(No Model.) 2 Sheets—Sheet 1.

J. B. KNUDSEN.

AIR BRAKE.

No. 468,387. Patented Feb. 9, 1892.

Fig. 1.

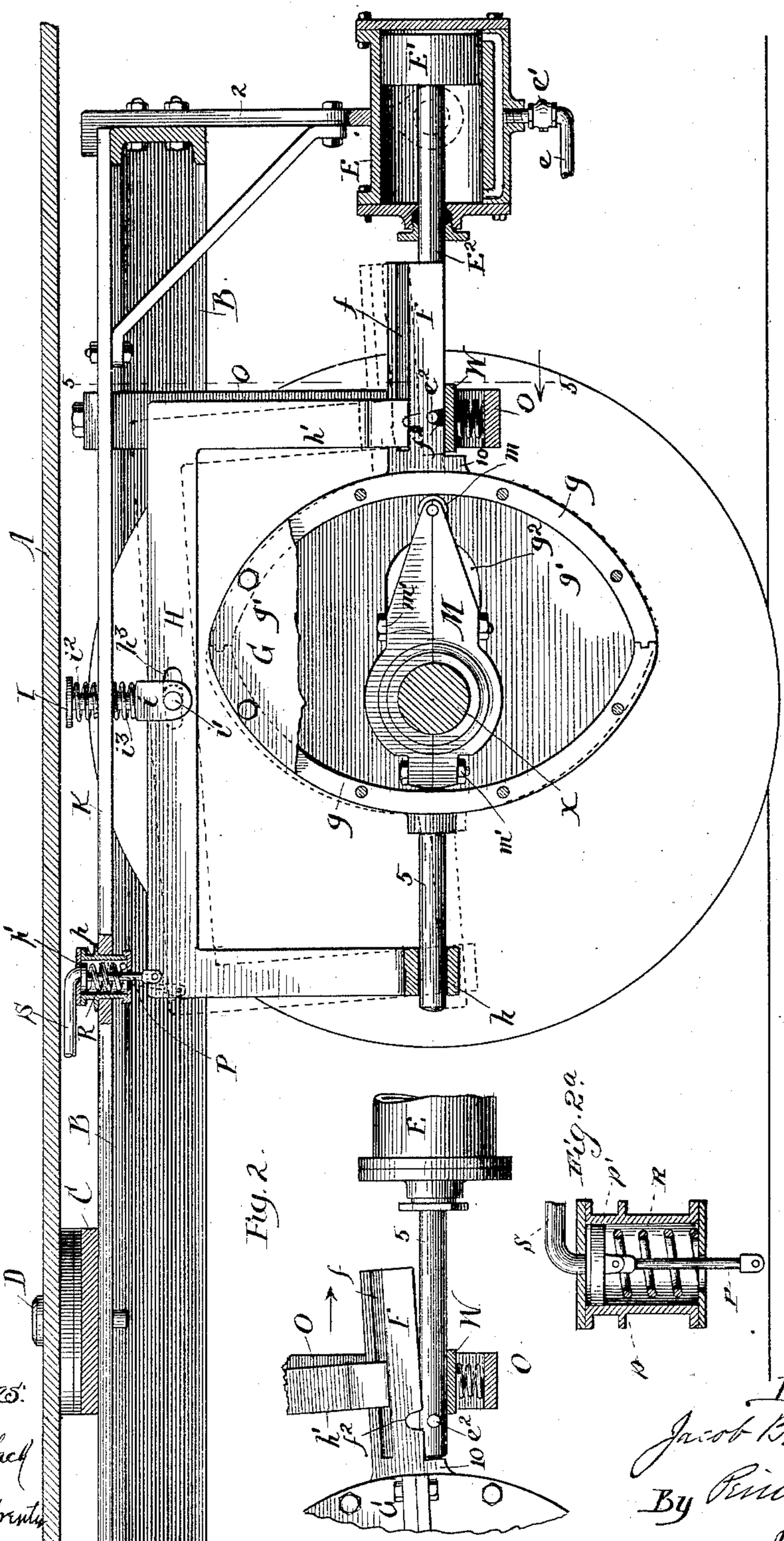

Fig. 2.

