(No Model.) 5 Sheets—Sheet 1.

W. J. HOLMAN.

ATTACHMENT FOR LOCOMOTIVE ENGINES.

No. 546,153. Patented Sept. 10, 1895.

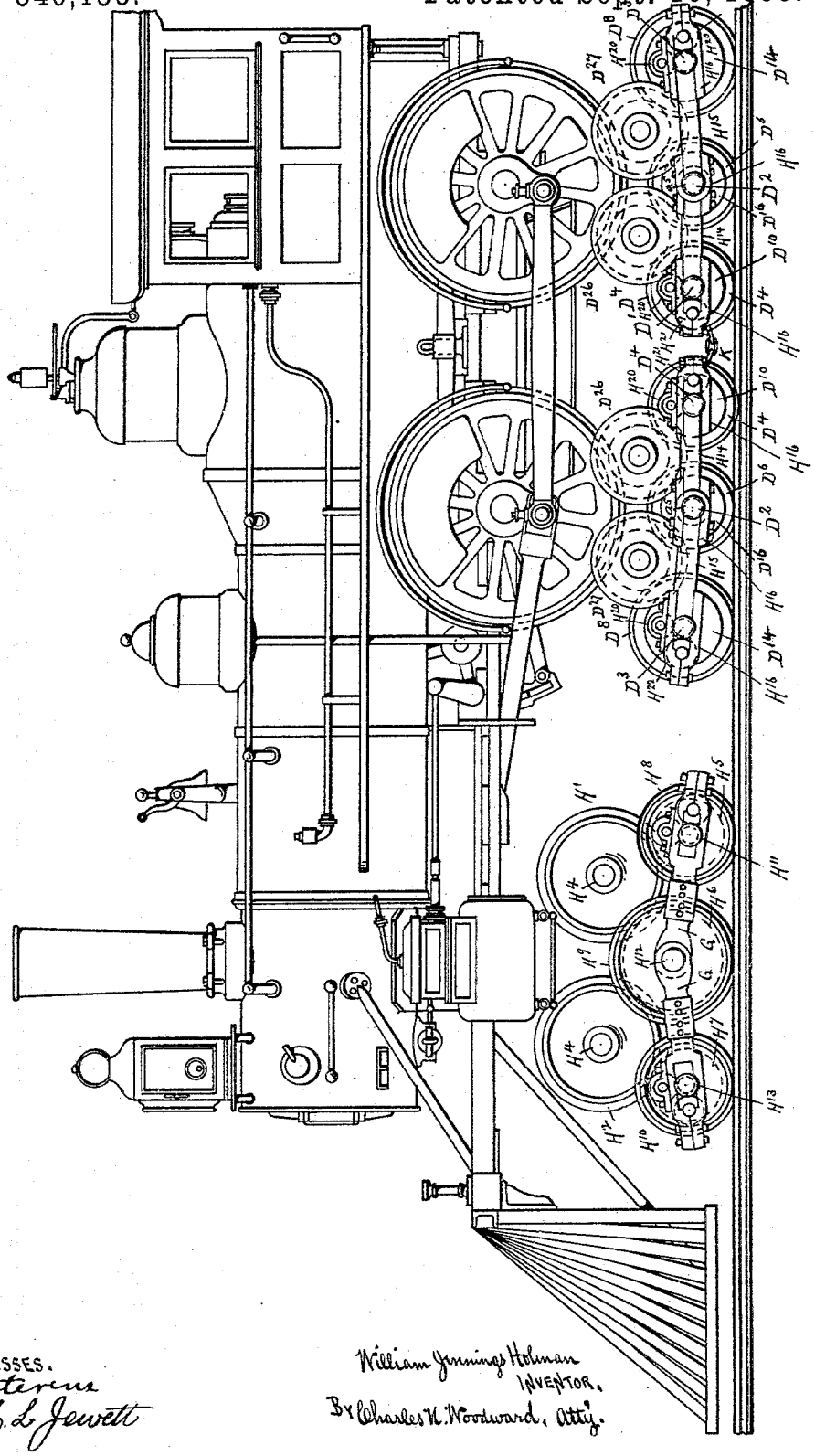

Fig. 1.

WITNESSES.
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R. H. L. Jewett

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By Charles N. Woodward, Atty.

(No Model.) 5 Sheets—Sheet 2.

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ATTACHMENT FOR LOCOMOTIVE ENGINES.

No. 546,153. Patented Sept. 10, 1895.

