

can shut off the flow of combustion gases entirely when no superheat is desired or when the load goes off.

This arrangement makes it unnecessary to flood the superheater and avoids accumulation of mud and scale in the tubes. By setting the damper at different positions up to the full opening any desired degree of superheat may be obtained. The damper may be regulated by hand from the front of the boiler or automatically by a simple automatic damper control installed in conjunction with the superheater. With this equipment the temperature of the superheat is controlled to within 50 deg. of any desired figure as shown by actual results obtained in installations of this type.

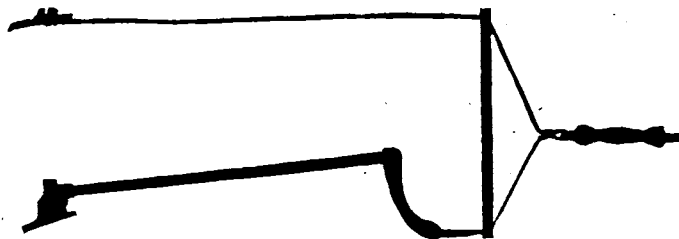
OVERHEAD CONSTRUCTION ON 2400-VOLT BUTTE, ANACONDA & PACIFIC RAILWAY

Overhead construction in connection with the electrification of the Butte, Anaconda & Pacific Railway, the first road in this country to be electrified for operation on as high a voltage as 2400 volts direct current, involves a number of noteworthy features. As described in the *ELECTRIC RAILWAY JOURNAL* for Feb. 10, page 241, the section of the road to be equipped lies between Butte and Anaconda, Mont., and comprises about 30 miles of main-line single track, the entire single-track mileage, including the sidings, yards, smelter tracks, etc., approximating 114 miles. Of this a total of 90 miles is now being electrified, and the remaining 24 miles, embracing the mine tracks on Butte Hill, minor sidings, etc., will continue to be operated by steam, although it is probable that the entire system will be electrified at an early date. The electrification has been designed and the apparatus is being furnished throughout by the General Electric Company.

Flexibility is to be the essential characteristic of the overhead conductor system. A special type of flexible catenary trolley suspension will be used over the larger part of the road, while direct suspension will be employed over some of the sidings and smelter tracks. Single No. 0000 copper trolley wire is to be used throughout, and single 1/2-in. galvanized-steel messenger cable will be strung for the catenary suspension, which will be supported every 150 ft. by side brackets on the main line and by cross-span construction in the yards.

Numerous yards are to be electrified. At many points in the yards six or eight tracks will have to be crossed, and the span wire will be supported in turn by a catenary cross span. In one place it will be necessary to span twelve tracks, which will be accomplished by using a third pole between the eighth and ninth tracks. All cross-span and bracket construction will be mounted on wood poles.

The cross spans, guys and anchors are to be insulated for 2400 volts by wood-strain insulators having a 12-in. break between the metal ends, this break distance having been



Flexible Pull-Off for Contact Wire on Curves

determined from tests made by the Butte, Anaconda & Pacific Railroad as being suitable for its particular conditions. The insulators are made of selected second-growth hickory, oil-impregnated and finished with transparent varnish. The metal end caps are protected from corrosion by sherardizing. Insulation where bracket construction exists is provided by porcelain insulators 3 1/2 in. high by 4 1/2 in.

in diameter. The small portion of the line where the ordinary method of direct suspension from side brackets is employed will be insulated for 2400 volts by wood-strain insulators.

The catenary system to be installed will have eleven points of suspension between the messenger cable and the trolley wire within the 150-ft. pole spacing on tangent track, the resultant distance between hangers averaging 13.6 ft. Between the messenger and the trolley wire the deflection will measure 28 in. at the points of support and 8 in. at the center of the span.

In order to provide great flexibility special hangers will be used. These are designed with extra long loops, so that at all times the rise of the trolley wire will be limited only by the upward pressure of the pantograph collector. The hangers consist of two duplicate malleable-iron castings riveted to the ends of a 1/8-in. x 5/8-in. steel strap, which loops over the messenger cable, and the malleable clamps are fastened to the trolley wire by a single bolt in one operation.



Hanger for Contact Wire

Flexibility is also obtained on large radius curves, which will be taken at reasonably high speed, by the use of specially designed flexible pull-offs, consisting of separate messenger and trolley clamps with an extended yoke to provide necessary clearance for the collector. The messenger and trolley wires are maintained in their proper positions by a strut located approximately 3 ft. from the wires. These new extended yoke trolley pull-offs will be used not only on the main line but also on the direct suspension construction to provide clearance for the collector. In the yard construction ordinary rigid pull-off hangers connecting the messenger cable and trolley wire will be employed. All metal parts subject to corrosion are protected by sherardizing.

Flexibility at the anchor points is obtained by overlapping the adjacent ends of the trolley wires for 150 ft., the end of each wire being anchored independently. The particular advantage of this method of anchoring lies in the opportunity to remove slack in the trolley wire by turnbuckles placed near the anchorage points. A special splicer for connecting the ends of the trolley wire and the anchor cable has been designed with excess mechanical strength.

Two methods of sectionalizing the line will be used, in neither of which is the supply of power interrupted as the collector passes from one section to another. For main-line high-speed operation the overhead construction is arranged so that the ends of the section overlap and are anchored and insulated independently. These parallel wires are spaced 12 in. apart, which distance is bridged by the pantograph collector.

For side lines and yard work a section insulator provided with 24 in. of wooden insulation on the runway is to be used. Wooden side bars carrying overlapping ends of the adjacent sections constitute the trolley circuit in this case, thus assuring non-interruption of energy.

At several points where crossings of the 2400-volt line and 600-volt lines occur on grades local conditions are encountered which permit dead sections on the lines, and this allows the cars on both roads to coast over the crossing. Under other conditions it is necessary to provide a commutating zone, which is energized by means of a double pole switch from the particular circuit upon which it is desired to operate the car. For the 2400-volt circuit it will also be necessary to provide a protecting zone of sufficient length to eliminate short-circuiting from a rear pantograph, through the common busbar and the front pantograph, to the commutating zone when the switch might be thrown to the 600-volt line.