Fig. 2a.

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Fig. 5.

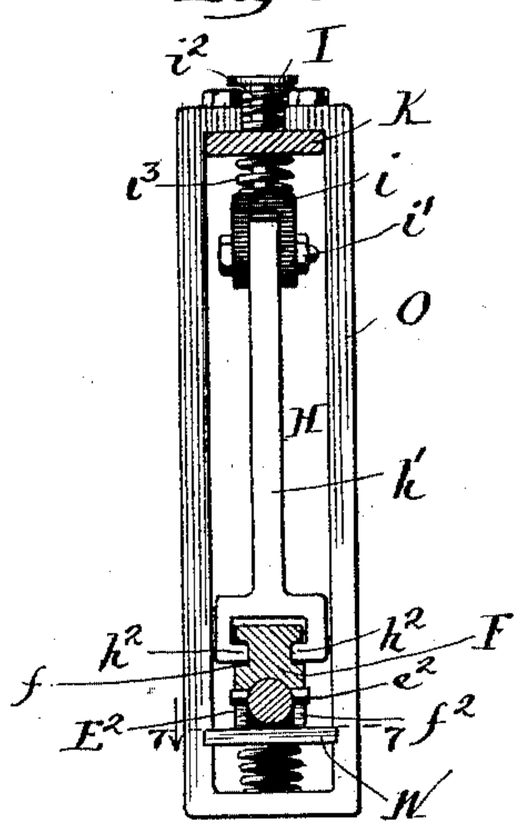


Fig. 3.

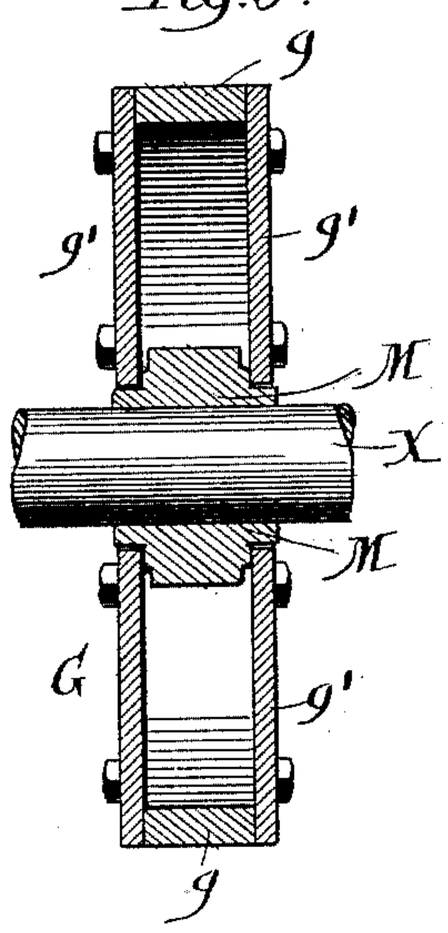


Fig. 6.

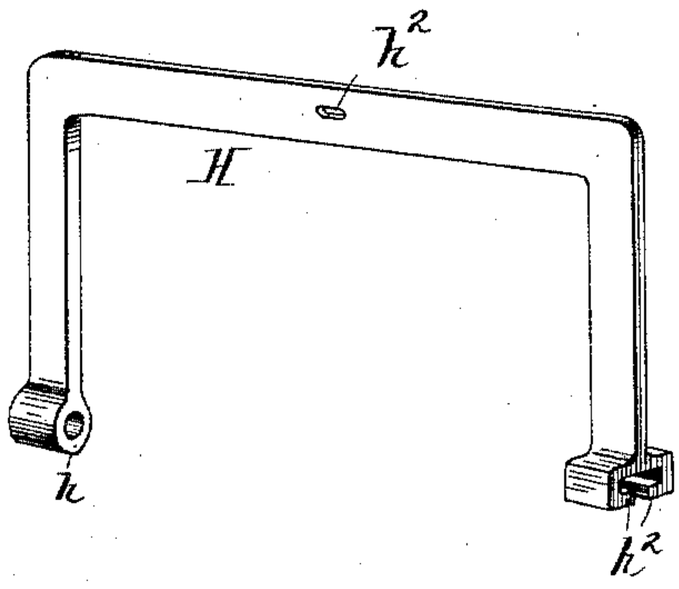


Fig. 4.