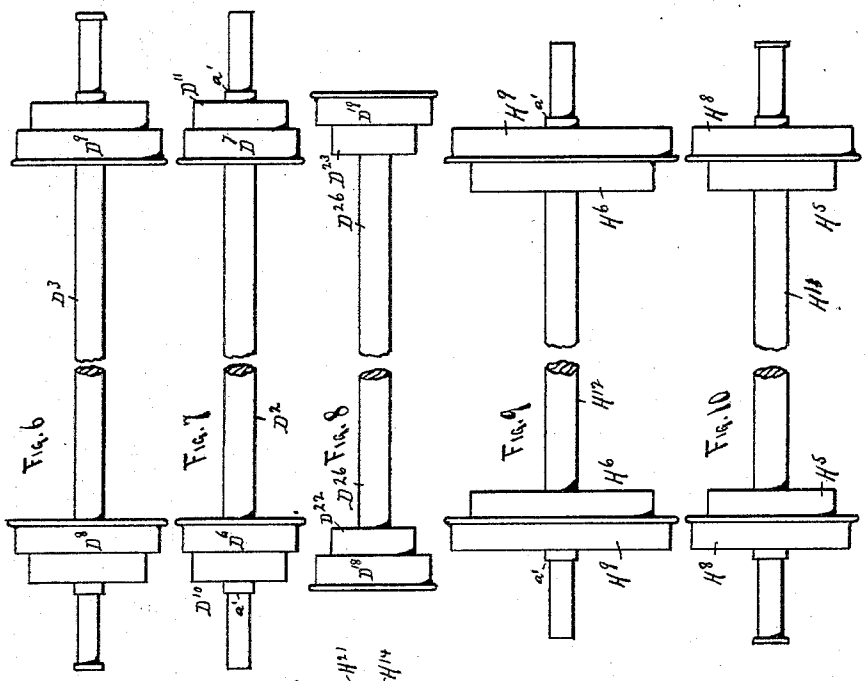

Fig. 6 Fig. 7 Fig. 8 Fig. 9 Fig. 10

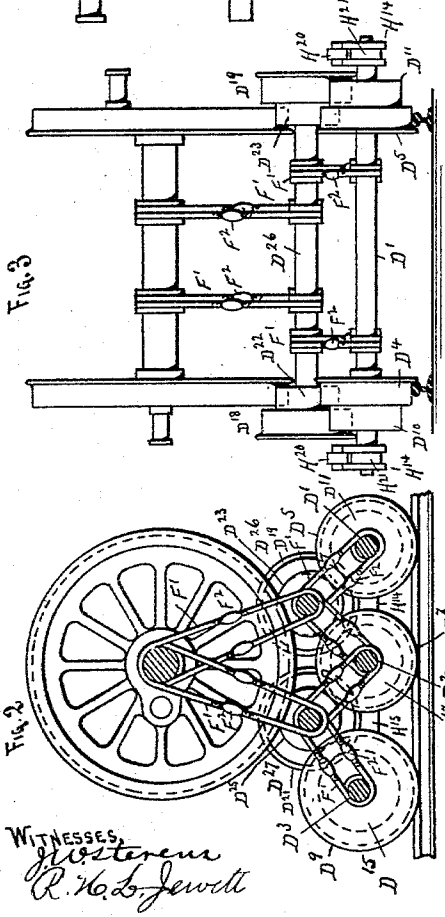

Fig. 3

Fig. 2

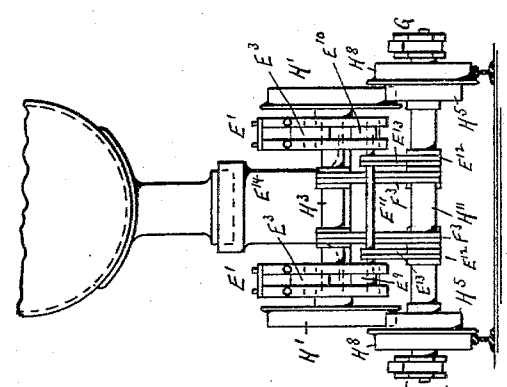

Fig. 5

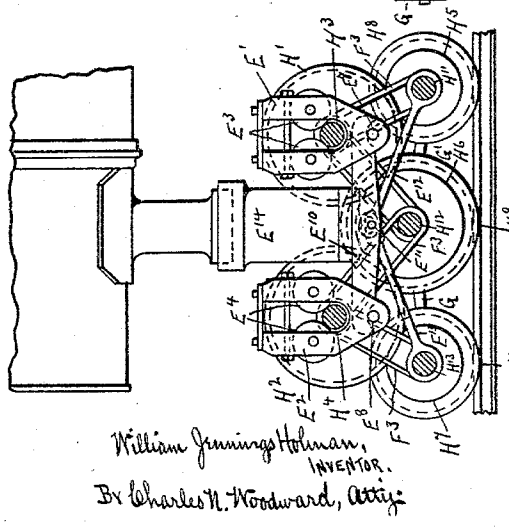

Fig. 4

Witnesses,
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(No Model.) 5 Sheets—Sheet 3.

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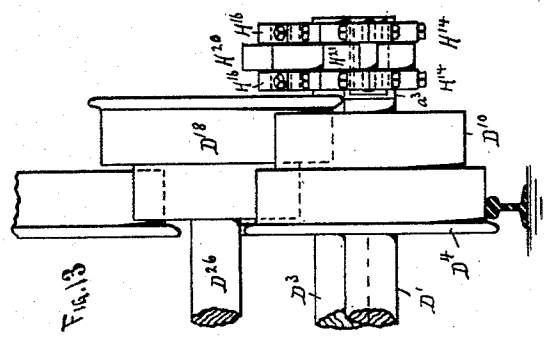

