

# LOCOMOTIVE VALVES AND VALVE GEARS

WITH A SPECIAL TREATISE ON VALVE SETTING

AN EXPLANATION OF THE CONSTRUCTION AND ACTION OF THE PLAIN  
SLIDE VALVE, THE PISTON VALVE AND THE GEARS WHICH  
OPERATE THEM, AS APPLIED TO LOCOMOTIVES

BY

JACOB H. YODER, B.S., M.E.,

*Supervisor, Apprentices, Pa. R. R. Co., Altoona, Pa.;*  
*Member Nat. Assoc. Corporation Training; Associate A.S.M.E.*

AND

GEORGE B. WHAREN, B.S., M.E.,

*Formerly Instructor, Mechanical Engineering, University of Pennsylvania;*  
*Associate Mem. A. S. M. E.; Formerly Machinist Apprentice*  
*Lehigh Valley Railroad Co.; Instructor of Apprentices,*  
*American Locomotive Co. and Pennsylvania Railroad Co.*

---

SECOND PRINTING—CORRECTED

---



NEW YORK  
D. VAN NOSTRAND COMPANY  
EIGHT WARREN STREET  
1921

## THE JOY VALVE GEAR

The Joy valve gear is of the radial type, but employs no eccentrics. Arm 1, Fig. 210, is pivoted to the guide yoke at fixed point *D* and connected to arm 2 at *C*. The other end of arm 2 is fastened to the main rod at *A*. Arm 3 connects with arm 2 at *B*, and is pivoted on a link-block at *F*, extending beyond to *G*. The valve rod is actuated by means of arm 4, one end of which is attached to the valve stem and the other to arm 3. The link

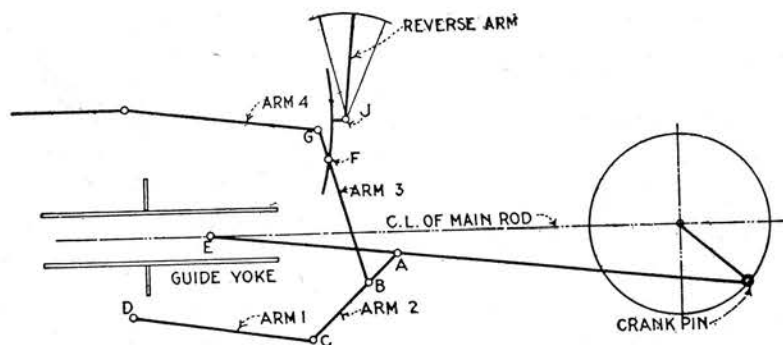


Fig. 210.—Line Diagram of Joy Valve Gear.

block is in the center of the link when the engine is on dead center. It is evident, therefore, that the valve opening on dead center (or in other words, the lead), is dependent upon the ratio between the lengths of arm 3. The Joy gear therefore gives constant lead.

The link is pivoted at *J* and controlled by the reversing arm. The link-block, carrying the arm 3, moves up and down in the link. As this link is tipped in either direction it controls the direction of motion of the valve and consequently the admission of steam to either end of the cylinder. Fig. 210 shows the arrangement of the Joy gear as used for outside admission valves. Fig. 211 illustrates the application of the Joy gear to a Philadelphia and Reading three-cylinder engine in which the inside cylinder is equipped with the Joy gear and inside admission valves. Fig. 212 is a line drawing of this three-cylinder Atlantic type locomotive. The main rod for