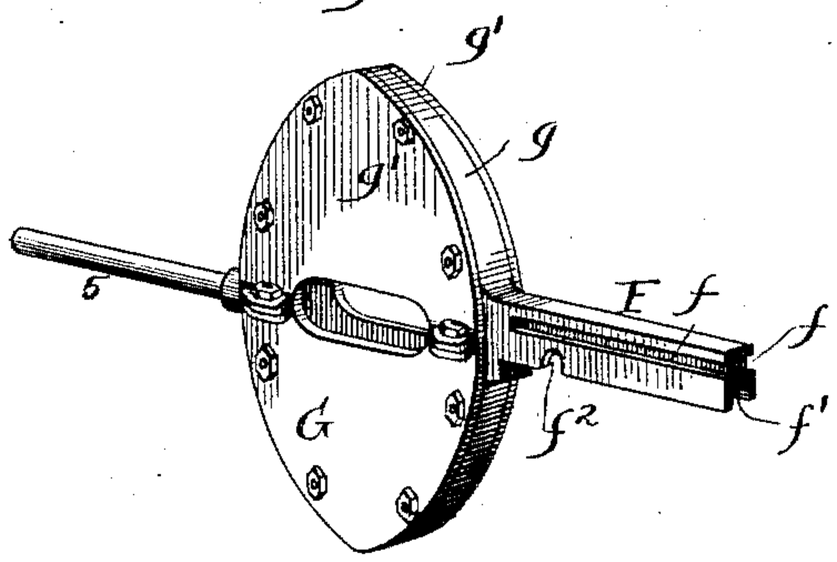
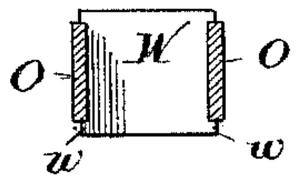


Fig. 7.



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UNITED STATES PATENT OFFICE.

JACOB B. KNUDSEN, OF FERNWOOD, ILLINOIS.

AIR-BRAKE.

SPECIFICATION forming part of Letters Patent No. 468,387, dated February 9, 1892.

Application filed December 30, 1890. Serial No. 376,213. (No model.)

To all whom it may concern:

Be it known that I, JACOB B. KNUDSEN, a citizen of the United States, residing at Fernwood, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Air-Brakes, of which I do declare the following to be a full, clear, and exact description, reference being had to the accompanying drawings, forming part of this specification.

My present invention has relation more particularly to that class of air-brakes in which the compression of the air is effected by the operation of a pump driven from the axle of the car-wheels; and my improvements are directed more particularly to the construction of mechanism for operating the piston of the air pump or compresser.

These improvements have for their object, primarily, to insure the operation of the pump in order to maintain a proper supply of air within the storage-chamber or reservoir of the air-brake system and to provide for throwing the air-pump out of action when a plenum pressure within the storage-chamber or reservoir is reached.

Figure 1 is a view in vertical section through a portion of the car-floor and a portion of the truck-frame and car-axle, showing my improvements in position for operating the air-pump, the cylinder of the pump being also shown in vertical section. Fig. 2 is a detail view, partly in side elevation and partly in vertical section, of a portion of the air-pump, its piston, and the actuating-arm for the piston. Fig. 2^a is a detail view, in vertical section, through the cylinder at the top of the throw-off bar. Fig. 3 is a view in vertical section of the driving-frame upon the car-axle. Fig. 4 is a perspective view of such frame, showing the driving-arm and supporting-rod connected thereto. Fig. 5 is a view in vertical section on line 5 5 of Fig. 1. Fig. 6 is a detail perspective view of the tilting bar whereby the driving-frame is carried. Fig. 7 is a view in transverse section on line 7 7 of Fig. 5.

