April 21, 1931. J. C. BURFORD 1,802,233

STEAM ENGINE

Filed May 11, 1927

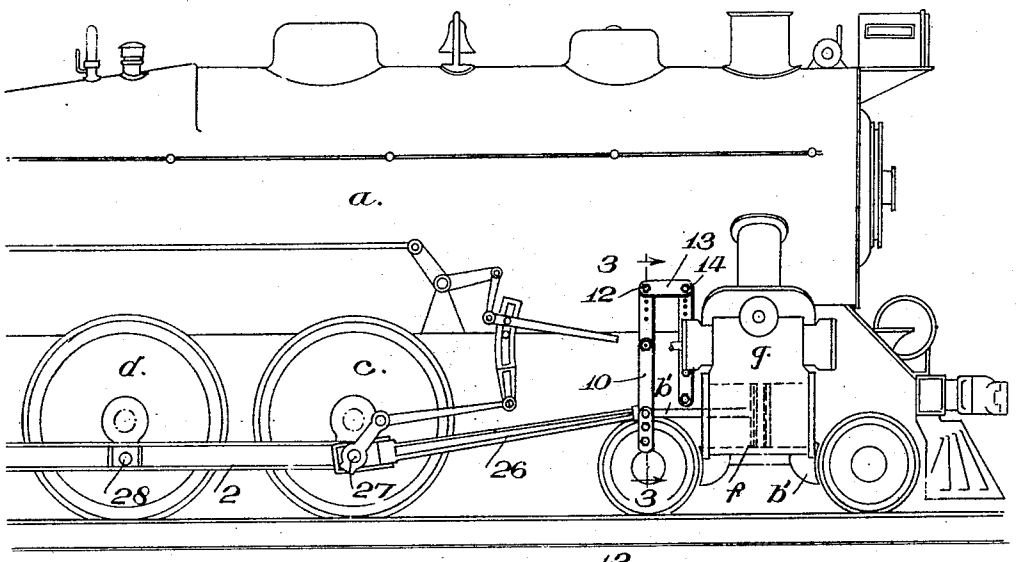

Fig. 1.

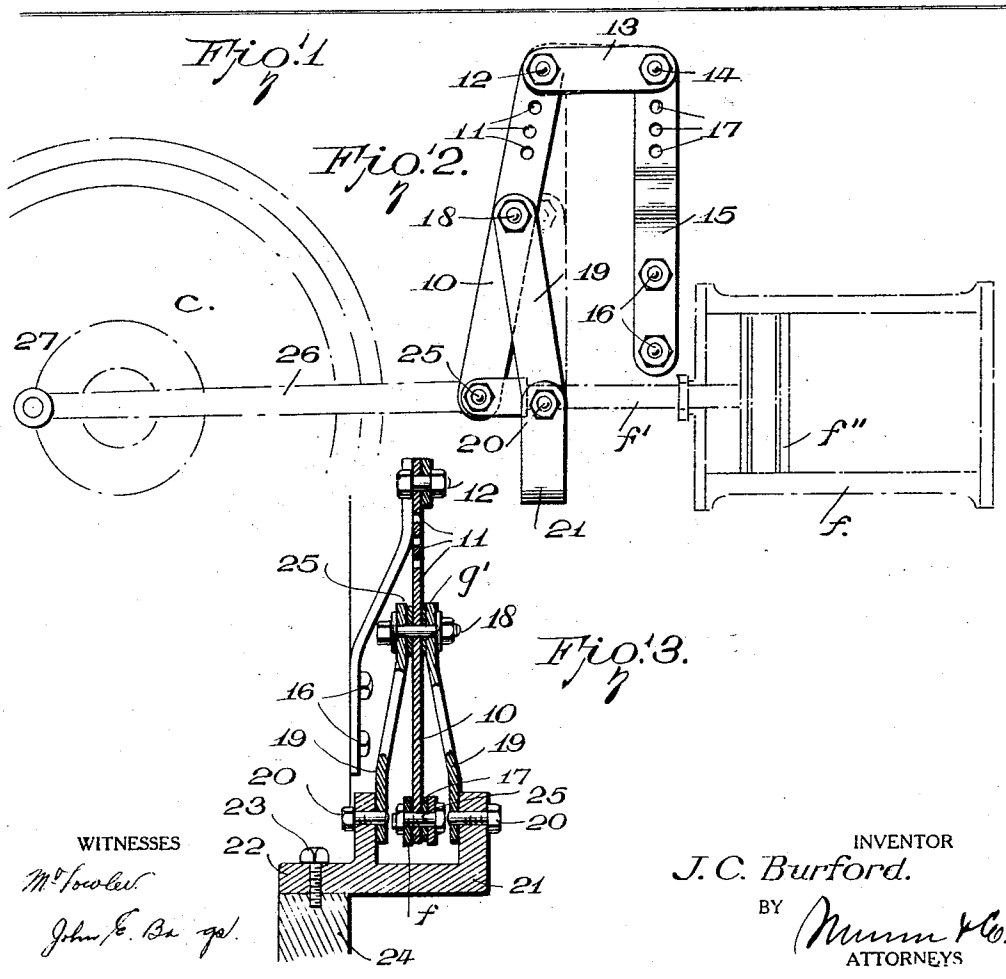

Fig. 2.