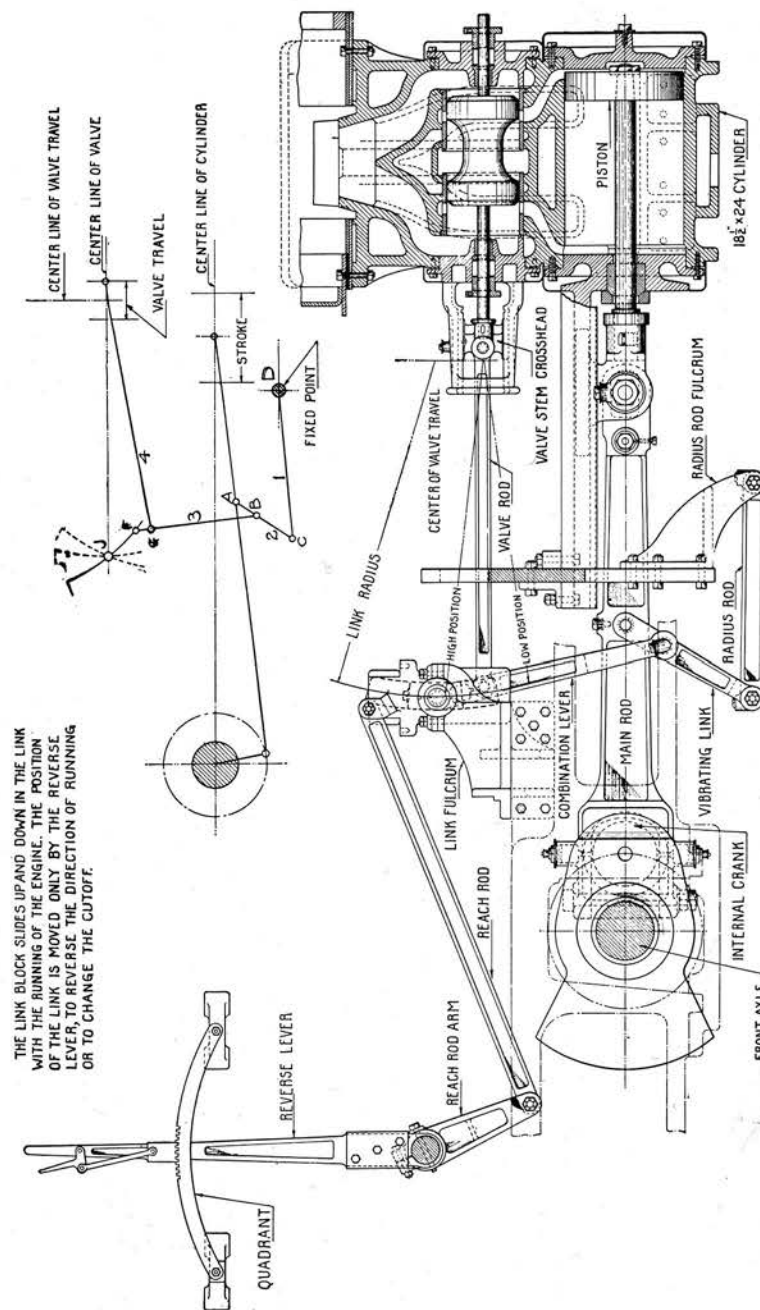


Fig. 211.—Joy Valve Gear Applied to an Atlantic Type, Three-cylinder Locomotive.

