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COMPLETE SPECIFICATION.

Improvements in or relating to Articulated Steam Locomotives.

We, BEYER, PEACOCK & COMPANY LIMITED, a British Company, of Gorton, Manchester, in the County of Lancaster, and JAMES HADFIELD, a British Subject, of The White House, Pinfold Lane, Romiley, in the County of Chester, do hereby declare the invention, for which we pray that a patent may be granted to us and the method by which it is to be performed, to be particularly described in and by the following statement :—

This invention relates to steam locomotives and particularly to articulated steam locomotives, that is locomotives in which a boiler unit is pivotally supported at its ends between two engine units.

The primary object of the invention is the provision of an improved articulated locomotive which will be capable of operating in places where boiler feed water is not available over long sections of the track.

The invention consists broadly of an articulated locomotive wherein the exhaust from the cylinders of each engine unit leads to alternative exhaust conduits which lead respectively to the blast pipe of the boiler unit and to a point connected to, or for connection to, the steam input of a condenser, valve means being provided for opening or closing the exhaust steam flow to said blast pipe and for opening or closing the exhaust steam flow to said point.

In order that the invention may be the more clearly understood an articulated locomotive system in accordance therewith will now be described, reference being made to the accompanying drawings wherein :—

Figure 1 is a side elevation of the system, the figure being separated into two parts of which the top part represents the left hand portion and the bottom part the right hand portion of the system.

Figure 2 is a plan of the system, this figure also being separated into two parts of which the top part represents the left hand portion and the bottom part the right hand portion of the system.

Figure 3 is a plan to a larger scale, partly in section, illustrating the steam exhaust system from the power units of the articulated locomotive.

Referring to the drawings the system illustrated comprises an articulated locomotive of known type characterised by the provision of two steam driven power units A and a common boiler unit B which is pivotally connected between said two power units. Each power unit A comprises a chassis 1 mounted on track wheels 2 and carrying steam cylinders 3 from which at least some of the track wheels are driven. The chassis 1 of each power unit also carries either a water tank 5 or a fuel tank 4. The boiler unit B comprises a boiler 6 mounted on a chassis 7. Said chassis 7 has no track wheels but is supported solely by the chassis 1 of the power units, said chassis 7 being mounted at its ends on said chassis 1 by means of pivot mountings 8 which permit of pivoting about vertical axes 9—9. The cylinders 3 are supplied with steam from the boiler 6 by way of steam pipes 10.

Articulated locomotives as so far described are quite well known. Hitherto in such articulated locomotives it has been the practice for the steam, after performing useful work in the cylinders, to be conveyed by suitably arranged exhaust pipes to a blast pipe arranged in the smoke box at the front end of the boiler, and to be discharged through the blast pipe nozzle and up the chimney thereby creating a partial vacuum in the smoke box which induces the products of combustion to pass through the boiler flue tubes and air to pass into the firebox.

In the present system provision is likewise made for discharging the exhaust steam through the blast pipe. Thus the exhaust ports 3*a* from the cylinders 3 of each power unit A are in communication with branch

[*Price* 2*s.* 8*d.*]

pipes 11 which merge into a trunk pipe 12, and the trunk pipes 12 from the two power units lead to the blast pipe 13. The branch pipes 11 of each power unit naturally lead in the usual way from the end of the cylinder block which is towards the boiler unit. In the present system however as best shown in Figure 3 the exhaust ports 3*a* from the cylinders of each power unit are also in communication with other branch pipes 14 which lead from the end of cylinder block which faces away from the boiler unit; these branch pipes 14 merge into a short longitudinal trunk pipe 15 which projects at the end of the power unit remote from the boiler unit. More particularly it will be seen that the exhaust ports 3*a* of each cylinder lead to a chamber 3*b*, the two chambers 3*b* being side by side between the cylinders. The branch pipes 11 lead from the respective chambers at one end, and the branch pipes 14 at the other.

