

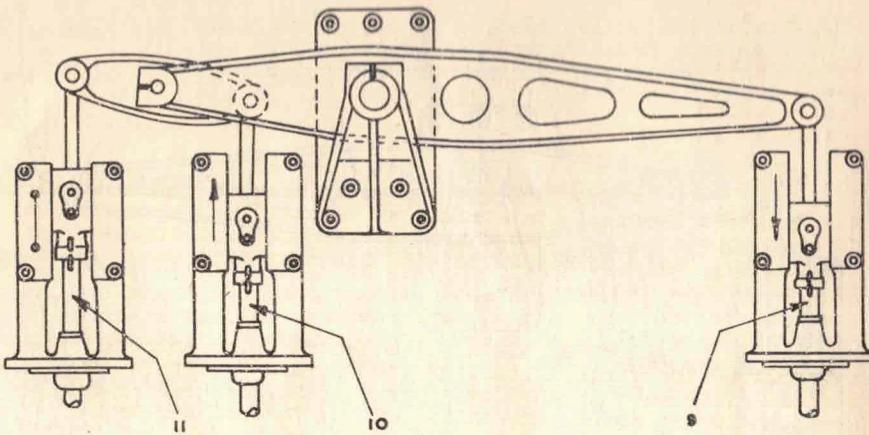
TRADE THEORY

FIG. 52-12.

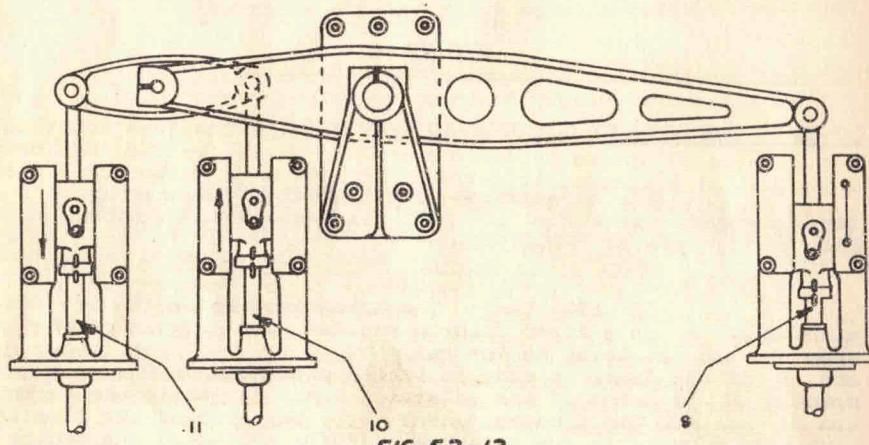
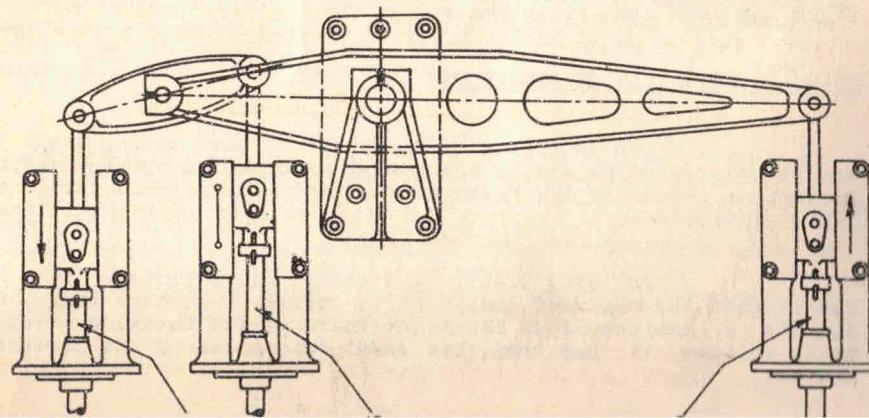


FIG. 52-13.

TRADE THEORY

In FIG. 52-12, valve spindle 11 has reached the forward limit of its travel. At this stage, spindle 9 has completed about two-thirds of its backward stroke, while the centre spindle 10, actuated by the conjugating gear, has completed approximately one-third of its forward stroke.