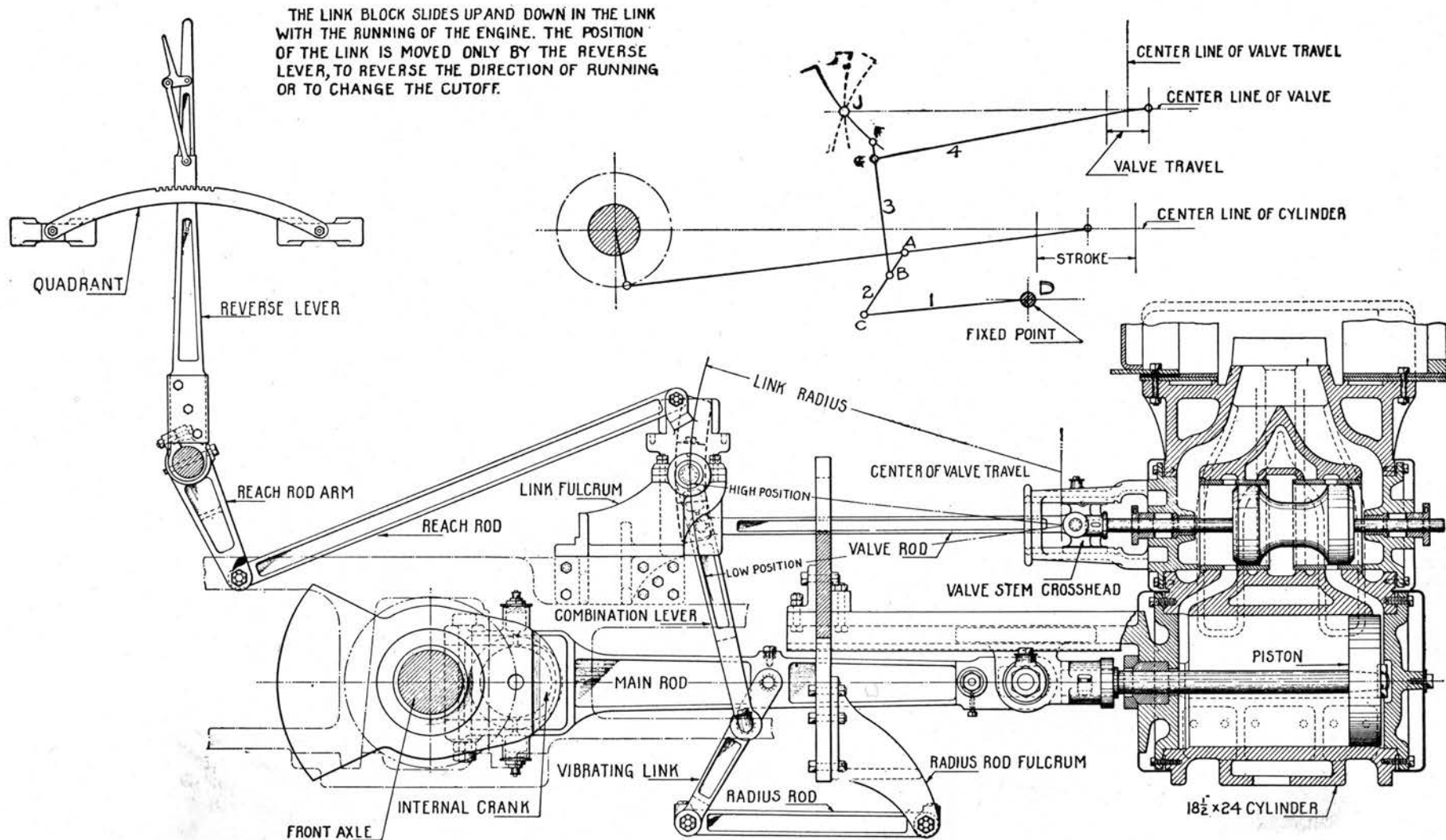


FIG. 211.—Joy Valve Gear Applied to an Atlantic Type, Three-cylinder Locomotive.

the inside cylinder connects to the front driving axle. The two outside cylinders have Walschaert valve gears to operate their valves. The eccentric

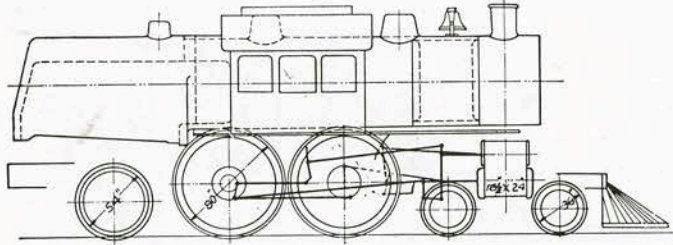


FIG. 212.—Three-cylinder, Simple Engine, Using Joy Valve Gear on Inside Cylinder and Walschaert Valve Gear on Outside Cylinders.

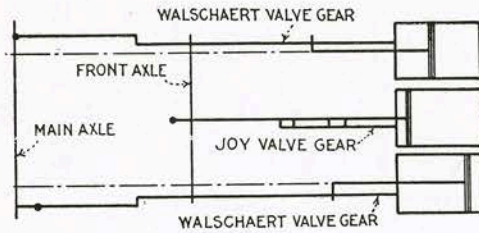


FIG. 213.—Arrangement of Cylinders and Valve Gears, Three-cylinder Engine.

motion for the Walschaert gears is taken from the main driving axles. Fig. 213 is a diagram illustrating the arrangement of cylinders and valve gears.