Fig. 13

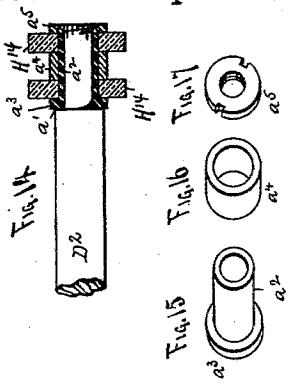

Fig. 14

Fig. 17

Fig. 16

Fig. 15

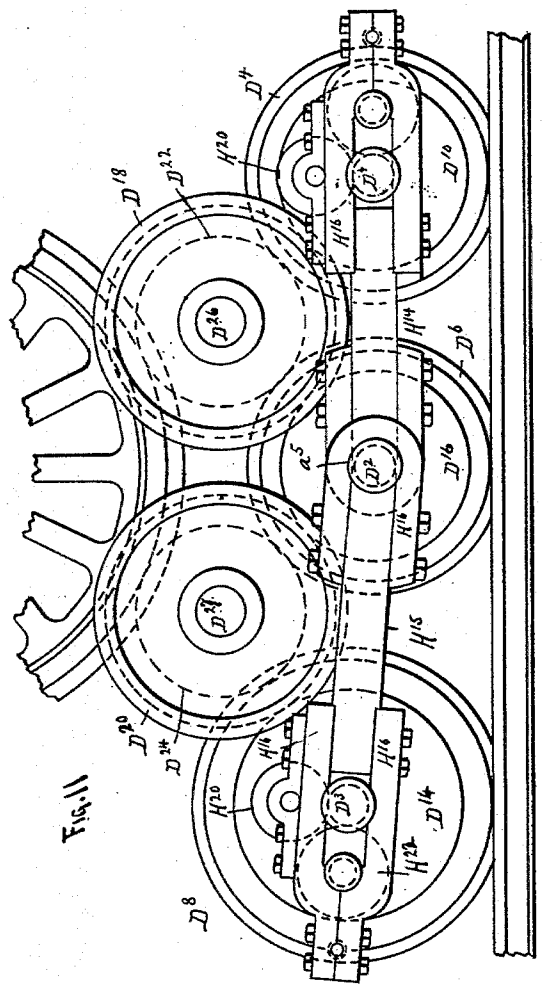

Fig. 11

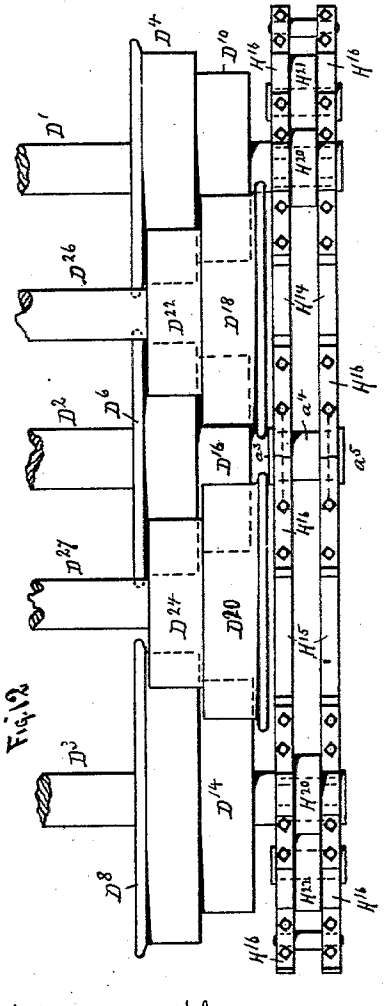

Fig. 12

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(No Model.) 5 Sheets—Sheet 4.

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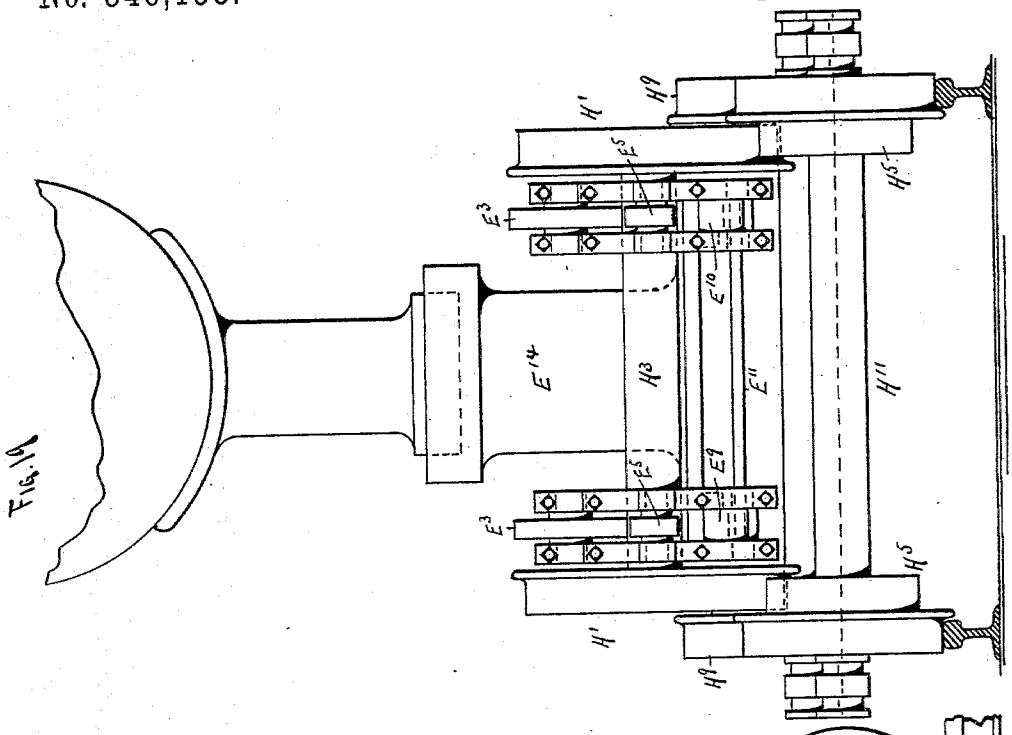

Fig. 1a.

