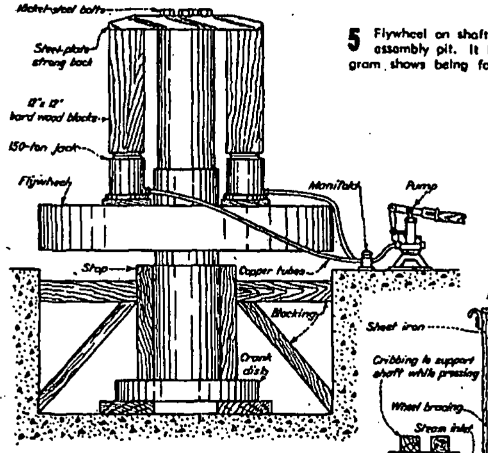
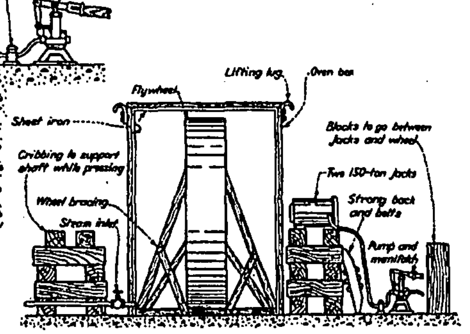


5 Flywheel on shaft. The shaft is blocked in place in the assembly pit. It is ready for its flywheel which the diagram shows being forced into its place by hydraulic jacks

6 Steam-heating box is shown at lower left. A flywheel is blocked on edge in a steam box for heating. Everything is in readiness to press in its shaft at the right time



and causes it to grip the shaft so the sections will be solidly together. Never put two or more heated sections on a shaft at the same time. The outside faces of the sections hubs will grip the shaft and draw apart as they cool.

The keyways also expand so dummy keys must be driven into the pole key slots to hold them in alignment as sections cool. Three or four such keys, distributed around the circumference, are sufficient.

Horizontal-Shaft Rotors. When assembling a horizontal-shaft rotor, assemble the pressing rig and hold the section against the shaft shoulder or stop blocks until it has gripped the shaft. A flywheel or single-section rotor can be blocked on edge. Put the keyway on top, and heat either by electric heaters or steam. When heating is completed lift off the heater box and bring the shaft to the hot piece. Fig. 6 shows a flywheel in a steam box with the strong back, bolts, jacks and blocking ready for instant use if necessary.

Several of these assemblies have been completed by putting the shaft in with a chain block or using a timber as a battering ram. If a hub seizes before it is home it will be difficult if not impossible to get it either on or off. On the other hand when everything goes well, assembly is made quickly. A hot section has been lifted from the oven, placed on the shaft and the next cold section put in, in less than 15 min.

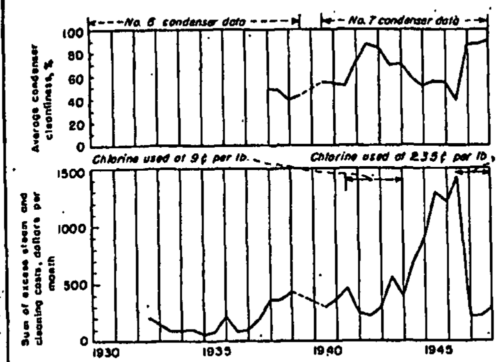
Removing Rotor From Shaft. It is sometimes necessary to remove a rotor from its shaft. It is foolhardy to attempt this without heating the rotor, cooling the shaft, or both. It may require three or more times more pull to start the rotor off than it took to put on the shaft. If the rotor was heated before putting on the shaft, the problem is more difficult than when a cold-press installation job was done.

Build a strong back of plates, described on p 69, June POWER, to fit against the hub of a *forged coupling* if the shaft has one or against the oil shedder of the bearing journal. Cut wood blocking and arrange to place the largest capacity jacks available between the strong back and the hub. Four 150-ton independent pump jacks with a common pump is not too large.