Each trunk pipe 12 has in it adjacent to the branch pipes 11 a shut-off valve 16 actuated by a hand wheel 17, and each trunk pipe 15 has in it adjacent to the branch pipes 14 a shut-off valve 18 actuated by a hand wheel 19. Normally, when the articulated locomotive is operating on sections of the railway where adequate supplies of suitable water are available, the valves 18 are kept closed and the valves 16 open so that the exhaust steam flows from the cylinders 3 to the blast pipe 13 in the usual way.

If however the articulated locomotive is operating on sections of the railway where water is in short supply, or, if available, is not suitable for boiler feed water owing to the presence of impurities, then a condensing track vehicle C is coupled to one or each end of the articulated locomotive, and the adjacent pipe or pipes 15 is or are connected to the condensers of said condensing track vehicle or vehicles. The adjacent valve or valves 18 is or are opened and the adjacent valve or valves 16 shut and the exhaust steam from the cylinders of the power unit or units will accordingly flow to the condensers of the condensing track vehicle or vehicles where it will be condensed and be available again for use in the boiler. In the drawing, only one condensing track vehicle is shown coupled to the rear end of the articulated locomotive, but there might be one at the other end only, or one at each end.

More particularly each condensing track vehicle C has a chassis 20 mounted on track wheels 21 and having mounted on it a number of condenser units 22. The steam input to the condenser units 22 is by way of a longitudinal pipe 23 which projects from the end of the vehicle towards the power unit A in line with the pipe 15. The pipes 23 and 15 are connected together by means of a short flexible connection 24, and thus the passage from the cylinders 3 to the condenser units 22 is completed.

For returning the condensation of the condensing vehicles C to the boiler 6, the condensation, from the condensers 22 of each vehicle C flows to a longitudinal output pipe 25. This extends to the end of the vehicle adjacent to the power unit and is connected by means of a short flexible connection 26, to the near end of a longitudinal pipe 27 mounted on the adjacent power unit A and extending substantially the full length thereof. Said pipe 27 is connected at its other end by means of a short flexible connection 28 to the near end of a longitudinal pipe 29 mounted on the boiler unit, and said pipe 29 communicates by way of a branch pipe 30 with a feed pump 31 which returns the water to the boiler 6 by way of a pipe 32. The reference 33 designates a valve in the pipe 27 near the extremity thereof for closing said pipe when a condensing vehicle is not being employed.

When the exhaust steam is being discharged to the condensing vehicles, then alternative means will have to be provided in the smoke box of the boiler to provide the necessary draught to draw the products of combustion through the boiler flue tubes and to induce the necessary air into the fire box. This can be arranged in several ways such as by providing suitable jets of live steam from the boiler in place of the exhaust blast, or by providing steam driven fans.

In the arrangement illustrated the former way is adopted. Thus live steam is taken from the boiler 6 at 34 under control by a valve operated by a handle 35 in the driver's cab 36, and passes along a pipe line 37 to an annular jet 38 surrounding the outlet end of the blast pipe 13. From this annular jet the live steam is discharged in an upward direction and thus provides the necessary draught.

As stated above, in some cases it may be sufficient to have only one condensing vehicle C. This may be coupled at either end of the articulated locomotive. The exhaust steam from the power unit remote from the condensing unit would then be conveyed to the blast pipe 13 in the usual way and if this supplies insufficient draught the draught could be augmented by the means described above. By employing one condensing vehicle the consumption of water would be reduced by nearly one half.

What we claim is :—

1. An articulated locomotive wherein the exhaust from the cylinders of each engine unit leads to alternative exhaust conduits which lead respectively to the blast pipe of the boiler unit and to a point connected to, or for connection to, the steam input of a condenser, valve means being provided for opening or closing the exhaust steam flow to

pipes 11 which merge into a trunk pipe 12, and the trunk pipes 12 from the two power units lead to the blast pipe 13. The branch pipes 11 of each power unit naturally lead in the usual way from the end of the cylinder block which is towards the boiler unit. In the present system however as best shown in Figure 3 the exhaust ports 3*a* from the cylinders of each power unit are also in communication with other branch pipes 14 which lead from the end of cylinder block which faces away from the boiler unit; these branch pipes 14 merge into a short longitudinal trunk pipe 15 which projects at the end of the power unit remote from the boiler unit. More particularly it will be seen that the exhaust ports 3*a* of each cylinder lead to a chamber 3*b*, the two chambers 3*b* being side by side between the cylinders. The branch pipes 11 lead from the respective chambers at one end, and the branch pipes 14 at the other.