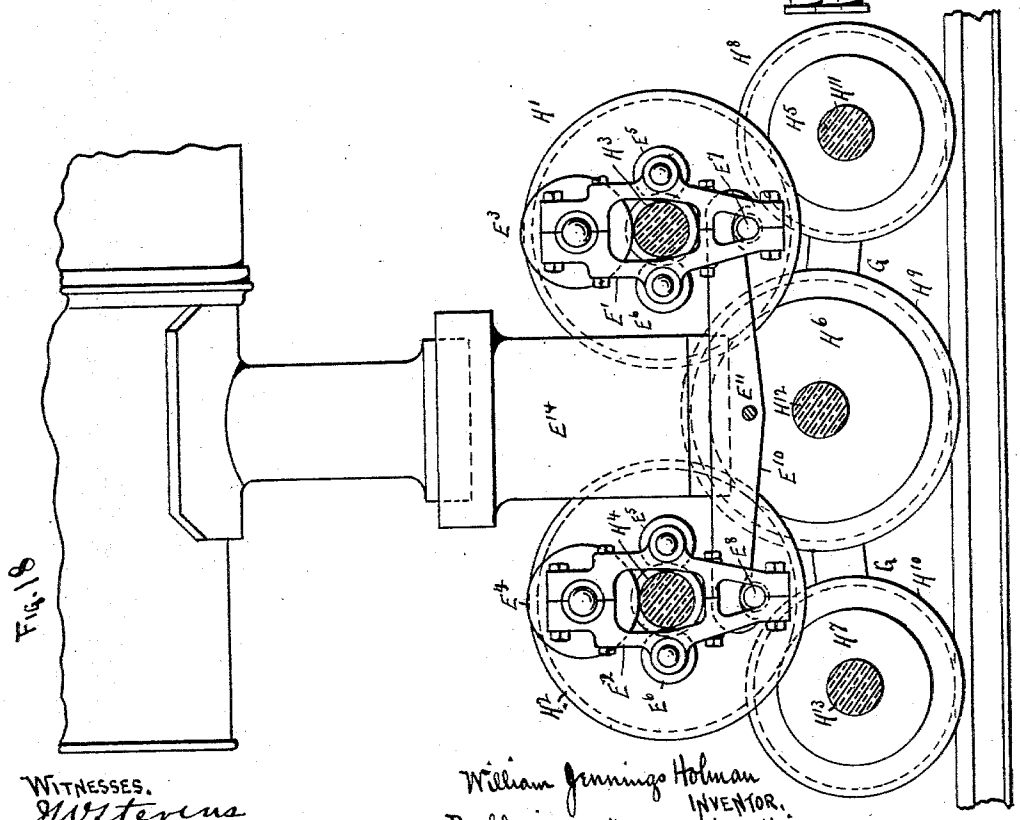

Fig. 1b.

Witnesses.
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(No Model.) 5 Sheets—Sheet 5.

W. J. HOLMAN.

ATTACHMENT FOR LOCOMOTIVE ENGINES.

No. 546,153. Patented Sept. 10, 1895.

