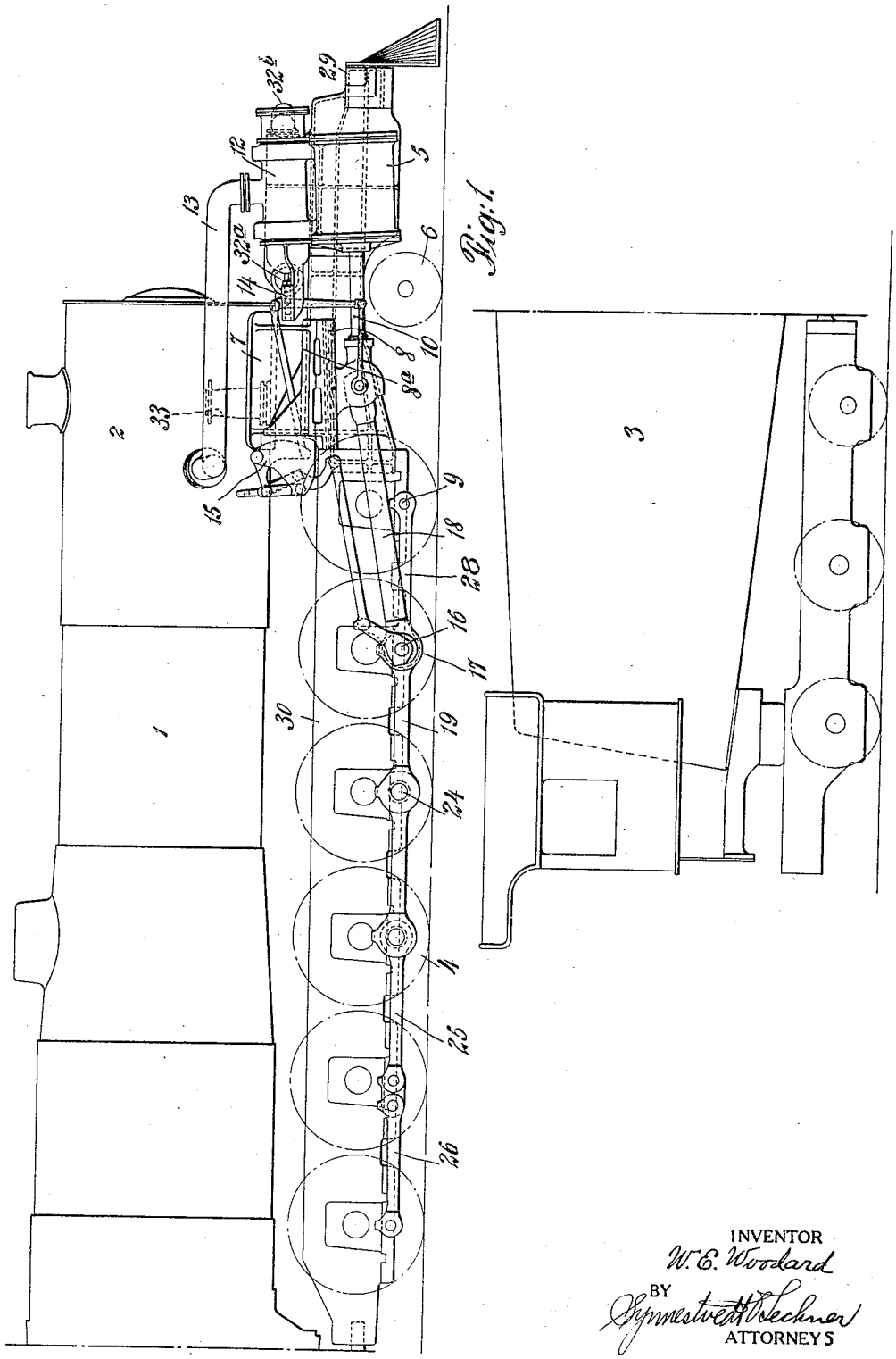
May 12, 1931. W. E. WOODARD 1,805,125

LOCOMOTIVE CONSTRUCTION

Filed May 8, 1928 4 Sheets-Sheet 1



INVENTOR
W. E. Woodard
BY
Symmestvedt & Lechner
ATTORNEYS