Each trunk pipe 12 has in it adjacent to the branch pipes 11 a shut-off valve 16 actuated by a hand wheel 17, and each trunk pipe 15 has in it adjacent to the branch pipes 14 a shut-off valve 18 actuated by a hand wheel 19. Normally, when the articulated locomotive is operating on sections of the railway where adequate supplies of suitable water are available, the valves 18 are kept closed and the valves 16 open so that the exhaust steam flows from the cylinders 3 to the blast pipe 13 in the usual way.

If however the articulated locomotive is operating on sections of the railway where water is in short supply, or, if available, is not suitable for boiler feed water owing to the presence of impurities, then a condensing track vehicle C is coupled to one or each end of the articulated locomotive, and the adjacent pipe or pipes 15 is or are connected to the condensers of said condensing track vehicle or vehicles. The adjacent valve or valves 18 is or are opened and the adjacent valve or valves 16 shut and the exhaust steam from the cylinders of the power unit or units will accordingly flow to the condensers of the condensing track vehicle or vehicles where it will be condensed and be available again for use in the boiler. In the drawing, only one condensing track vehicle is shown coupled to the rear end of the articulated locomotive, but there might be one at the other end only, or one at each end.

More particularly each condensing track vehicle C has a chassis 20 mounted on track wheels 21 and having mounted on it a number of condenser units 22. The steam input to the condenser units 22 is by way of a longitudinal pipe 23 which projects from the end of the vehicle towards the power unit A in line with the pipe 15. The pipes 23 and 15 are connected together by means of a short flexible connection 24, and thus the passage from the cylinders 3 to the condenser units 22 is completed.

For returning the condensation of the condensing vehicles C to the boiler 6, the condensation, from the condensers 22 of each vehicle C flows to a longitudinal output pipe 25. This extends to the end of the vehicle adjacent to the power unit and is connected by means of a short flexible connection 26, to the near end of a longitudinal pipe 27 mounted on the adjacent power unit A and extending substantially the full length thereof. Said pipe 27 is connected at its other end by means of a short flexible connection 28 to the near end of a longitudinal pipe 29 mounted on the boiler unit, and said pipe 29 communicates by way of a branch pipe 30 with a feed pump 31 which returns the water to the boiler 6 by way of a pipe 32. The reference 33 designates a valve in the pipe 27 near the extremity thereof for closing said pipe when a condensing vehicle is not being employed.

When the exhaust steam is being discharged to the condensing vehicles, then alternative means will have to be provided in the smoke box of the boiler to provide the necessary draught to draw the products of combustion through the boiler flue tubes and to induce the necessary air into the fire box. This can be arranged in several ways such as by providing suitable jets of live steam from the boiler in place of the exhaust blast, or by providing steam driven fans.

In the arrangement illustrated the former way is adopted. Thus live steam is taken from the boiler 6 at 34 under control by a valve operated by a handle 35 in the driver's cab 36, and passes along a pipe line 37 to an annular jet 38 surrounding the outlet end of the blast pipe 13. From this annular jet the live steam is discharged in an upward direction and thus provides the necessary draught.

As stated above, in some cases it may be sufficient to have only one condensing vehicle C. This may be coupled at either end of the articulated locomotive. The exhaust steam from the power unit remote from the condensing unit would then be conveyed to the blast pipe 13 in the usual way and if this supplies insufficient draught the draught could be augmented by the means described above. By employing one condensing vehicle the consumption of water would be reduced by nearly one half.

What we claim is:—

1. An articulated locomotive wherein the exhaust from the cylinders of each engine unit leads to alternative exhaust conduits which lead respectively to the blast pipe of the boiler unit and to a point connected to, or for connection to, the steam input of a condenser, valve means being provided for opening or closing the exhaust steam flow to

said blast pipe and for opening or closing the exhaust steam flow to said point.