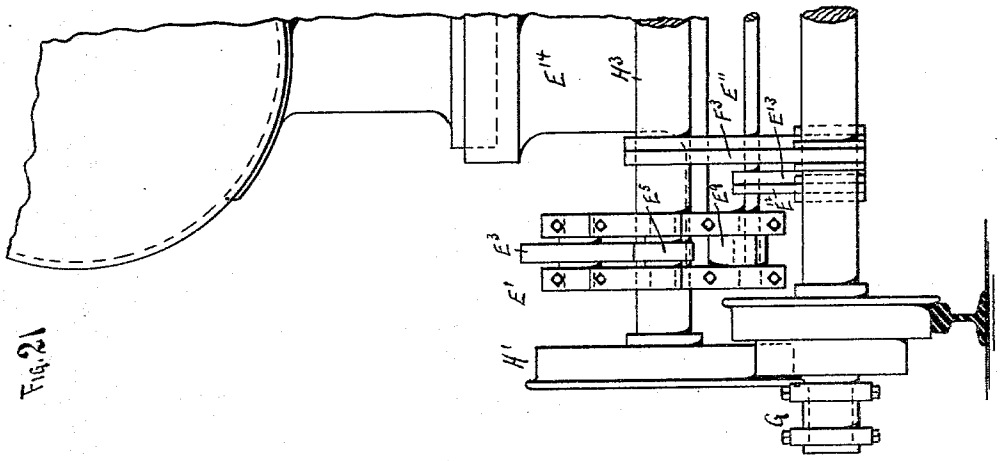

Fig. 21

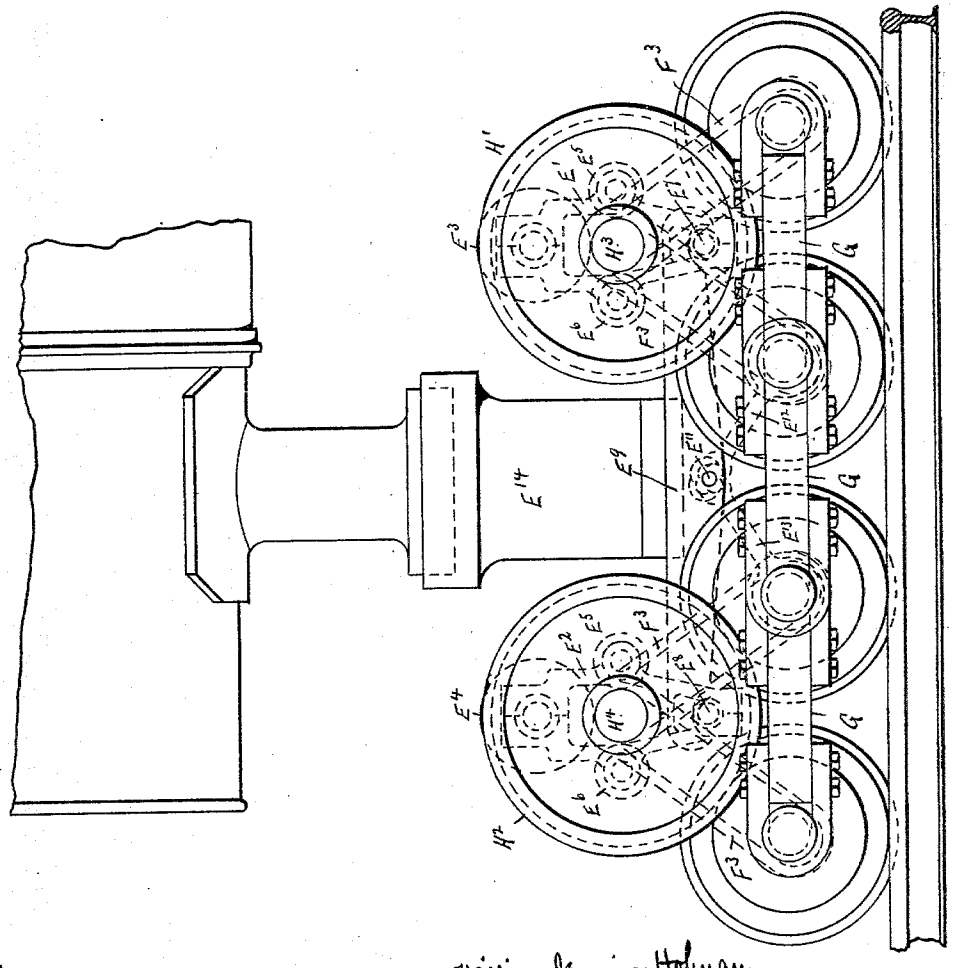

Fig. 20

Witnesses.
J. Westervelt
R. H. L. Jewett

William Jennings Holman,
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UNITED STATES PATENT OFFICE.

WILLIAM JENNINGS HOLMAN, OF MINNEAPOLIS, MINNESOTA.

ATTACHMENT FOR LOCOMOTIVE-ENGINES.

SPECIFICATION forming part of Letters Patent No. 546,153, dated September 10, 1895.

Application filed December 18, 1894. Serial No. 532,139. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM JENNINGS HOLMAN, a citizen of the United States, residing at Minneapolis, in the county of Hennepin and State of Minnesota, have invented new and useful Attachments for Locomotive-Engines, of which the following is a specification.

My invention relates to improvements in locomotive-engines; and it consists in the formation and use of a series of compound trucks composed of double-tread, single-flanged, axle-coupled metallic or composition friction roller-geared wheels so constructed, proportioned, and arranged as that when placed under the locomotive driving-wheels and superstructure the same horizontal position of the boiler is maintained without any expensive or material alteration of the locomotive proper.

The objects or purposes of my invention are to increase the speed, safety, and economy of railroad travel and transportation. I attain these objects by the mechanism illustrated in the accompanying drawings, in which—

Figure 1 is a side elevation of an ordinary locomotive with my attachments in position on the track. Fig. 2 is an inside view of the sectional detail of one of the speeding-trucks with one of the driving-wheels of a locomotive resting upon it, showing the position and arrangement of the sectional links about the axles coupled by turnbuckles. Fig. 3 is a rear view of the same. Fig. 4 is an inside view of the "pony-truck" carrying the pilot and forward end of the boiler, showing the position and arrangement of the links, check-rods, equalizers, and pendants, and their anti-friction-rollers. Fig. 5 is a front view of the same. Figs. 6, 7, 8, 9, and 10 are detached detail views, enlarged, of the friction-geared wheels with the axles foreshortened. Fig. 11 is an enlarged side elevation of one of the speeding-trucks with a section of one of the driving-wheels resting upon it, as viewed from outside the track. Fig. 12 is an enlarged plan view of the same, and Fig. 13 is an enlarged front elevation of one side of the same. Fig. 14 is a sectional detail of a portion of one of the axles and bearing sleeves or collars and a set of the coupling-bars, illustrating more fully their construction. Figs. 15, 16, and 17 are perspective views of the sleeve, collar, and binding-nut detached. Fig. 18 is an enlarged sectional detail of the pony-truck viewed from the inside, illustrating a modification in the supporting mechanism, and Fig. 19 is a front view of the same. Fig. 20 is a view similar to Fig. 18, illustrating another modification in the manner of constructing the pony-truck. Fig. 21 is a front view of the same.

To be more specific, my attachments consist of compound trucks composed of ten flanged wheels coupled by axles of various lengths suited to the gage of the railroad, the position of the wheels in the truck and the offices they perform, there being five pairs of wheels in each truck, which may be of any kind of metal or composition best suited to durability and safety. One of these trucks I place under each pair of the locomotive's driving-wheels, and by way of distinction call them "speeding-trucks." (See Figs. 2 and 11.) One truck (when the locomotive used is so fashioned as to require it) is placed forward of the speeding-trucks, which in common railroad parlance is called a "pony-truck," the office of which is to support with stability, not absolutely rigid, in any required position the pilot and forward end of the boiler, as shown in Figs. 4 and 5. As the two speeding-trucks are substantially equivalent, I have designated the corresponding parts by like letters of reference, D' D^2 D^3 being the axles of the lower set of wheels, the axles D' having the flanged wheels D^4 D^5, the axles D^2 having the flanged wheels D^6 D^7, and the axles D^3 having the flanged wheels D^8 D^9, the wheels D^4 D^5 and D^6 D^7 being of the same diameter, while the wheels D^8 D^9 are preferably of larger diameter, as hereinafter explained. The wheels D^4 D^5 have outwardly-extended hubs D^{10} D^{11}, the wheels D^8 D^9 have outwardly-extended hubs D^{14} D^{15}, while the wheels D^6 D^7 have similar outwardly-extended hubs D^{16} D^{17}. The wheels D^4 D^5 D^6 D^7 are uniform in diameter, and the hubs of the wheels D^8 D^9 are also uniform, but larger than the hubs of the smaller wheels.