May 12, 1931. W. E. WOODARD 1,805,125

LOCOMOTIVE CONSTRUCTION

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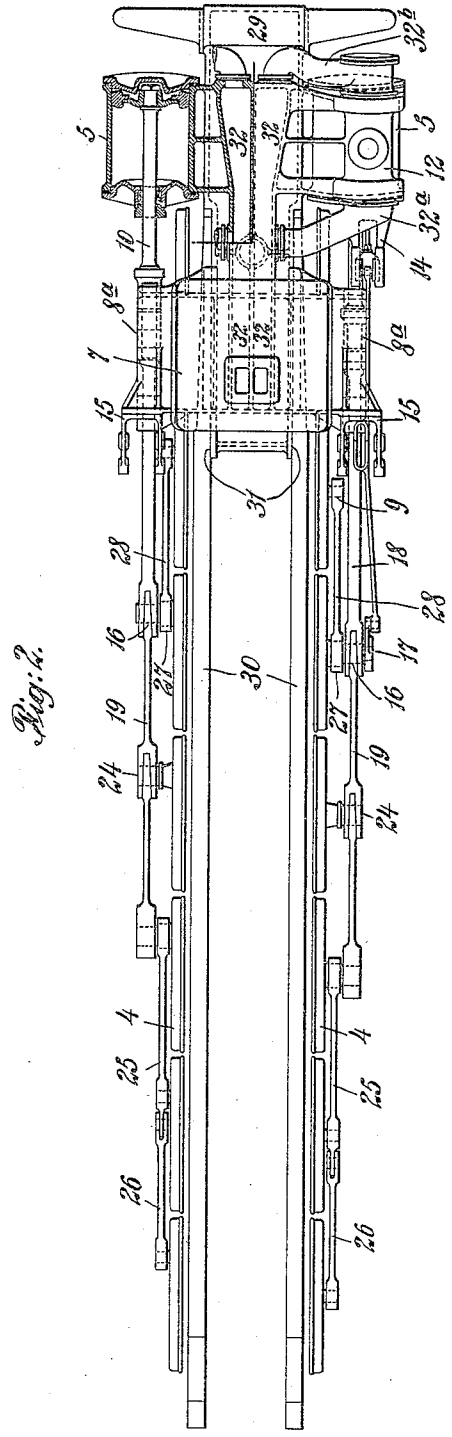


Fig. 2.

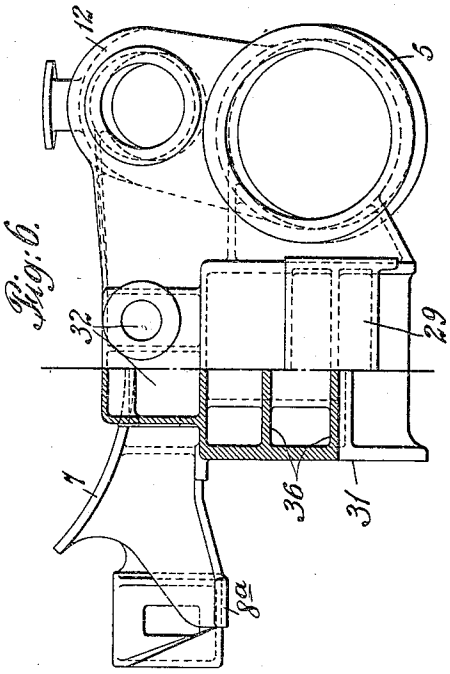


Fig. 6.