2. An articulated locomotive according to Claim 1 wherein said condenser is the condenser of a separate condensing track vehicle adapted to be coupled to the locomotive.

3. An articulated locomotive according to Claim 2 wherein there are two of such points, one for connection to the steam input of a condensing track vehicle when coupled to one end of the articulated locomotive and adapted to be supplied by the exhaust of the engine unit at said one end, and the other for connection to the steam input of a condensing track vehicle when coupled to the other end of the articulated locomotive and adapted to be supplied by the exhaust of the engine unit at said other end.

4. An articulated locomotive according to Claim 3 wherein the cylinders of each engine unit exhaust into respective adjacent chambers between said cylinders, and each chamber has an exhaust pipe extending from it at each end, the two exhaust pipes from the ends of said chambers towards said boiler unit converging into one and joining the exhaust conduit which leads to said blast pipe, and the two exhaust pipes from the ends of said chambers remote from said boiler unit converging into one and joining the exhaust conduit which extends to the respective point.

5. An articulated locomotive according to Claim 3 or 4 wherein said articulated locomotive carries piping for connection to the condensed water outputs of such condensing track vehicles and feed means are provided connected to said piping and to the boiler of the boiler unit for feeding said condensed water back to said boiler.

6. An articulated locomotive according to Claim 5 wherein said piping consists of a pipe line extending from one end of the articulated locomotive to the other, and said feed means consist of a feed pump connected to an intermediate point of said pipe line and to the boiler.

7. An articulated locomotive according to any of the preceding claims, wherein alternative means are provided in the smoke box of the boiler to provide the necessary draught, when the exhaust steam from the engine unit or units is being discharged to the condensing track vehicle or vehicles.

8. An articulated locomotive according to Claim 7 wherein said alternative means comprise means for providing a blast of live steam from the boiler instead of the exhaust blast.

9. An articulated locomotive according to Claim 8 wherein said blast of live steam is discharged from an annular jet surrounding the upper end of the exhaust blast pipe.

10. An articulated locomotive according to Claim 7 wherein said alternative means comprise steam driven fans for producing an air blast.

11. An articulated locomotive substantially as herein described with reference to the accompanying drawings.

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PROVISIONAL SPECIFICATION.

Improvements in or relating to Articulated Steam Locomotives.

We, BEYER, PEACOCK & COMPANY LIMITED, a British Company of Gorton, Manchester, in the County of Lancaster, and JAMES HADFIELD, a British Subject, of The White House, Pinfold Lane, Romiley, in the County of Chester, do hereby declare this invention to be described in the following statement :—

This invention relates to steam locomotives and particularly to articulated steam locomotives.

The primary object of the invention is the provision of an improved articulated locomotive which will be capable of operating in places where boiler feed water is not available over long sections of the track.

In order that the nature of the invention may be understood an articulated locomotive system in accordance therewith will now be described, reference being made to the accompanying drawings wherein :—

Figure 1 is a side elevation of the system, the figure being separated into two parts of which the top part represents the left hand portion and the bottom part the right hand portion of the system.

Figure 2 is a plan of the system, this figure also being separated into two parts of which the top part represents the left hand portion and the bottom part the right hand portion of the system.

Referring to the drawings the system illustrated comprises an articulated locomotive of known type characterised by the provision of two steam driven power units A and a common boiler B which is pivotally connected between said two power units. Each power unit A comprises a chassis 1

* C L M S *

mounted on track wheels 2 and carrying steam cylinders 3 from which at least some of the track wheels are driven. The chassis 1 of each power unit also carries either a water tank 5 or a fuel tank 4. The boiler unit B comprises a boiler 6 mounted on a chassis 7. Said chassis 7 has no track wheels but is supported solely by the chassis 1 of the power units, said chassis 7 being mounted at its ends on said chassis 1 by means of pivot mountings 8 which permit of pivoting about vertical axes 9—9. The cylinders 3 are supplied with steam from the boiler 6 by way of steam pipes 10.