A designates the floor of the car, beneath which extends the truck-frame B, this frame being shown as connected to the transom C and to the car-floor A by means of a suitable king-bolt D. The truck-frame is of well-known construction and will be supported upon the axles of the car in the usual manner; but as this truck-frame forms no part of my present invention I have not deemed it necessary to illustrate the same in detail.

The cylinder E of the air-pump is sustained by a suitable bracket 2, that depends from the truck-frame B, and from this air-pump cylinder leads a discharge-pipe, *e* (provided with a suitable check-valve *e'*) to a compressed-air reservoir located at any convenient point. Within the cylinder E works the piston E', the rod or stem E^2 of which is provided with a cross-pin e^2, adapted to be engaged by the connecting-arm F when the pump is to be operated. The connecting-arm F is united to the periphery of the driving-frame G, this frame being preferably formed of the rim or periphery *g* and the sides *g'*, bolted thereto. The periphery *g* and the sides *g'* may be formed in sections to permit them to be conveniently placed upon the car-axle.

To that part of the periphery *g* opposite the point at which the connecting-arm F is attached is united a guide-rod 5, that is mounted in the expanded end *h* of the throw-off bar H. This throw-off bar H is provided, also, with the depending end *h'*, adapted to engage with the connecting-arm F, a convenient method of effecting this engagement being to provide the sides of the arm F with the grooves *f*, into which the inwardly-bent ends h^2 of the throw-off bar will enter. The throw-off bar H is sustained by means of the rod I, the yoke-shaped ends *i* of which are pivotally connected to the throw-off bar H by means of the pin *i'*. This rod I passes through a top plate K, that is supported by the truck-frame B, and upon each side of this top plate and encircling the rod I are placed the coiled springs i^2 and i^3, which serve to sustain the throw-off bar H in such manner that an elastic action thereof can be had to compensate for the movements of the truck-frame with respect to the car-axle. The slot h^3 of the bar H, through which the pivot-pin *i* passes, is made of a size somewhat larger than the bolt, so as to permit a longitudinal movement of this bar, as will be presently stated.

The side plates *g'* of the shifting frame G are provided with the long openings g^2 to permit this frame to move back and forth

upon the car-axle X, and upon this axle and within the shifting frame G is fixed the driving-arm M, the outer portion of which is provided with a friction-roller *m*, that bears against the inner face of the periphery *g* of the shifting frame G. This driving-frame M is preferably formed in sections conveniently bolted together, as at *m'*, as such construction permits the driving-arm to be readily placed in position on the axle.

The connecting-arm F is preferably formed with a channel *f'*, adapted to partially inclose the piston-rod E^2 of the air-pump, as the arm is thereby held in better working relation to the piston. The under side of the arm F is also furnished with notches f^2, adapted to receive the pin *e* when this arm is to be thrown into engagement with the piston-rod E^2 of the air-pump in order to supply compressed air to the compressed-air chamber or reservoir. By preference the arm F, when in the position shown in Fig. 1, rests upon a spring-seated plate W, carried at the lower portion of the suspension strap or frame O, that is bolted to and depends from the top plate K of the truck-frame B, this spring-seated plate W being preferably formed with extensions *w* to retain it in position between the arms of the suspension strap or frame O.