In FIG. 52-13, valve spindle 9 has reached the backward limit of its stroke, while spindle 11 has moved through approximately one-third of its backward stroke. At this stage, the centre spindle 10 has completed about two-thirds of its forward stroke.

In FIG. 52-14, the centre valve spindle 10 has reached the forward limit of its travel. At this stage, spindle 11 has completed two-thirds of its backward stroke, and spindle 9 about one-third of its forward stroke.

During the remaining half revolution of the crank the cycle will be repeated, but with the valves moving in the opposite direction.

52-22 DISADVANTAGES OF THE GRESLEY MOVEMENT

The Gresley movement, although it gives satisfactory service at speeds suitable for heavy goods traffic, has been found, at high speeds, to cause considerable disturbance in the steam distribution to the centre cylinder.

This error is due, primarily, to the whip and back lash developed in the transverse lever, the effect of which is to cause considerable over-travel of the valve. Moreover, due to the alignment of the cylinders, and to the fact that the pivot pin 3, FIG. 52-11, and the extension link pin 8 of the transverse lever move in arcs of different radii instead of in a straight line, the movement of the centre valve is not correctly synchronised with that of the crank.

Certain modifications in design have been made to offset this latter error, particularly as regards the length of the arms of the floating lever, but these alterations do not correct faults in steam distribution created by whip of the lever.

52-23 CONJUGATING MECHANISM OF D58 CLASS ENGINES

To ensure satisfactory service under all operating conditions, the conjugating mechanism of the D58 class engine has been designed to overcome the disadvantages inherent in the Gresley transverse lever movement.

The arrangement of the mechanism controlling the centre valve of the D58 class engine is shown in FIG. 52-15. This mechanism differs from the Gresley conjugating link in that a rocking shaft is substituted for the large transverse rocking lever.

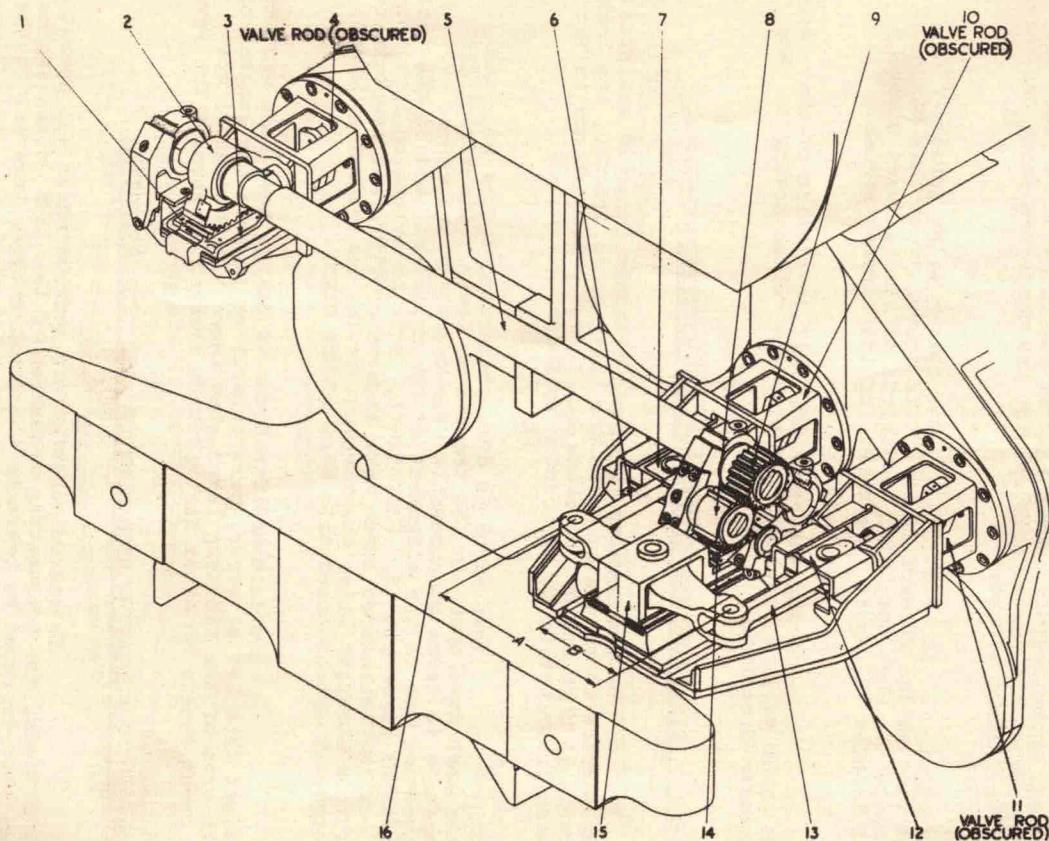


FIG. 52-15

Geared racks 1 and 14, which are attached, respectively, to the tail rod crosshead 3 and the right hand valve, and to the conjugating crosshead 15 in which the floating lever 16 is seated.