D^{26} D^{27} are the axles of the upper tier of wheels, the flanged wheels being denoted at D^{18} D^{19} D^{20} D^{21}, and resting by their treads upon the hubs of the wheels D^4 D^5 D^6 D^7 D^8 D^9, and supporting the main traction-wheels

of the locomotive upon their hubs D^{22} D^{23} D^{24} D^{25}, as shown. The forward or pony-truck wheels H′ H^2 are placed upon the axles H^3 H^4, which are shorter than the ordinary and arranged to be supported upon the inwardly-extended hubs H^5 H^6 H^7 of the flanged wheels H^8 H^9 H^{10}, the latter mounted upon the axles H^{11} H^{12} H^{13}, the central wheel H^9 being preferably larger than the wheels H^8 H^{10}, as shown. By this means the forward truck is supported in line with the other parts of the locomotive and the whole weight borne by the antifriction-rollers. The central wheel H^9 being larger than the wheels H^8 H^{10}, the tendency of the truck-wheels H′ H^2 to "climb" over the wheels upon the rails is lessened, while at the same time the strains are uniformly distributed.

Each wheel in the speeding-truck has two diameters in line with a common center. The smaller of these, for brevity, I have termed the "hub," while the larger diameter of the wheels I designate as the "major part," and these in every case are flanged, while the hubs in no case are. (See Figs. 6, 7, 8, 9, and 10.) The flanges may be on the inside margin of the periphery or tread facing outwardly, as in the case of a common car-wheel, with the hub extending outwardly, or the flange may be on the outside of the periphery facing inwardly, with the hub extending outwardly, as may be required, for best results in their positions and arrangement (see Figs. 6 and 8); or, as in case of the rail-wheels of the pony-truck, the flanges may be on the inside peripheries of the major parts facing outwardly, with the hubs extending inwardly, which places the flanges approximately around the center of the wheels, as shown in Figs. 9 and 10. The difference between the diameters of the major parts and hubs of the wheels I term "gearing," and since the peripheries of the wheels are friction-surfaces, not cogged, they are called "friction-geared wheels." It must be obvious that the sizes of the gearing may be greater or less, this to be determined by the requirement in any given construction. The gearing may be such as to double the speed of the ordinary locomotive without increasing the action of the movable parts of the engine, or impairing to any appreciable extent its efficiency in other directions. The width of the periphery or tread of the hub should in all cases be made to exceed that of the major part of the wheel by a half-inch or more, to avoid any interference of major parts, under any circumstances short of breakage and wreck, as shown in Fig. 13. The projecting corners of all hubs should be made oval or rounding somewhat, to conform, as near as may be, to the reversed form of the fillet forming the connection between the tread and flange of the wheel made to rest upon it, so as to avoid or lessen abrasion from contact in motion. The tread or periphery of the major part of the rail-wheels (the wheels in direct contact with the rails) should be beveled or conical, as any ordinary car-wheels, while all the other tread-surfaces throughout the truck-wheels, and the driving-wheels of the locomotive as well, should be made plane surfaces, corresponding with the planes of their axles, so that when placed in contact with each other in pairs their bearings would be perfect throughout.

It will be observed by referring to the drawings, Figs. 2, 3, 4, 5, 11, 12, and 13, that the wheels composing the trucks are double-tiered—three wheels on either rail coupled by their axles forming the base, with two above them on either side severally resting on the center wheels and the ones on their respective sides. In the speeding-trucks the treads of the major parts of the rail-wheels by their axles are made to conform to the rails, with their flanges inside facing the rail, the hubs extending outwardly, while the two pairs of wheels above these are so spaced by their axles that their major parts are made to rest on the hubs of the wheels beneath them. The flanges on the upper wheels are on the outside of the periphery, facing the hubs of the wheels beneath and given sufficient play to accommodate themselves to the curvature of the track. The hubs of the upper wheels extend inwardly, forming the bearings of the driving-wheels of the locomotive. (See Fig. 2.)

No change in the gage of the driving-wheels is made necessary in the application and use of my device, as more clearly indicated by reference to Fig. 13.

The size of the speeding-truck wheels for both the upper and lower tiers and the distance apart that the track-wheels should be placed will always be properly determined by the diameters and wheel-base of the drivers in a given construction, the wheels being so arranged with the drivers in place upon them that the sum of the weights through their strains will be equally distributed upon the track-wheels; but in the case of the pony-truck, the weights coming upon it vertically through the two pairs of upper wheels, as in the case shown in Figs. 1 and 4, the center rail-wheels should be enough larger than those forward and back of them to insure one-third only of the weight borne by and imparted through the upper wheels to fall upon them, while the remainder would be carried by their fellows in front and rear in equal parts, and their several sizes in this proportion should be so regulated as to carry the boiler in a horizontal position.

