considerably, 29 to 1 and 600 to 1, yet the total actual difference in lost power is not very large.

Fig. 5 is for a 20-in. by 11 ft. Putnam lathe, gear reduction varying from 3-1 to 80-1. The maximum loss is about 1.2 h.p.

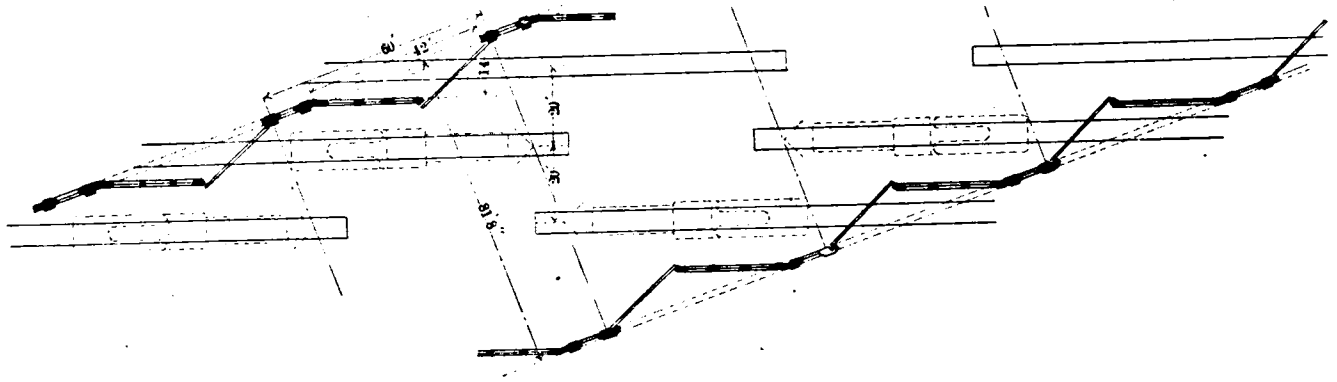
Fig. 6 shows incidentally the power lost in a 60-in. planer; Figs. 8 and 9, in punches; Figs. 15, 16 and 17, in some woodworking tools.

Similar curves could be given for a large number of machines, but these are sufficient to show the general trend of the losses, especially as they show that the losses are small, except when the spindle or table is running at top speed. At the high spindle speed it is rather unlikely that a maximum cut is to be taken, but in all probability only light finishing cuts or polishing, so that in general the power lost in friction in the machine may be neglected in considering the question of size of motor required.

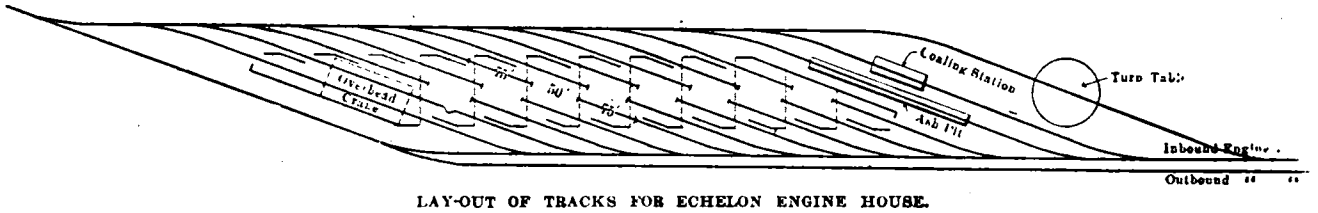
(To be continued.)

A NEW FORM OF ENGINE HOUSE.

The problem of housing locomotives to provide satisfactory storage, facilities for repairs and for quickly handling them into and out of the house, of such form as to be easily heated and ventilated, is one which has taken the attention of railroad men for several years. Several houses of rectangular form have been built and are now in service. These require transfer tables and in order to avoid this and to provide convenient means of extension, a design has been suggested by Mr. J. J. Turner, third vice-president of the Pennsylvania Lines West of Pittsburg, which he has called the Echelon house, the basis of which is a parallelogram. The arrangement illustrated provides a building with tracks running through it, the walls of the building being so constructed as to provide doors for each track, the plan having been developed under the direction of Mr. Trimble, chief engineer of maintenance of way of the Pennsylvania Lines West of Pittsburg. The house itself lies between two parallel tracks and encloses a portion of "ladder" tracks between the main tracks, the house being entered from either side. At one end and outside of the building is a turn-table, a coal station and an ash-pit. At the other end and inside of the building are two tracks running clear through the building, over which an electric travelling crane is located. The other tracks do not extend across an open space at the center of the building, which provides a passage way from end to end. With tracks located at 20-ft. centers considerable space is provided both inside and outside of the house for necessary repair work. The word Echelon is used to designate this construction because of the character of the walls, and the construction used to avoid making the doors too large. It is understood that the idea has not yet been put into the form of construction. It, however, furnishes an interesting study which is now under consideration.



PART PLAN OF ECHELON ENGINE HOUSE.



LAY-OUT OF TRACKS FOR ECHELON ENGINE HOUSE.

THE REPAIRING OF LOCOMOTIVE FRAMES.

A few years ago the wrought iron frames that have done so well for half a century were universally used. The failure of these was of rare occurrence, and was easily repaired in the blacksmith shop. To-day we have the low carbon cast-steel frame with all its imperfections. Another innovation is the welding of broken frames on the engine with oil for fuel, or with aluminum thermit.

Evidently the steel frame will be the frame for the future, for the reason that it can be produced much cheaper than wrought-iron forged frames. Future developments may bring the steel frame to such a standard that it will resist the strain to which it is subjected as well as the forged wrought-iron frame. From my point of view and the many failures that have come to my notice in the past two years, the steel frame has not yet reached the standard that the wrought-iron frame has. Many of the steel frames break at the intersection of the pedestal to the back bone of the frame where the main driving axle is located. As this failure often takes place with our largest engine frame, it is evident that the severest strain comes at this point, and it cannot be expected that an ordinary weld at this point will be stronger than the original solid material. When a broken steel frame is placed in the blacksmith shop, the best method practical to strengthen this portion of the frame should be adopted, regardless of extra expense. The method adopted in the Southern Pacific shops is to forge a new piece of the best quality of iron and cut out the defective portion; weld in a new "T" piece with the fiber flowing in the direction of the strain to which this portion is subjected. By this method we have to make three welds. This may look like a roundabout way of repairing the fracture. The object is to get a sound piece of iron at the point where failures continually occur in the steel frame. The method adopted for welding the new piece into the steel frame is first to weld a piece of iron about an inch thick on to the different ends of the frame at the proper angle to receive the V-shaped piece. By this method we have for our main welds iron to iron to receive the V-shaped piece.

Recently we have been changing many of our compound

*From a paper read by Mr. S. Uren before the National Railroad Blacksmiths' Association.