From the foregoing construction it will be seen that if the parts are in the position illustrated in Fig. 1 of the drawings and the car is put in motion the rotation of the axle X will cause a corresponding revolution of the driving-arm M, and as this arm is revolved its friction-roll *m* will bear against the eccentrically-shaped periphery *g* of the shifting frame G and will cause a reciprocating movement of the arm F, attached to this frame. As the arm F is at such time engaged with the pin e^2 of the piston-rod E^2, it is manifest that a reciprocating movement of the piston-rod E^2 and piston E' will be effected, thereby causing the compression of air within the pump-cylinder E, from which cylinder the air will be conducted by the delivery-pipe *e* to a suitable chamber or reservoir, from whence it will be distributed to the car-brakes, as may be needed. This operation of the pump will continue so long as the car is in motion and so long as the shifting-arm F is in engagement with the pin e^2 of the piston-rod E^2. When, however, a plenum pressure within the storage-chamber of the air-brake system is attained, it is desirable that the air-pump should be thrown out of operation, and it is to effect this throwing of the air-pump out of operation that I have mounted the shifting frame G and its arm F in such manner that a ready disengagement of the arm F from the piston-rod can be secured. This disengagement of the arm F from the piston-rod E^2 is secured by rocking the throw-off bar H about the pivot-pin *i'*, and while this rocking movement of the throw-off bar might be produced by a treadle or lever connected to the throw-off bar still I prefer to provide means whereby an automatic movement of the throw-off bar and a consequent automatic disengagement of the connecting-arm F from the piston-rod E^2 shall occur when a plenum pressure within the storage-chamber of the brake system has been reached. To accomplish this I connect to the rear end of the throw-off bar H a piston-rod P, that moves within a cylinder *p*, that is carried by the top plate K of the truck-frame B. The stem of this piston-rod P is pivotally connected to its head *p'* and to the throw-off bar H, and upon this stem and within the cylinder *p* is carried a resistance-spring R, that bears against the head of the piston and the end of the cylinder with a predetermined force. With the end of the cylinder *p* opposite that through which the piston P passes connects a pipe S, that also connects with the storage chamber or reservoir of the air-brake system, so that when a plenum pressure within such chamber or reservoir is reached the force of the resistance-spring R will be overcome, thereby permitting the head *p'* of the piston P to be depressed and causing this piston P, by reason of its connection with the throw-off bar H, to rock this bar about the pivot-pin *i'*. As the arms of the throw-off bar H are attached to the connecting-bar F and the rod 5, it is manifest that as this throw-off bar is thus rocked the shifting frame G, the connecting-arm F, and the rod 5 will be correspondingly moved and the connecting-arm F will be lifted to such extent as to disengage this arm from the cross-pin e^2 of the piston-rod E^2. Hence it will be seen that when such movement of the throw-off bar H occurs by reason of the plenum pressure within the storage chamber or reservoir of the air-brake system the air-pump will be thrown out of action and will remain out of action until the pressure of air within the storage chamber or reservoir is so far diminished as to permit the spring R to again lift the piston-rod P and shift the throw-off bar H in such manner as to again cause the connecting-arm F to engage with the cross-pin e^2 of the piston-rod E^2, as it is desirable that the piston-rod E^2 shall remain as far as possible within the cylinder E of the air-pump during the time that such pump is out of action. In order to protect the piston from accumulating dirt and dust, I provide that the end of the piston-rod E^2 shall be struck by the shoulder or extension 10 at the base of the connecting-arm F, so that after the disengagement of the connecting-arm F and the piston-rod E^2 occurs the further movement of the shifting frame G will force the piston-rod E^2 inward, where it will remain until a re-engagement of the piston-rod and connecting-arm occurs. My purpose in providing the throw-off bar H with a long slot h^2 to receive the pivot-pin *i'* is to enable this bar H to receive the backward shift at the same time that it is rocked about the pivot-pin, since by this arrangement the ends of the arms *h* and

h' of the throw-off bar H will be constantly maintained at uniform distances from the car-axle X, and consequently the striking of the shifting frame against the ends of these arms will be avoided.

The precise details of construction above set out may be varied without departing from the spirit of my invention, and to such details, therefore, I do not wish the invention to be understood as restricted.

My improved mechanism above described, while applicable for use in other situations, is more particularly designed for air-brake systems of street-railway cars.