The transverse shaft 5 is supported by bearings across the front of the engine, and carries the gear quadrant 2 and pinion 9, the former meshing with the rack 1, and the latter, through the idler gear 8, engaging the rack 14.

As in the Gresley gear, the floating lever 16 is coupled to the left hand and centre valve rod crossheads 12 and 7 by means of the tension links 13 and 6 respectively.

#### 24 PRINCIPLE OF OPERATION

When the engine is in motion, the valve rod 4, FIG. 52-15, acting through the rack and gear sector 2, produce a semi-rotary movement of the transverse shaft 5 in its bearings. This movement of the shaft is transmitted through the pinion 9 and idler gear 8 to the rack 14, causing the latter, and with it the conjugating crosshead to reciprocate in the guideways.

Since the gear sector 2 corresponds to a gear of 42 teeth, and the pinion 9 has 18 teeth, the longitudinal movement of the conjugating crosshead will be half that of the valve

This movement of the conjugating crosshead, in conjunction with the reciprocating movement of the left hand valve rod 11, will, in turn, cause the floating lever 16 to oscillate and move the centre valve rod 10 backward and forward in the steam chest. Since the dimensions A and B of the floating lever are in the ratio of 2 : 1, the travel of the centre valve will be equal to that of the outside valves.

#### 52-25 SETTING THE VALVES OF A THREE CYLINDER LOCOMOTIVE

Before attempting to set the inside admission valves of D57 and D58 class engines, the "dead centre" positions of all three cranks and the port opening positions of all three valves must be located. To simplify setting, it is usual to mark the dead centre positions of the centre crank on the outer face of one of the driving wheels.

The valves of the outer cylinders are set first by making any necessary adjustments to the Walschaert motion gears in the manner already described, without reference to the movement of the centre valve.

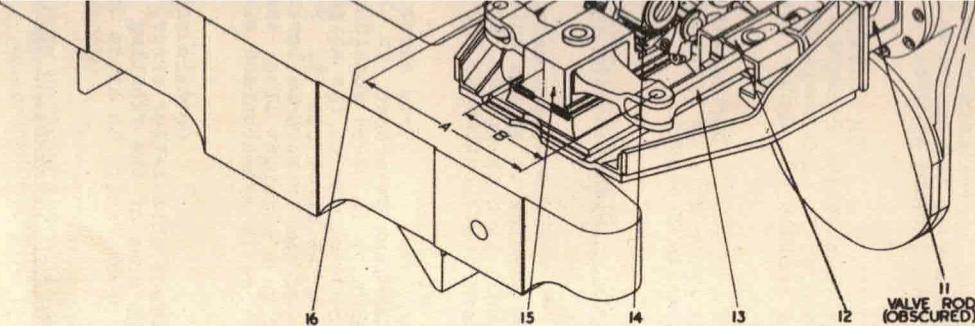


FIG. 52-15

Geared racks 1 and 14, which are free to move longitudinally in special guideways, are attached, respectively, to the tail rod crosshead 3 of the right hand valve, and to the conjugating crosshead 15 in which the floating lever 16 is pivoted.

The transverse shaft 5 is supported in bearings across the front of the engine, and carries the gear quadrant 2 and pinion 9, the former meshing with the rack 1, and the latter, through the idler gear 8, engaging the rack 14.

As in the Gresley gear, the floating lever 16 is coupled to the left hand and centre valve rod crossheads 12 and 7 by means of the extension links 13 and 6 respectively.