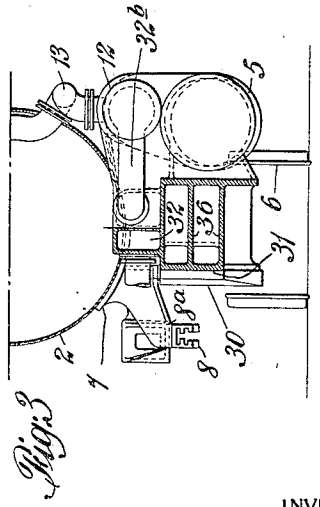


Fig. 3

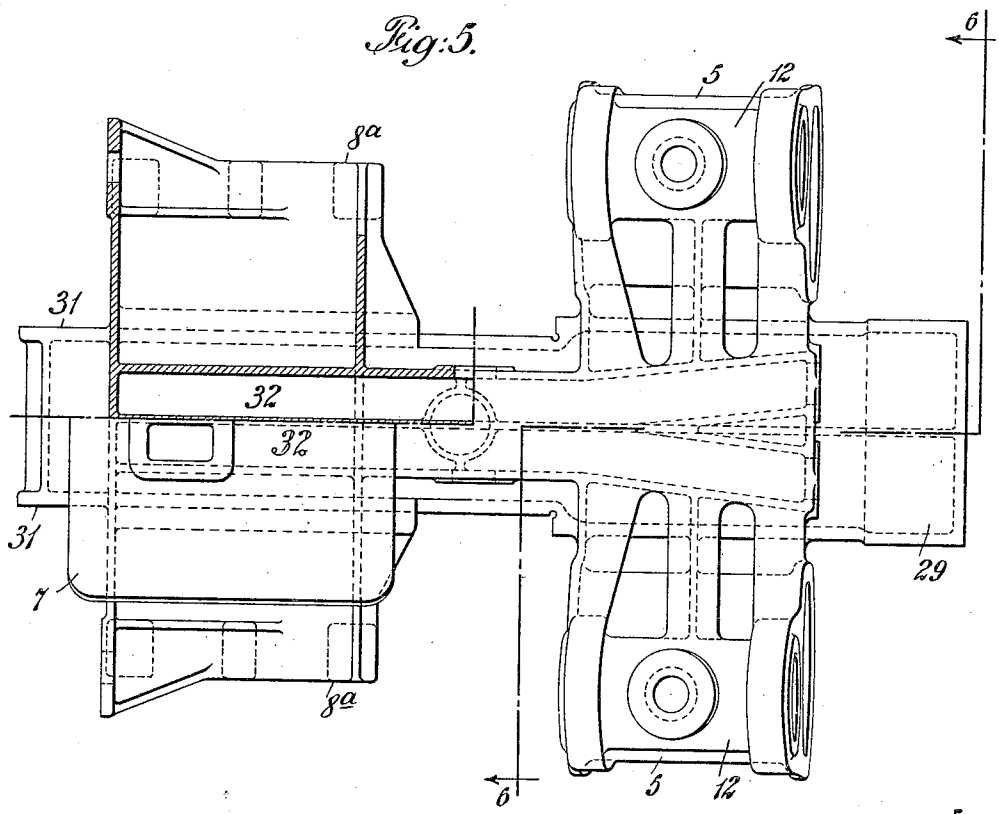
INVENTOR
W. E. Woodard
BY
Ernest Stewart & Lechner
ATTORNEYS

May 12, 1931. W. E. WOODARD 1,805,125

LOCOMOTIVE CONSTRUCTION

Filed May 8, 1928 4 Sheets-Sheet 3

Fig: 5.