Having determined the size of the wheels and their positions relatively, I will now proceed to describe my method of holding them in their proper places. Each of the rail-wheels have their axles passing through their centers and projecting outwardly beyond the wheels sufficiently to admit of there being placed about those of the two extreme base-wheels two pairs of parallel coupling-bars H^{14} H^{15}, one pair on either side, made in sec-

tions and coupled about the journals by straps H^{16}, bolted to the sections between shoulders and flanges to stay them in position far enough apart to admit of antifriction-rollers, two and a half or three times the diameter of the projecting axles, to be placed between them, leaving the inner bar sufficiently removed from the wheels to prevent any contact with the flanges of the wheels in the upper tier. These antifriction-rollers are journaled into the side bars, one H^{20} at or near either end directly over the centers of the projecting axles and resting upon them, so as to carry the side bars free from any vertical contact with the revolving axles or journals, while two other antifriction-rollers H^{21} H^{22} are similarly journaled at or near either end of the side bars and placed forward and back in contact with the same journals, though slightly below an imaginary line drawn through the centers of the contiguous wheels, to prevent the upper antifriction-rollers being raised off the journals upon which they are resting from any strain, reversed motion, or other cause. The peripheries of the antifriction-rollers should be case-hardened and of such breadth as to resist all strains with minimum abrasion. I form a plain spindle on the projecting ends of the axles D^3 of the center rail-wheels of all trucks, with shoulders a' far enough from the wheels in the speeding-trucks to prevent the side bars from coming in contact with the flanges of the wheels in the upper tiers. (See Figs. 14, 15, 16, and 17.) About these spindles I place open-ended brass or cast-steel sleeves a^2, lined inside with "Babbitt" or other soft metal or composition. The rims or rings of the sleeves should have sufficient metal to resist any strain that ever would be liable to come upon them in successfully resisting any tendency of the track-wheels separating along the rails, owing to the weight upon them, after being coupled about by the four sections of coupling side bars H^{14} H^{15}, two in each section, pulling in opposite directions about them. On the inner ends of these sleeves toward the wheels projecting flanges a^3 are formed as shoulders, against which the inner section of the side bars H^{14} H^{15} are made to rest, and the length of the sleeves, measuring from the shoulders of these flanges, should exceed by a half-inch or so the space from outside to outside of the side bars at the ends where they are fixed by the shoulders and grooves and flanges of the journals of the antifriction-rollers, so that the two parallel side bars may maintain their position buckled around the two ends of the sleeves. I have separating-rings a^4 tightly fitting the sleeves between the parallel sections of the side bars to stay them in position. The outer circumference of the projecting end of the sleeve beyond the line of the side bars I have threaded to receive a thin cap a^5, with heavy flanges, the insides of which are threaded so as to screw onto the projecting ends of the sleeves, the heavy flanges forming shoulders acting as stays for the outer line of the side bars in all cases. The caps also serve the purpose of excluding dust and preventing waste of oil or grease used for lubrication. This construction affords a vertical working hinge in the center of each truck, enabling the wheels to accommodate themselves freely to any irregularities of track, as shown more clearly by reference to Figs. 11 and 12.

Having determined the size and position and held in placement the three rail-wheels of the speeding-trucks, I will proceed to complete them by placing the major parts of the two upper pairs of wheels on the bearings formed by the hubs of the central rail-wheels, and those of the adjacent wheels on either side, giving them about the same play between the flanges and the hubs as is common between the flanges of car-wheels and rails. The extreme projections of the hubs of the rail-wheels of the speeding-trucks, by means of the wheels of the upper tier, form the base or "gage" of the locomotive-drivers when in position upon the track. This would be equivalent to widening the standard-gage roads thirty-three per cent., and I claim for the trucks a reduction of the oscillatory motion of the engine sixty-six per cent. To these considerations and the fact that by raising the locomotive and inserting the trucks the construction is made "bottom-heavy" rather than "top-heavy" and the conclusion must be irresistible that the danger of derailment from irregularities of track and high-speeding will be greatly lessened in the use of my device, as compared with the common construction. There are no projections of the axle or journals on the upper wheels of any of the trucks, as shown by Figs. 3, 5, 8, 12, and 13. In like manner the drivers of the locomotives are placed on the bearings formed by the hubs of the upper tiers of wheels projecting from the major portions of the truck-wheels inwardly, giving them the same play as between the upper and lower tiers of the truck-wheels. The positions of the wheels relatively, including the drivers, and the direction of their strains in placement, are such that no appliances other than the two parallel coupling side bars would be necessary to prevent displacements, while the engineer is using ordinary care in the management and control of the engine, except in cases of unavoidable accident; but to avoid the possibility of displacement of the wheels from carelessness or other causes, short of wreck, where anything may break, I couple the axles of all the wheels in contact in all the trucks, including those of the drivers, on both sides of their centers, with slack sectional links F′ lined inside about their bearings with Babbitt or other soft metal, and regulated in their lengths by turnbuckles F^2. These links are never in tension with the wheels in full bearing, but are sensitive in disturbances, ever ready and of sufficient strength for any emergency. As

stated, the flanges of the rail-wheels of the pony-truck may be on the inside of the periphery of the major part facing the rails, with hubs projecting inwardly, as shown in Figs. 18 and 19, or where the position of the cylinders of the locomotive are made to permit it, the hubs may be made to project outwardly and the axles of the upper tier of wheels lengthened and the wheels reversed, presenting the same general appearance as one of the speeding-trucks, as shown in Figs. 20 and 21. The rail-wheels of the pony-trucks are coupled together by side bars G, in principle substantially the same as those of the speeding-trucks, as shown in Figs. 1 and 11, the upper tier of wheels in the pony-truck having but one tread each, being plane surfaces, otherwise formed as ordinary car-wheels having no projecting journals. (See Figs. 5, 19, and 21. I construct and place around the axles of the two upper wheels in the pony-truck and as near either wheel as may be without interference hangers $E' E^2$ in pairs, so spaced as to admit of antifriction-rollers $E^3 E^4$ between them and journaled into them above and about the axles, as shown in Figs. 4, 5, 18, and 19. The antifriction-rollers, through their journals, support the hangers with any weight upon them in suspension while revolving about the axles as the wheels may turn. These hangers may be formed in sections and bolted together, so as to encircle the axles, but kept from contact with them by the antifriction-rollers E^3 E^4 E^5 E^6, as more clearly shown in Figs. 4, 5, 18, and 19. At the lower ends of the hangers $E' E^2$ "rests" are formed to receive heavy round pins $E^7 E^8$, with grooves and shoulders at the ends, which are placed enough below the axles to admit the ends of the heavy equalizing-beams $E^9 E^{10}$ to rest upon them and extend from one to the other of the opposite hangers on the respective axles without interference. The greatest depths of the equalizing-beams $E^9 E^{10}$ are at their centers and the opposite beams are connected by a cross-rod E^{11}, around which, at either end and near the equalizing-beams, are placed two check-rods $E^{12} E^{13}$, extending in opposite directions and with some slack coupled about the outer axles $H^{11} H^{13}$ of the rail-wheels $H^8 H^{10}$ to prevent collision with the hangers or rollers, the equalizing-beams $E^9 E^{10}$ forming the foundation upon which a platform is supported, to which the female truck center casting E^{14} is bolted, thus completing the truck. Safety-links F^3 will also be arranged about the axles of the pony-truck similar to the links F' on the speeding-trucks and for the same purpose.