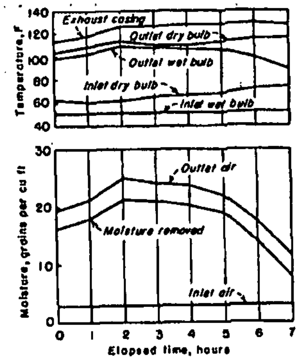
If the rotor has a cast rim and spokes, heat the rim by induction. If the rotor is laminated or has a winding, place electric heaters as near the circumference as possible. Raise temperature to around 180 F and at the same time, keep the shaft cooled with ice and salt, or dry ice if obtainable. Put full pull on the jacks and if rotor doesn't start, hold the pressure and bump end of shaft with a heavy timber or steel billet. A heavy blow often starts an obstinate rotor. Do not apply direct heat to the hub of a large rotor. The colder rim and spokes prevent expansion away from the shaft so the hub may grip the shaft harder than before heating.

Removing a Damaged Shaft. Fig. 3 shows a rotor, of four cast-steel sections, whose rim was heated to about 255 F by induction in about 2 hr while the hub's temperature increased to about 75 F with scarcely any increase *in shaft temperature.* After heating, four 150-ton jacks were used on the strong backs to remove the cast-steel rotor from its shaft, badly damaged by an accident in handling. The rotor started at 450-ton pressure and came off easily.

Against orders, not to try replacing the four sections on a new shaft at one time, the same winding was used to expand the rotor bore when installing the new shaft. The end sections bit first on the shaft. After that all lengthwise contraction of the metal occurred between the end sections. As a result there was a space between the sections around the through-bolt bosses when the rotor cooled. Special hand-fitted blocks had to be put between the sections to prevent springing the shaft when the through bolts were tightened.



1 During earlier years St. Johns River water was cleaner causing less condenser fouling. Coupled with the low oil cost, efficiency loss was not intolerable



2 Variation in wet and dry bulb reading measures moisture removal in drying

How Talleyrand's Condenser Operating Experience Varied Over the Years

Growing population and changing river conditions continuously posed new problems in keeping surface condensers clean. Increasing fuel costs made it imperative to find optimum means of reducing fouling with minimum hazard to station personnel

By T W BOSTWICK, J A CASSIDEY and J P HANCOCK*
City of Jacksonville, Florida

▶TALLEYRAND GENERATING STATION, on the west bank of the St. Johns River in Jacksonville, was one of the first large steam-power plants built in Florida. From 6000 kw in 1913 the station has grown to a total capacity of 81,500 kw in five units today. An interesting phase of this growth is the development of operating and maintenance methods to control surface-condenser cleanliness.

Condensers. Table I lists principal data of the main condensers. No. 1, 4 and 5 have more surface per kw capacity than 6 and 7. This graphically illustrates the condenser manufacturer's contribution to the advancement of power plant design. Steam lanes give more effective surface use and, combined with more complete air removal, represent a relative saving in equipment cost.

Circulating Water. Average temperature of the St. Johns water has been 73 F for 20 years, with maximum and minimum yearly averages of 74 and 71 F. In contrast, the chemical and bacteriological content has varied markedly. Once the plant site is chosen, little can be done to change cooling-water type and character. The operating and development engineer must devise maintenance methods to cope with the ever-changing problem.

In the early 1930s the St. Johns River was relatively unpolluted. Jacksonville's population was then about 130,000; today it is above 235,000. The low chlorine demand of 3 ppm, bottom of table II, indicates the low pollution from raw sewage and industrial wastes. Water salinity as tested over a 20-year period shows a variation from 180 to 17,000 ppm sodium chloride. No trend has been found in this factor.

Stream pollution from all sources has been an ever-increasing problem. Trade waste from nearby industrial plants has multiplied the chlorine demand three to four times. Microscopic plant and animal life has changed in type and variety to survive and flourish under the latest conditions. Early difficulties were encountered with mussels, barnacles and heavy moss deposits in intake tunnels. Today slime-producing organ-

* Abstract of paper read before Florida Section ASME at April 1948 meeting of Florida Engineering Society