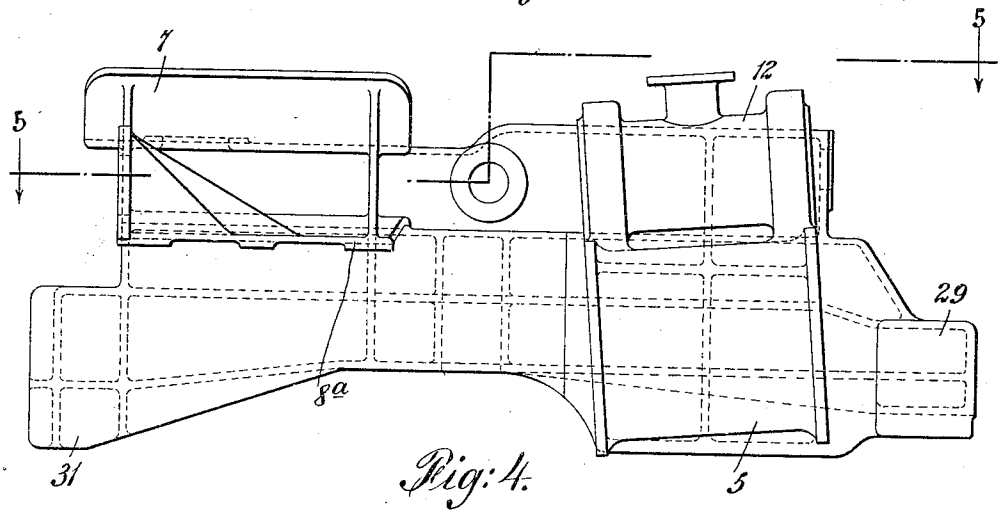


Fig: 4.

INVENTOR
W. E. Woodard
BY
Synnestvedt & Lechner
ATTORNEYS

May 12, 1931. W. E. WOODARD 1,805,125

LOCOMOTIVE CONSTRUCTION

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Fig: 7

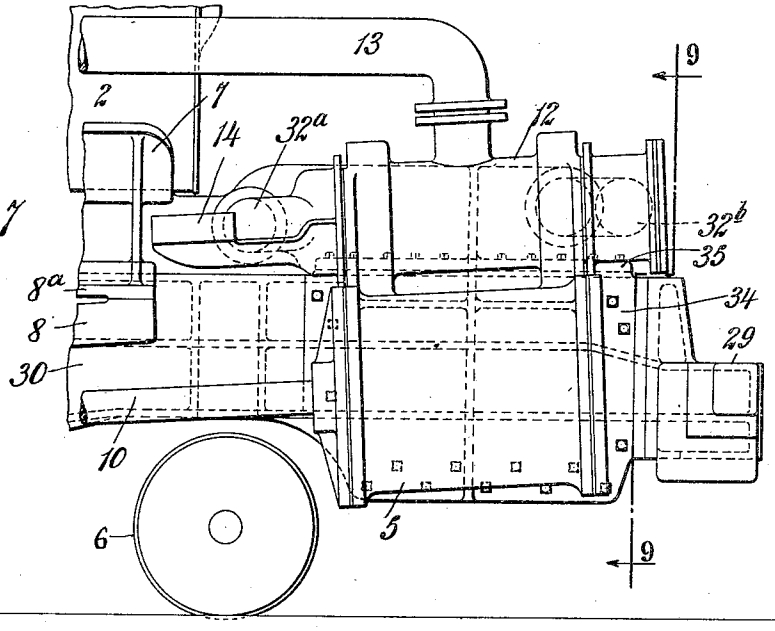


Fig: 8.

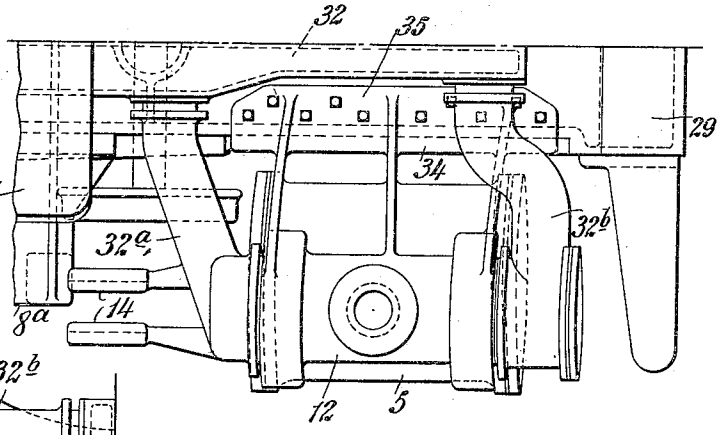


Fig: 9.