Fig. 3.

WITNESSES

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STEAM ENGINE

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This invention relates to improvements in steam engines generally, and more particularly to those types of such engines embodying power transmission mechanisms for translating a reciprocating movement or motion into a rotary movement or motion, such as obtained in locomotives and the like.

In a large number of steam engines, and particularly locomotives, it has been the practice to make use of cross heads mounted for to and fro sliding movement in guideways, formed by spaced guide members arranged in parallel relation one with respect to the other and between the reciprocating power element and the driven rotary element, with the cross head coupled to these elements for the purpose. Aside from the added cost of material used in the manufacture of these cross heads and guides and the labor necessary for their installation, the cost of upkeep, repair and replacement of the same forms an important item of expense in railroad rolling stock operation and maintenance. This expense is extremely excessive in the upkeep, repair and replacement of the cross heads and guides as aforesaid, by reason of these parts being generally exposed at all times to the weather, and, consequently, for the accumulation on the guides of dirt, grit, etc., which, in addition to the ordinary wear on the same and the cross heads, due to the enormous amount of friction created during the rubbing or sliding movement of the latter on the guides as to quickly abrade or otherwise seriously damage the abutting surfaces and to an extent to render the life of the parts of comparatively short duration.

It is therefore the principal object of the present invention to provide for gear or mechanism of an extremely simplified and refined construction and arrangement of parts, wherein the usual cross heads and guides are eliminated from steam engine structures, and consequently the heavy expense in connection therewith avoided, without in any way impairing the ordinary high degree of efficiency in operation of the engine and particularly locomotives.

Another important object of the invention is to provide for a gear or mechanism of the character hereinbefore mentioned, and one having a low initial cost in labor and material, both in the manufacture and installation, as well as corresponding low cost in upkeep, repair, or replacement of the parts thereof.

A further object of the invention is to provide for a gear or mechanism as hereinbefore characterized, and which is adapted to be readily and easily installed on known types of steam engine and with equal facility on both used engines, after the removal of previously installed cross heads and guides therefrom, and new engines from which the cross heads and guides have been eliminated in favor of the proposed new gear or mechanism.

With the foregoing and other equally important objects and advantages in view, the invention resides in the certain new and useful construction and arrangement of parts as will be hereinafter more fully described, set forth in the appended claims and illustrated in the accompanying drawing, in which:—

Figure 1 is a side elevation of a locomotive showing a practical application of the gear or mechanism thereto,

Fig. 2 is an enlarged side elevation of the gear mechanism as operatively connected to the piston rod and the connecting rod of an engine, with the engine cylinder shown in longitudinal section, and

Fig. 3 is a vertical section taken on the line 3—3 of Fig. 1.

Referring to the drawing, wherein similar characters of reference designate corresponding parts in the several views thereof, *a* indicates generally a conventional form of locomotive; *b'* the forward truck; *c* and *d* two of the drivers at one side of the locomotive; 2 the side rod connecting the crank pins of the drivers; *f* the engine cylinder; *f'* the piston rod projecting rearwardly from the engine cylinder and connected to the head or piston *f''* within the latter; and *g* the steam chest housing the slide valve controlling the operation of the piston.

The embodiment of the invention, as illustrated, comprises a long bar or rod 10 (here-

inafter called the transmission lever), having one end portion beyond its center formed with a series of longitudinally spaced apertures 11 for the adjustable engagement of the same on a pivot 12 mounted in one end of a bar or lever 13. The opposite end of the short lever 13 is pivoted, as at 14 to one end of a supporting member or bracket 15 which is to be secured in proper and necessary position on a stationary part of the locomotive by means of bolts or other suitable fastenings 16. The end portion of the bracket 16, to which the short lever 13 is pivoted, is also provided with a series of longitudinally spaced apertures 17, corresponding in number to that of the apertures 11 on the transmission lever 10, and are complemental thereto, whereby the short lever 13 may be adjusted thereon in accordance with its adjusted connection with the lever 10. This adjustment permits of the effective lengthening or shortening of the arc of swinging movement of the transmission lever 10, as will be necessary in its application to different sizes and types of steam engines or locomotives.