One advantage in forming the shifting frame G with the side plates and periphery, as shown, is that the driving-arm is thereby very much better protected from the accumulation of dirt and dust than would be possible if no side plates were employed. The feature of forming the side plates and periphery of this shifting frame in sections and of forming the driving-arm in sections is also important, since it affords a ready means whereby the parts may be attached to the axles of the cars.

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

1. In air-brake mechanism, the combination, with the air-pump, of a connecting-arm adapted to engage the piston-rod of said pump, an eccentrically-shaped shifting frame for operating said connecting-arm, a guide-rod attached to said shifting frame at a point opposite said connecting-arm, a pivoted throw-off bar connected to said guide-rod and said connecting-arm, a driving-arm located within said shifting frame and having a friction-roll adapted to bear against the periphery of said shifting frame, and suitable means for operating said throw-off bar, substantially as described.

2. In air-brake mechanism, the combination, with the air-pump, of the connecting-arm adapted to engage the piston-rod of said pump, a shifting frame for operating said connecting-arm, a pivoted throw-off bar for throwing said connecting-arm out of engagement with said piston-rod, a guide-rod attached to said shifting frame at a point opposite said connecting-arm, a pivoted throw-off bar for throwing said connecting-arm out of engagement with said piston-rod, a guide-rod attached to said shifting frame at a point opposite said connecting-arm, said throw-off bar being attached to said guide-rod and said connecting-arm, a driving-arm within said shifting frame, a piston-rod connected to said throw-off bar, a spring-seated piston for operating said piston-rod, a cylinder for said piston, and a suitable pipe for admitting air to said piston, substantially as described.

3. In air-brake mechanism, the combination, with the air-pump, of a connecting-arm adapted to engage the piston-rod of said pump, an eccentrically-shaped shifting frame for operating said connecting-arm, a guide-rod attached to said shifting frame, a throw-off bar connected to said guide-rod and said connecting-arm and provided with a slot, a pivot-pin for said throw-off bar, passing through the slot thereof, and suitable means for rocking said throw-off bar about its pivot-pin, substantially as described.

4. In air-brake mechanism, the combination, with the air-pump, of a connecting-arm adapted to engage the piston-rod of said pump, a shifting frame for operating said connecting-arm, a throw-off bar for throwing said connecting-arm out of engagement with said piston-rod, a driving-arm for operating said shifting frame, and suitable means for operating said throw-off bar, said shifting-frame bar being furnished with a shoulder adapted to force the piston-rod into the cylinder after the disengagement of the connecting-arm and piston-rod is effected, substantially as described.

5. In air-brake mechanism, the combination, with the air-pump, of a connecting-arm adapted to engage the piston-rod of said pump, a shifting frame for operating said connecting-arm, a throw-off bar for throwing said connecting-arm out of engagement with said piston-rod, a pivot-rod and pivot-pin for sustaining said throw-off bar, a top-plate for sustaining said throw-off bar, suitable springs for giving to said throw-off bar an elastic support, and suitable means for operating said throw-off bar, substantially as described.

6. In air-brake mechanism, the combination, with the air-pump comprising a cylinder E and piston-rod E^2, provided with a pin e^2, of a connecting-rod F, adapted to engage said piston-rod, a shifting frame G, consisting of side plates g' and periphery g, a driving-arm M within said shifting frame and provided with a friction-roller m at its end, a pivoted throw-off bar H, and suitable means for operating said throw-off bar, substantially as described.

7. In air-brake mechanism, the combination, with the air-pump and its piston-rod E^2, of a connecting-arm F, adapted to engage said piston-rod and provided with longitudinal slots f, a shifting frame G, to which said connecting-arm is attached, a guide-rod 5, also connected to said shifting frame, a throw-off bar H, one arm of which is connected to said guide-rod 5 and the opposite arm of which has yoke-shaped portions adapted to enter the slots f of the connecting-arm, a pivot-pin for sustaining said throw-off bar, and suitable means for operating said throw-off bar, substantially as described.

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