Engine Foundations*

Their Function to Hold the Engine and to Absorb Vibrations

By R. B. Dale

ENGINE foundations perform two functions; they hold the engine bed rigidly in place and they absorb vibrations. The foundation must, therefore, be heavy and bulky and it must have a substantial and firm bearing in the earth. Concrete is by far the most available and best suited material for this purpose. It is not only a comparatively inexpensive material but it is also exceedingly convenient to handle and to mold into the necessary form. Moreover, with intelligent supervision, the foundation may be built without the use of skilled labor. However, sufficient time must be allowed for the concrete to set before a load is placed on the foundation.

The engine base is held to the foundation by means of anchor bolts. These are mild-steel rods several feet long with a square nut and anchor plate at one end and a hexagon nut at the other. The foundation is usually built and the anchor bolts set in the locations indicated for them on the engine builder's setting plans before the engine has been shipped so that the foundation may be ready to receive it when it arrives. The anchor bolts are hung from a template which is securely fastened to the top of the forms for the concrete, and the anchor plate is completely buried in the concrete. A small wooden box, tapering from the lower end to the upper end, is made to surround the anchor bolt; this allows for a slight adjustment of the bolt so that it will fit into the cored holes provided for it in the engine bed. This precaution is necessary because it is almost impossible and, in any case, too expensive, to set them so that an accurate fit is obtained.

When the engine arrives and after the concrete has properly set, the engine is moved to its foundation where it is set into position. Small iron wedges are

driven under the edge of the engine bed until the engine is level, thus leaving a space of $\frac{1}{2}$ inch or more between the engine base and the top of the concrete. The hexagon nuts on the upper ends of the bolts are then tightened up, after which a cement grout is run under the engine base and allowed to set. When the grout has set the wedges are removed and the nuts on the anchor bolts are again tightened as much as possible.

In order that the foundation may perform to the fullest extent its function as an absorber of vibrations, the vertical hole through which the anchor bolt passes is not filled with grout. This allows the bolt to stretch or elongate throughout its entire length whenever subjected to shock. It may be said to act somewhat in the manner of a spring. If the anchor plate is of ample area, no advantage in holding-down force is obtained by grouting the bolt for the whole of its length as the bond between the steel and the concrete is comparatively slight in effect. Any lateral movement of the engine on the foundation is prevented by the force of friction which exists between the engine bed and the top of the foundation. The greater the initial tension in the bolts, the greater is this resisting force. If a slight movement should take place this resisting force would increase enormously because the tension in the bolts would increase as they are stretched to accommodate themselves to the new position. Shearing strains which are liable to occur in the bolt between the top of the foundation and the engine bed, if it is completely bedded in the grout, are also prevented.

It is sometimes necessary to change an old foundation to accommodate a new arrangement, such as the compounding of low- and high-pressure steam cylinders, to increase the power of the engine. Whenever it is necessary to set an anchor bolt in an old foundation, the difficulty may be met in one of two ways. In the

first method a hole is drilled in the concrete slightly larger in diameter than the bolt to be used and to the proper depth. A bolt is then prepared by cutting a slot in one end lengthwise of the bolt and about six or eight inches long. This slot is then fitted with a wedge of hardened steel held in place by a pin of soft copper or other soft metal. The bolt is lowered into the hole and struck several hard blows on the upper end with a heavy hammer. This shears the soft metal pin and drives the wedge into the slot, thus enlarging the diameter of the bolt at the lower end. The bolt is then grouted into the hole and the nut is tightened to complete the work.

In the second method a hole is drilled for the bolt as before. A second hole is then drilled laterally through the side of the masonry to meet the first hole and this is enlarged sufficiently to take the standard anchor plate. The work is completed in the customary manner, precautions being taken to grout the anchor plate to a firm bearing in the old concrete. The first method is cheap and simple, although there is no certainty as to what happens in the bottom of the hole. It also has the advantages of the grouted bolt previously mentioned. The second method, while it is more troublesome and expensive, is the more reliable and should be used in preference to the first.

The reciprocating engine, since the tendency to produce vibration is greater than in the case of the steam turbine, requires a comparatively heavy foundation. In some cases and in peculiar locations this advantage of the turbine may be so great that the choice of equipment is strongly influenced in its favor. The heavy foundation is expensive to build and, in the case of large units, the cost of the foundation forms a large percentage of the total expenditure of the installation.

* Reprinted from *Power*.

Turpentine from Dead and Down Timber

Recovering Values from Seemingly Waste Material

LESS than ten years ago certain far-sighted turpentine operators in the South began to take thought of utilizing the dead "light wood" in the pine forests for purposes of getting turpentine, which was then rapidly advancing in price. There are at present vast quantities of pine logs and tall stumps left as a result of careless lumbering in the past. This material is rich in turpentine and a cord of dead pine wood can be made to yield from 12 to 16 gallons of the spirits. The time is short until the bulk of the available dead pine wood in the southern pineries will be utilized for this and other purposes. The State of Florida, to say nothing of the other yellow pine produc-

ing states, is annually losing many thousands of dollars from the waste of this dead and down timber. There are millions of cubic feet of standing pine timber unfit for saw logs, left in cut-over land. There are millions of cubic feet of the richest light wood in the form of stumps, which can be utilized very profitably. The conservationists found a way to use this wood that is now wasting, for the purpose of making the best grades of turpentine and alcohol. This is now being done on a large scale with promises of a still further growth. A number of plants have already been built in Florida and Georgia for the purpose of converting the dead and down light wood,

stumps and mill waste, etc., into turpentine and other by-products.

The problem of determining whether it is cheaper to gather the dead wood and the stumps for the turpentine they contain, or to tap live thrifty trees and distill the resin, has been satisfactorily worked out. There seems to be little doubt as to the answer when the small cost of the dead pine wood is considered. It is estimated that there are more than a million cords of dead wood in the State of Florida alone. None of it is valuable enough to pay the cost of transportation for purposes other than that of dry distillation. A conservative estimate of the

Trees Killed by Wind, Insects and Fire in Florida.

Trees Killed by Boxing and Fire in Washington County, Florida.