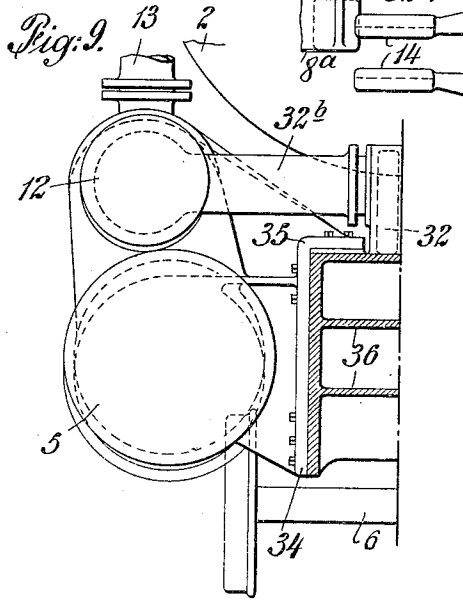
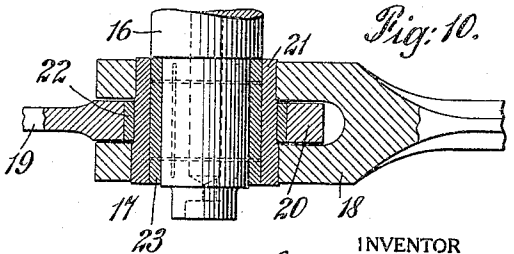


Fig: 10.



INVENTOR
W. E. Woodard
BY
Symmes Hall & Duckworth
ATTORNEYS

Patented May 12, 1931

1,805,125

UNITED STATES PATENT OFFICE

WILLIAM E. WOODARD, OF FOREST HILLS, NEW YORK

LOCOMOTIVE CONSTRUCTION

Application filed May 8, 1928. Serial No. 276,024.

This invention relates to locomotives and is particularly concerned with locomotives of very high tractive power, it being one of the principal objects of the invention to provide a locomotive which has a higher tractive power than any locomotive heretofore in use in which a single pair of cylinders is used to drive all of the driving wheels.

As is well known in the art of locomotive design and construction, the tractive power which it is possible to develop is definitely limited by the weight upon the drivers and the permissible or possible weight for a single pair of driving wheels is also a pretty well established quantity. Therefore, in order to increase the tractive power, it becomes necessary to employ more and more pairs of driving wheels and to distribute as much of the weight of the locomotive among these driving wheels as possible.

However, where the usual two cylinder construction is employed, which construction is more generally favored by locomotive designers than any other type of construction, the number of pairs of driving wheels which it is feasible to drive from these two cylinders has also been definitely limited. Indeed, I know of no instance in which more than five pairs of coupled drivers have been driven by a single pair of cylinders. Where more drivers have been employed they have been grouped into units of five pairs or less, each unit being driven by a separate pair of cylinders. This construction is well typified by the familiar Mallet locomotive.

The Mallet type of construction, however, introduces a number of more or less serious objections, among which might be mentioned the duplication of moving parts, the necessity for using flexible joints in the steam and exhaust pipes, the unusual length of the conduits necessary to carry the steam to the cylinders, as well as the exhaust steam from the cylinders, the great overall length of the locomotive and the large increase in weight without the possibility of proportionately taking advantage of the increased weight for the development of tractive power.

The use of higher numbers of pairs of drivers has also been restricted because of other troublesome problems which are introduced thereby. Among these might be mentioned the necessity for having an extremely large diameter of cylinder in order to develop the power necessary to drive the wheels in question. This would increase the overall width between the cylinders to a degree prohibited by existing clearance requirements. Furthermore, with the types of constructions heretofore proposed, it would be necessary to have crank pins, main axles, counterweights, driving boxes, as well as many other associated parts which might be enumerated of excessive size and weight.

With the foregoing brief review of the art as it exists at present, the objects of my invention will be more clearly understood and these may be stated as involving the provision of a locomotive having a much higher tractive power than heretofore possible in any locomotive driven by a single pair of cylinders; the provision of a locomotive having a higher tractive power than heretofore possible without the necessity of articulated driving units with their incidental objections already noted above; the provision of a locomotive of the character herein described in which the leading truck can be located much closer to the leading driver than in ordinary construction whereby it is possible to greatly improve the track reactions; the provision of a locomotive in which six or more pairs of driving wheels can be coupled together and driven by a single pair of cylinders; the provision of a locomotive of the character described in which the weight of the parts at the forward end of the locomotive can be more satisfactorily distributed than heretofore possible; and the provision of a locomotive in which the cylinder and saddle construction, the cross head guide, valve gear and driving rod arrangements and the connection between these various parts and the frames, boiler and smoke box may be materially improved.