By the employment of the antifriction-roller-supported hangers in the pony-trucks I claim a saving of at least three-fourths of the ordinary journal-friction. Slack chains K couple the trucks under each separate pair of driving-wheels at their ends as additional safeguard-binders.

To one skilled in mechanical construction the points where lubrication would be required in my device will be so apparent that I have thought it quite unnecessary in the drawings to show oil-cups or other devices therefor or to refer to them in my specifications.

Place a pair of driving-wheels upon one of my trucks and draw lines tangential to the driving-wheels through their points of contact with the wheels below and produce the lines to an intersection and you have inclined lines of V shape, giving two bearing-points for each driver with an aggregate bearing-surface of sixteen inches, while with the drivers on the horizontal rail with a single bearing-surface under each the aggregate bearing-surfaces could not exceed four inches, and hence with my trucks greater adhesion and durability of surfaces in contact is secured, and, if greater adhesion, more power may be applied without slipping the drivers, which is always the limit of the power of a locomotive.

In my construction I have three wheels on either rail in each truck and two on the top of these. More would be surplusage and less would be injudicious, involving the reconstruction of the entire locomotive. The flexibility of my trucks with the locomotive resting upon them is such that at least two-thirds of the concussion and oscillations from irregularities of track are absorbed by them, imparting an ease and steadiness of motion calculated to prolong the life of the engine, road-bed, and rails, while the multiplied distribution of the weight through the wheels and over the tracks is no small factor in their preservation as well.

Since in my construction there are three bearing-points on the rail under each driver, the chances of rail-breaking are reduced more than it is proposed the speed shall be increased, and so with flange and axle breaking, while the liability of spreading the track or jumping the rails is lessened in a greater degree by the diminished and evenly distributed weights along the rails and the action of the flanges on the upper tier of wheels in the trucks.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. The combination with a locomotive of a speeding truck consisting of reversely flanged wheels having inwardly extended hubs running in contact with the treads of the locomotive drivers, and flanged traction wheels coupled by their axles and running upon the track and having outwardly extended hubs supporting the treads of said reversely flanged wheels, whereby the speed of the locomotive may be increased without altering its running gear or increasing the speed of the moving parts, substantially as and for the purpose hereinbefore set forth.

2. The combination with a locomotive of a speeding truck consisting of reversely flanged

wheels having inwardly extended hubs running in contact with the treads of the locomotive drivers, and flanged traction wheels having outwardly extended hubs supporting the treads of said reversely flanged wheels, and with the axles of said traction wheels coupled by independent side rods adapted to oscillate about the central axles whereby the speed of the locomotive may be increased without altering its running gear or increasing the speed of the moving parts and the requisite flexibility secured, substantially as and for the purpose set forth.

3. An attachment for locomotives consisting of flanged wheels running upon the track and with extended hubs, reversely flanged wheels supported upon said extended hubs, and with extended hubs supporting the treads of the traction wheels of the locomotive, and coupling binder rods connecting the axles of said flanged wheels, and with anti-friction rollers therein adapted to carry the end thrust and support said coupling binder rods, substantially as shown and described.

4. In an attachment to a locomotive, flanged wheels running upon the track and having extended hubs and coupled by their axles, flanged wheels running by their treads upon said extended hubs, and with hangers upon their axles, anti-friction rollers within said hangers, and supporting them upon said axles, and equalizing bars carried by said hangers and supporting the forward end of said locomotive, substantially as shown and described.

5. In an attachment to a locomotive, three sets of flanged wheels running upon the track, the central set being the largest in diameter, and with extended hubs and coupled by their axles, two sets of flanged wheels supported by their treads upon said extended hubs and with hangers upon their axles, anti-friction rollers within said hangers and supporting them upon said axles, and equalizing bars carried by said hangers and supporting the forward end of said locomotive, substantially as shown and described.

6. In an attachment to locomotives, a series of flanged wheels mounted upon axles and running upon the track and with extended hubs, coupling rods connecting the axles of said flanged wheels, reversely flanged wheels supported by their treads upon said extended hubs, and with extended hubs adapted to support the traction wheels of said locomotive, and safety rods or chains connecting the several axles loosely, substantially as shown and described.

7. In an attachment to locomotives, a series of sets of flanged wheels running upon the track and with extended hubs, one set of said wheels being larger in diameter than the others, coupling rods connecting the axles of said flanged wheels, reversely flanged wheels supported by their treads upon said extended hubs, and with reversely extended hubs supporting the traction wheels of the locomotive, substantially as shown and described.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

WILLIAM JENNINGS HOLMAN.

In presence of—
WM. A. PETERSON,
C. N. WOODWARD.