#### 52-24 PRINCIPLE OF OPERATION

When the engine is in motion, the valve rod 4, FIG. 52-15, acting through the rack 1 and gear sector 2, produce a semi-rotary movement of the transverse shaft 5 in its bearings. This movement of the shaft is transmitted through the pinion 9 and idler gear 8 to the rack 14, causing the latter, and with it the conjugating crosshead 15, to reciprocate in the guideways.

Since the gear sector 2 corresponds with a gear of 42 teeth, and the pinion 9 has 21 teeth, the longitudinal movement of the conjugating crosshead will be half that of the valve rod.

This movement of the conjugating crosshead, in conjunction with the reciprocating movement of the left hand valve rod 11, will, in turn, cause the floating lever 16 to oscillate and move the centre valve rod 10 backward and forward in the steam chest. Since the dimensions A and B of the floating lever are in the ratio of 2 : 1, the travel of the centre valve will be equal to that of the outside valves.

#### 52-25 SETTING THE VALVES OF A THREE CYLINDER LOCOMOTIVE

Before attempting to set the inside admission valves of D57 and D58 class engines, the "dead centre" positions of all three cranks and the port opening positions of all three valves must be located. To simplify setting, it is usual to mark the dead centre positions of the centre crank on the outer face of one of the driving wheels.

The valves of the outer cylinders are set first by making any necessary adjustments to the Walschaert motion gears in the manner already described, without reference to the movement of the centre valve.

52-26 SETTING THE CENTRE VALVE OF D57 CLASS ENGINES

To equalise the leads of the centre valve, the engine should be placed in full fore gear and the following procedure adopted:-

- (a) Set the centre crank on front and back dead centres, in turn, and scribe arcs on the valve spindle with the standard valve trammel.
- (b) Determine the "leads" in these positions by measuring the distance between these arcs and the corresponding port opening marks.

If, for example, leads of  $\frac{1}{16}$  in. are required at each end on engines fitted with the Gresley conjugating gear, and it is found that the indicated leads are:-

$$\text{Front port} = \frac{3}{32} \text{ in.} \quad \text{Back port} = \frac{1}{32} \text{ in.}$$

then it will be necessary to equalise the leads by:-

- (i) adjusting the valve check nuts so that the valve is moved backward  

$$\frac{1}{2} \left[ \frac{3}{32} - \frac{1}{32} \right] = \frac{1}{32} \text{ in.}, \text{ relative to its spindle; or}$$
- (ii) lengthening the extension link 4, FIG. 52-11, of the centre valve  $\frac{1}{32}$  in.; the leads will then be  $\frac{1}{16}$  in. at each end.

NOTE:- When altering the length of the link, it will be noted that the centre valve will be moved toward the back of the steam chest by an amount equal to the alteration made. This will occur regardless of whether the change in length is made in the centre link or in one of the outside links. If more than one link is altered, the correction of the centre valve will equal the sum of the alterations made.

If any subsequent alteration is made in the settings of either of the outside valve gears, it will be necessary to recheck the leads of the centre valve and make any necessary adjustments.

52-27 SETTING THE CENTRE VALVE OF D58 CLASS ENGINES

The gears and racks of the D58 class engine should be aligned in their correct relative position as follows:-

- (a) Set the right hand valve in mid-position and engage the gear sector and right hand rack so that the marked tooth of the rack engages the marked space on the gear sector.
- (b) Repeat operation (a) and engage the similarly marked teeth or spaces of the left hand gear, the idler, and the conjugating crosshead rack.
- (c) Notch up the reversing gear  $\frac{1}{2}$  turns from full fore gear position. Set centre crank on front and back centre in turn, and check the leads in this position with the standard valve trammel.
- (d) Make any adjustment necessary to equalise the leads by varying the position of the conjugating crosshead rack. This is done by releasing the clamping nut of the rack and wedge, and adjusting the thickness of the packing pieces provided.

It should be noted that the centre valve will be moved twice the amount of any correction made; thus, to increase the back port opening by  $\frac{1}{32}$  in., it will be necessary to move the valve backward on its seat by reducing the thickness of the packing piece  $\frac{1}{64}$  in. As on D57 class engines, provision is also made for adjusting the valve on its spindle when required.

NOTE:- When making any corrections to the valve gear of an engine out of steam, always make a suitable allowance for subsequent longitudinal expansion of the valve spindles. A final recheck should be made when the engine is under steam.