How the foregoing objects and advantages are attained, as well as any other objects and advantages which may appear hereinafter,

is illustrated in the accompanying drawings which disclose a preferred embodiment of my invention.

In the drawings—

Fig. 1 is a side elevation of a locomotive embodying my invention having six pairs of driving wheels.

Fig. 2 is a plan view with the boiler and smoke box omitted.

Fig. 3 is a half elevation just ahead of the cylinders and a half sectional view taken approximately at a point just ahead of the forward drivers.

Fig. 4 is a side elevation of an improved unitary casting or locomotive machinery bed used at the forward end of the locomotive.

Fig. 5 is a plan view of Fig. 4 partly in section on the line 5—5 of Fig. 4.

Fig. 6 is a front elevation of Fig. 4 partly in section on the line 6—6 of Fig. 5.

Fig. 7 is a fragmentary side elevation of the forward part of a locomotive illustrating a modification in the cylinder construction.

Fig. 8 is a plan view of Fig. 7.

Fig. 9 is a section on the line 9—9 of Fig. 7, and

Fig. 10 is an enlarged sectional view illustrating the articulated main rod construction.

Referring to the drawings, and particularly to Figs. 1 to 6 inclusive, it will be seen that my locomotive includes the boiler 1, smoke box 2, the fire box 3 and the six pairs of coupled drivers 4 driven by the single pair of cylinders 5. Forwardly of the first pair of drivers is the leading truck 6 which I prefer to make of the two-wheel type, although it might very well be possible to use a four-wheel type.

As will be seen upon inspection, particularly of Fig. 1, the leading truck 6 is placed approximately in the plane of the forward end of the smoke box and the distance along the track from this truck back to the first pair of drivers is substantially equal to or very little more than the distance between driving wheel centers. This greatly improves the track reactions which it is possible to secure with my locomotive, for it is a well known fact that it is a decided detriment to the track to have a truck load imposed upon it at any considerable distance from the adjacent driver load, my arrangement making possible a more uniform loading of the track thus minimizing the wave action and reducing the rail stresses. In other words, by my invention it is possible, once the track has been depressed by a pair of wheels, to keep it in its depressed condition until all of the wheels has passed over the same spot.

I locate the cylinder saddle 7 in much the usual position with respect to the smoke box 2, but at a point intermediate the forward truck 6 and the first pair of driving wheels, as will be clearly seen upon inspection of the drawings. Immediately below the saddle 7 at each side I provide the cross head guide supports 8*a*, and it will be noted that the location of the saddle 7 and the guides 8 is sufficiently far forward of the first pair of driving wheels so as to clear the path of travel of the forward crank pin 9. This permits the guides 8 to be pulled in toward the center of the locomotive sufficiently far to encroach upon the plane of movement of the forward crank pin 9. To state the matter in another way, by locating the cross head guides in the manner in which I have located them, I am enabled to bring them closer to the center of the locomotive without interfering with the driving rod connections on the forward driver.

The cylinders 5 are located forwardly of the leading truck 6 and are arranged as shown at a slight angle, so that the piston rod 10 will clear the engine truck wheel as it swings. Above the cylinders and cast integral therewith are the valve chests 12 to which are coupled the steam pipes 13. At the rear the steam chests 12 are provided with suitable brackets 14 for carrying certain of the valve motion parts. A bracket 15 is also provided at the rear of the saddle structure 7 for carrying the balance of the valve motion parts.

The cross head is connected to the crank pin 16 on the second pair of driving wheels by means of the multipart articulated main driving rod indicated as a whole by the reference character 17. This main rod is of the general type illustrated in my Patent #1,662,595, issued March 13, 1928, and includes the forked member 18 with the forked portion suitably apertured to fit over the driving pin 16 (see Fig. 10). The forward end of the second member 19 of this multipart articulated main driving rod is provided with an eye 20 adapted to fit into the fork on the member 18. A bushing 21 is pressed into the fork of the member 18 with the eye 20 in place. A second bushing 22 is pressed into the eye of the member 19. Between the bushing 21 and the pin 16 is a rotating or floating sleeve 23 which is made of suitable bearing metal.