Articulated locomotives as so far described are quite well known. Hitherto in such articulated locomotives it has been the practice for the steam, after performing useful work in the cylinders, to be conveyed by suitably arranged exhaust pipes to a blast pipe arranged in the smoke box at the front end of the boiler, and to be discharged through the blast pipe nozzle and up the chimney thereby creating a partial vacuum in the smoke box which induces the products of combustion to pass through the boiler flue tubes and air to pass into the firebox.

In the present system provision is likewise made for discharging the exhaust steam through the blast pipe. Thus the exhaust ports from the cylinders 3 of each power unit A are in communication with branch pipes 11 which merge into a trunk pipe 12, and the trunk pipes 12 from the two power units lead to the blast pipe 13. The branch pipes 11 of each power unit naturally lead in the usual way from the end of the cylinder block which is towards the boiler unit. In the present system however the exhaust ports from the cylinders of each power unit are also in communication with other branch pipes 14 which lead from the end of cylinder block which faces away from the boiler unit; these branch pipes 14 merge into a short longitudinal trunk pipe 15 which projects at the end of the power unit remote from the boiler unit.

Each trunk pipe 12 has in it adjacent to the branch pipes 11 a shut-off valve 16 actuated by a hand wheel 17, and each trunk pipe 15 has in it adjacent to the branch pipes 14 a shut-off valve 18 actuated by a hand wheel 19. Normally, when the articulated locomotive is operating on sections of the railway where adequate supplies of suitable water are available, the valves 18 are kept closed and the valves 16 open so that the exhaust steam flows from the cylinders 3 to the blast pipe 13 in the usual way.

If however the articulated locomotive is operating on sections of the railway where water is in short supply or if available is not suitable for boiler feed water owing to the presence of impurities, then two condensing vehicles C are coupled one to each end of the articulated locomotive, and the adjacent pipes 15 are connected to the condensers of said condensing vehicles. The valves 18 are opened and the valves 16 shut and the exhaust steam from the cylinders of the power units will accordingly flow to the condensers of the condensing vehicles where it will be condensed and be available again for use in the boiler. In the drawing, for purposes of space economy only one condensing vehicle is shown, but in practice two will usually be used.

More particularly each condensing vehicle B has a chassis 20 mounted on track wheels 21 and having mounted on it a number of condenser units 22. The steam input to the condenser units 22 is by way of a longitudinal pipe 23 which projects from the end of the vehicle towards the power unit A in line with the pipe 15. The pipes 23 and 15 are connected together by means of a short flexible hose connection 24, and thus the passage from the cylinders 3 to the condenser units 22 is completed.

For returning the condensation of the condensing vehicles C to the boiler 6, the condensation, from the condensers 22 of each vehicle C flows to a longitudinal output pipe 25. This extends to the end of the vehicle adjacent to the power unit and is connected by means of a short flexible hose connection 26, to the near end of a longitudinal pipe 27 mounted on the adjacent power unit A and extending substantially the full length thereof. Said pipe 27 is connected at its other end by means of a short flexible hose connection 28 to the near end of a longitudinal pipe 29 mounted on the boiler unit, and said pipe 29 communicates by way of a branch pipe 30 with a feed pump 31 which return the water to the boiler 6 by way of a pipe 32. The reference 33 designates a valve in the pipe 27 near the extremity thereof for closing said pipe when a condensing vehicle is not being employed.

When the exhaust steam is being discharged to the condensing vehicles, then alternative means will have to be provided in the smoke box of the boiler to provide the necessary draft to draw the products of combustion through the boiler flue tubes and to induce the necessary air into the fire box. This can be arranged in several ways such as by providing suitable jets of live steam from the boiler in place of the exhaust blast, or by providing steam driven fans.

As indicated above, in some cases it may be sufficient to have only one condensing vehicle C. This may be coupled at either end of the articulated locomotive. The exhaust steam from the power unit remote from the condensing unit would then be conveyed to the blast pipe 13 in the usual way and if this supplies insufficient draft the draft could be augmented by the alternative

means described above. By employing one condensing vehicle the consumption of water would be reduced by nearly one half.

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