them and refunding the purchase price. The foregoing expresses our entire and exclusive warranty and liability as to patents, and we will not be liable for any damages whatsoever, suffered by reason of any infringement claimed, except as provided herein. You will hold us harmless and indemnified against any and all claims, demands, liabilities, damages, costs and expenses resulting from or connected with any claim of patent infringement arising out of the manufacture by us of goods in accordance with a design or specifications which you furnish us.

8. CANCELLATION AND RETURNED EQUIPMENT. Orders may be cancelled only with our written consent and upon payment of reasonable and proper cancellation charges. Goods may be returned only when specifically authorized and you will be charged for placing returned goods in saleable condition, any sales expenses then incurred by us, plus a restocking charge and any outgoing and incoming transportation costs which we pay.

9. CREDIT AND PAYMENT. Payment for products shall be net 15th prox. Pro-rata payments shall become due with partial shipments. A late charge of 1 percent per month or the maximum permitted by law, whichever is less, will be imposed on all pastdue invoices. We reserve the right at any time to alter, suspend, credit, or to change credit terms provided herein, when in its sole opinion your financial condition so warrants. In such a case, in addition to any other remedies herein or by law provided, cash payment or satisfactory security from you may be required by us before shipment; or, the due date of payment by you under this contract may be accelerated by us. Failure to pay invoices at maturity date at our election makes all subsequent invoices immediately due and payable irrespective of terms, and we may withhold all subsequent deliveries until the full account is settled, and we may terminate this agreement. Acceptance by us of less than full payment shall not be a waiver of any of our rights. You represent by sending each purchase order to us that you are not insolvent as that term is defined in applicable state or federal statutes. In the event you become insolvent before delivery of any products purchased hereunder, you will notify us in writing. A failure to notify us of insolvency at the time of delivery shall be construed as a reaffirmation of your solvency at that time. Irrespective of whether the products purchased hereunder are delivered directly to you, or to a customer of yours, and irrespective of the size of the shipment, we shall have the right to stop delivery of the goods by a bailee if you become insolvent, repudiate, or fail to make a payment due before delivery, or if for any other reason we have a right to withhold or reclaim goods under the applicable state and federal statutes. Where you are responsible for any delay in shipment the date of completion of goods may be treated by us as the date of shipment for purposes of payment. Completed goods shall be held at your cost and risk and we shall have the right to bill you for reasonable storage and insurance expenses. Regardless of price quoted, all orders will be invoiced in the minimum amount of $10.00 net.

10. SPECIAL JIGS, FIXTURES AND PATTERNS. Any jigs, fixtures, patterns and like items which may be included in an order will remain our property without credit to you. We will assume the maintenance and replacement expenses of such items, but shall have the right to discard and scrap them after they have been inactive for one year without credit to you.

11. INSPECTION. Inspection of goods in our plant by you or your representative will be permitted insofar as this does not unduly interfere with our production workflow, provided that complete details of the inspection you desire are submitted to us in writing in advance.

12. RECORDS, AUDITS AND PROPRIETARY DATA. Unless otherwise specifically agreed in writing signed by an authorized officer, neither you nor any representative of yours, nor any other person, shall have any right to examine or audit our cost accounts, books or records of any kind or on any matter, or be entitled to, or have control over, any engineering or production prints, drawings or technical data which we, in our sole discretion, may consider in whole or in part proprietary to ourselves.