A similarly articulated construction may be used at the crank pin 24 on the third pair of drivers, but beyond this point I have not found it to be necessary to use the articulated construction, the connecting rods 25 and 26 being used to drive #5 and #6 drivers.

The connecting rod bearing area 27 on the second pair of drivers is of a size sufficient to drive only the first pair of drivers, the coupling being made through the connecting rod 28. This construction is more particularly described and its advantages pointed

out in my copending application Serial No. 276,023, filed May 8, 1928.

As will be seen particularly from Figs. 4 to 6, inclusive, I prefer to form the cylinders, valve chests, the saddle, the bumper support 29, the cross head guide supports and the valve motion brackets in a single unitary casting for the reasons pointed out in my copending application Serial No. 276,022, filed May 8, 1928. This structure, as a whole, I believe can be best referred to as the locomotive machinery bed or support, and it will be seen that by disposing the parts in the manner hereinbefore described, it is possible to provide a very substantial area of contact between the locomotive frames 30 and the machinery bed. For instance, below the saddle 7 the bed is provided with the frame attaching portions 31 which can be made to extend the full depth of the frames 30.

By this construction I am enabled to secure a connection between the frames and cylinders of greater length and depth than has been possible in previous practice. This is of special advantage, for the reason that the saddle constitutes the primary connection between the locomotive frames and the boiler, the other connections between these parts being constructed to carry vertical loads only, whereas the saddle ties the frames and boiler rigidly together.

This unitary casting is provided with exhaust steam passages 32 which extend back into the saddle structure, and from there are suitably connected to the exhaust nozzle 33, the pipes 32*a* and 32*b* carrying the exhaust steam from the ends of the chests to the cavities 32.

In the modifications illustrated in Figs. 7 to 9 inclusive, the only difference resides in the fact that the cylinders 5 with the steam chests 12 are cast in a separate piece and provided with suitable vertical and horizontal flanges 34 and 35 which are adapted to be bolted to the foreward extension of the locomotive machinery bed. It will be noted, however, that the same rigid construction is made possible since a very extended bolting area is presented by the flanges 34 and 35. The machinery bed in this instance, as well as in the construction of the other figures, is cross braced by means of the webs 36, as well as by other strength members illustrated in the drawings.

It will be seen that my improved construction enables me to drive six pairs of driving wheels with one pair of cylinders. In this way the power which can be developed with my locomotive is entirely comparable to that which would be possible with many types of articulated Mallets, and I have attained this desirable result without the objections incident to the Mallet type and without undue lengthening of the locomotive as a whole. By keeping the cross head guides and the cylinders well in toward the center line of the locomotive, the bending moment on the frames is not excessive, nor are the riding qualities of the locomotive impaired.

The saving in weight which I am enabled to effect, insofar as the machinery parts of the locomotive are concerned, can be advantageously placed in the boiler in order to increase its size and capacity, and, therefore, its power to generate steam. In other words, in the only comparable type of locomotive, namely, the Mallet, the weight of the machinery parts is considerably increased because of their duplication, which, of course, is not the case with my improved locomotive.

I claim:—

1. A locomotive including, in combination, a boiler and smokebox, a leading truck, six pairs of drivers, saddle and cross head guides between the leading truck and the forward driver, a pair of cylinders in advance of the saddle adapted to drive all of said drivers and multipart articulated main driving rods coupled to #2 drivers.

2. A unitary locomotive machinery bed having a saddle casting and cylinder barrels with their steam chests offset longitudinally of the locomotive.

3. A unitary locomotive machinery bed having a saddle casting and cylinder barrels with their steam chests offset longitudinally of the locomotive, together with steam passages in the bed for conveying the exhaust steam from the steam chest cavities to the exhaust base.

4. A unitary locomotive machinery bed having a saddle casting and cylinder barrels with their steam chests offset longitudinally of the locomotive, together with steam passages in the bed for conveying the exhaust steam from the steam chest cavities to the exhaust base and exhaust steam connections between said chests and said cavities.