An intermediate part of the transmission lever 10 is provided with a pivot 18, which connects thereto the upper end of a yoke made up of two bars or arms 19, of equal length, and which are bent on outwardly diverging lines, away from the pivot connection 18, in a manner to provide sufficient clearance therebetween for the lower end of the lever 10 in its oscillating movement on the pivot 18. The ends of the diverging portions of the bars or arms 19 are engaged on pivots 20 carried in the opposite legs of a substantially U-shaped bracket 21. This bracket 21 is provided with an offset portion 22 for the engagement therewith of a suitable fastening 23 by means of which the bracket is to be secured in proper position on a stationary part 24 of the locomotive.

The end of the transmission lever 10, opposite to its end engaged on the pivot 12, is also provided with a pivot 25 by means of which this end of the same is attached to the adjacent ends of the piston rod f' and a connecting rod 26. The opposite end of the connecting rod 26 is pivotally engaged on the crank pin or eccentric 27 of the driver c, whereby, when the piston f'' and the piston rod f' are reciprocated, the motion thereof will be transmitted to and through the transmission lever 10 to the connecting rod 26, whereby, by virtue of the oscillating or rocking movement of the lever 10 and the rod 26, these motions will be translated into a rotary motion at the crank or eccentric 27 of the driver c. This rotary motion of the driver c, will, of course, be imparted to driver d, through the medium of the side bar 2 connecting the crank or eccentric 28 of the latter with the crank or eccentric 27 of the driver c.

In the installation of the gear or mechanism thus provided, the same will be mounted in the vertical position as shown, or otherwise, depending upon the relative positions of the engine parts with which it is to cooperate, and whether the power transmission of a particular engine is horizontal, as in the present instance, vertical or at an angle between the horizontal or vertical. In any case, the pivots 14 and 20 are stationary points of connection of the gear or mechanism, and the pivots 12, 18 and 25 are moving parts of the same.

In the operation of the gear or mechanism, and referring particularly to Fig. 2, the moving pivot point 25 will move in a substantially straight line throughout its distance of travel, coincident with and corresponding to the length of travel of the piston f'' in the engine cylinder f and in both directions of its reciprocating movement with the result that the latter motion will be transmitted to the connecting rod 26 with an equal degree of accuracy and efficiency to that obtained in the use of the more expensive and massive cross head and guide-way construction, which the present invention seeks to render obsolete and to otherwise eliminate. This straight line travel of the moving pivot 25, of the transmission lever 10, is effected by the stationary pivot 20, of the yoke 19, being disposed in the plane defined by the path of movement of the moving pivot 25, and the moving pivot 18 on the transmission lever 10, which latter pivot 18 and the moving pivot 12, at the other or upper end of the transmission lever 10, move in an arc relatively with the swing of the lower end of the lever 10 to either side of its vertical or alined position with the yoke 19. In other words, the length of the lower portion of the transmission lever 10 is maintained uniform at all times and throughout the straight line travel of the same by the moving of the fulcrums or pivot points 12 and 18 in the arc defined by the oscillating movement of the yoke 19 on its stationary pivot 20, and which compensates for the greater oscillating movement of the lower end of the transmission lever 10. It is also obvious that in this arrangement and operation of the device, the bodily movement of the fulcrums 12 and 18 in the described arc, is in absorption of and compensation for the oscillating movement which would otherwise be communicated to the pivot point 25 by the oscillations of the crank connected rod 26.

Without further description, it is thought that the features and advantages of the invention will be readily apparent to those skiled in the art, and it will of course be understood that changes in form, proportion and minor details of construction may be resorted to, without departing from the spirit of the invention or its scope as claimed.

Having thus fully described the invention, what is claimed is:—

1. A gear for stream engines and the like comprising a bracket supported vertically at one side of an engine, an angularly disposed link pivoted at one end to the upper end of said bracket, a transmission lever having the upper of its ends pivoted to the other or free end of said link, a second bracket supported from the engine, a yoke pivotally connected at its lower end to said second bracket and at its upper end to an intermediate point on said transmission lever, and a pivot connecting the other or lower end of said transmission lever commonly to the adjacent ends of the piston and connecting rods of the engine whereby the last-mentioned end of said lever will travel in a substantially straight line coincident with the straight line travel of the piston.

2. The combination with a steam engine or the like including a cylinder, a piston and a connecting rod, of a bracket supported vertically on the engine and immediately adjacent an end of the cylinder, an angularly disposed link pivoted at one end to the upper end of said bracket, a transmission lever pivoted at its upper end to the other or free end of said link, means for adjusting said link relative to said bracket and to the connected end of said transmission lever, a second bracket supported on the engine immediately adjacent to and inward of the extreme outer limit of travel of the rod of the piston, a yoke pivotally connected at its lower end to said second bracket and at its other or upper end to the center of said transmission lever, and a pivot connecting the other or lower end of said transmission lever commonly to the adjacent ends of the piston and connecting rods of the engine, whereby the last mentioned end of said lever will travel in a substantially straight line coincident with the straight line travel of the piston.

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