5. A unitary locomotive machinery bed having a saddle casting and cylinder barrels with their steam chests offset longitudinally of the locomotive, together with supports for the crosshead guides and valve motion located in substantially the transverse plane of the saddle.

6. A locomotive including, in combination, a boiler and smoke box, a leading truck, a plurality of pairs of driving wheels, a saddle and crosshead guides located between the leading truck and the forward pair of drivers and a pair of cylinders for driving all of said drivers located in advance of the leading truck.

7. A locomotive including, in combination with its main frames, a machinery bed having the saddle portion in one plane and the cylinder barrels in a plane in advance thereof, together with securing flanges in the transverse plane of the saddle adapted to

provide bolting connection between the bed and the frames.

8. A locomotive including, in combination with its main frames, a machinery bed having the saddle portion in one plane and the cylinder barrels in a plane in advance thereof, together with securing flanges in the transverse plane of the saddle adapted to provide bolting connection between the bed and the frames, said bolting area being substantially the depth of the frame and the length of the cylinder saddle.

9. A locomotive including, in combination, a boiler and smoke box, a saddle below the smoke box, cylinder barrels and steam chests in advance of the saddle, a steam pipe leading forwardly from the smoke box to the steam chests, and exhaust passages leading rearwardly from the steam chests to the exhaust base in the saddle.

10. A locomotive machinery bed cast in one piece and including a saddle structure in the rear portion, cylinder barrels and steam chests in advance of said saddle structure, frame bolting areas in the plane of said saddle structure, crosshead guide supports in the plane of said saddle structure, and valve motion supports.

11. A locomotive machinery bed cast in one piece and including a saddle structure in the rear portion, cylinder barrels and steam chests in advance of said saddle structure, frame bolting areas in the plane of said saddle structure, crosshead guide supports in the plane of said saddle structure, valve motion supports, and a bumper support in advance of the cylinders.

12. A locomotive including, in combination, a boiler and smoke box, more than five pairs of driving wheels, a leading truck, a saddle structure between the leading truck and the forward pair of driving wheels, cylinders in advance of the leading truck, crosshead guides in the transverse plane of the saddle, said guides and cylinders lying in a plane to the inside of the outer end of the forward crank pin but being located sufficiently far forward to clear the path of movement of said forward crank pin, multipart articulated main driving rods coupled first to #2 drivers, and connecting rods between #2 pins and #1 pins.

13. A locomotive including, in combination, a boiler and smoke box, a saddle below the smoke box, cylinder barrels and steam chests in advance of the saddle, and crosshead guide supports in the transverse plane of the saddle and cast integral therewith.

14. A locomotive including, in combination, a boiler, main side frames, a saddle connecting the frames and the boiler, cylinders ahead of the saddle and supported therefrom, and crosshead guide supports in the transverse plane of the saddle supported from the saddle throughout substantially their entire length.

15. A locomotive including, in combination, a boiler, main side frame, a saddle connecting the frames and the boiler, cylinders ahead of the saddle and supported therefrom, a bumper support ahead of the cylinders, and crosshead guide supports in the transverse plane of the saddle supported therefrom throughout substantially their entire length, said saddle, cylinders, bumper support and guide supports all being cast integral.

16. A locomotive including, in combination, a boiler, main side frames, a saddle connecting the frames and the boiler, cylinders ahead of the saddle and supported therefrom, and crosshead guide supports in the transverse plane of the saddle supported from the saddle throughout substantially their entire length, said saddle, cylinders and guide supports all being cast integral.

17. A locomotive including, in combination, a boiler and smoke box, a leading truck, more than five pairs of drivers, a saddle and crosshead guides located between the leading truck and the forward pair of drivers, a pair of cylinders in advance of the leading truck, and multipart articulated driving rods.

18. A locomotive including, in combination, more than five pairs of drivers, a saddle in advance of the drivers, crosshead guides in the transverse plane of the saddle supported therefrom throughout substantially their entire length, a pair of cylinders in advance of the saddle and guides, and multi-part articulated driving rods.

In testimony whereof I have hereunto signed my name.

WILLIAM E. WOODARD.