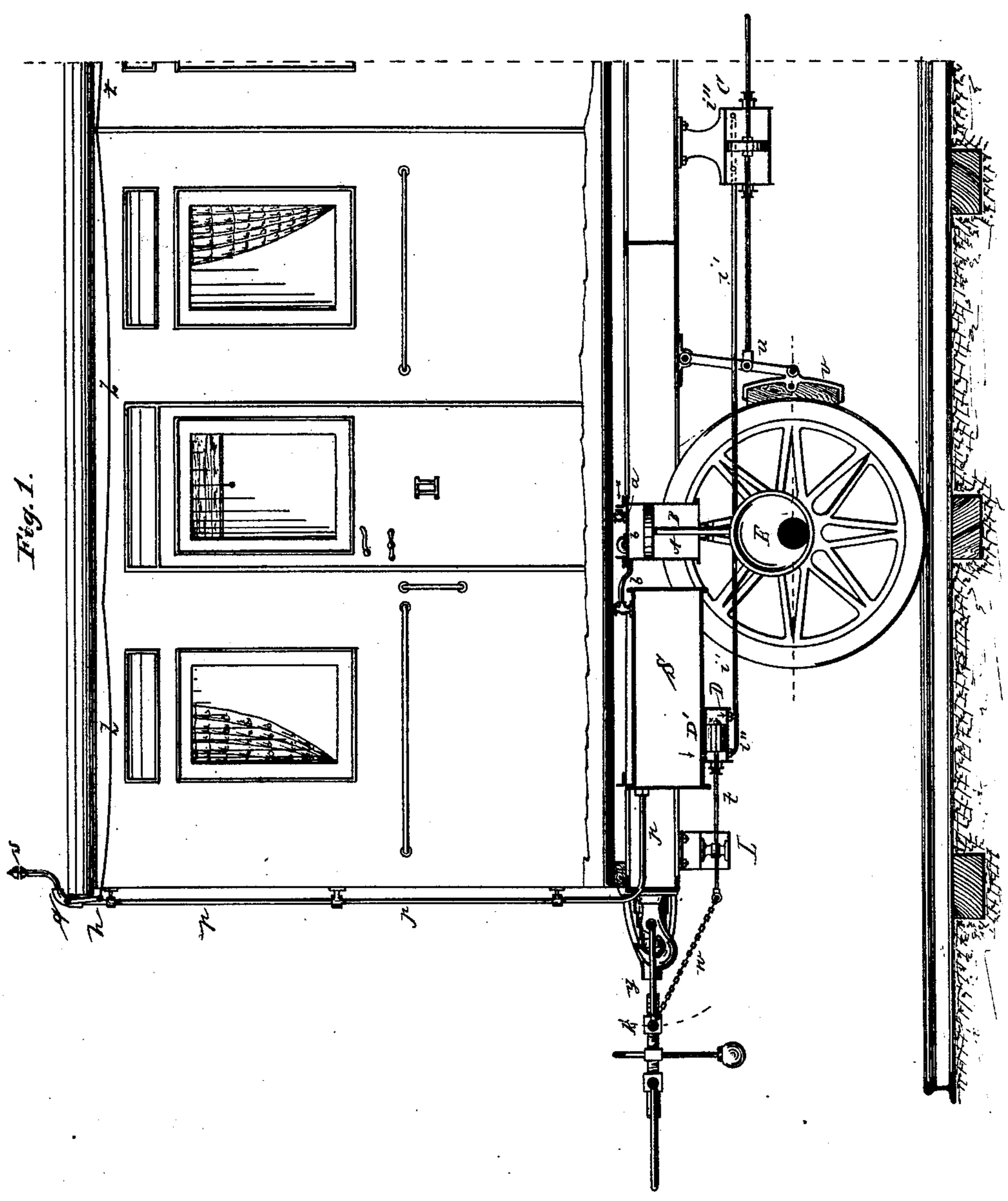
4 Sheets—Sheet 1.

R. SCHULTZ, called NIBORN.

Air-Brake for Railroad-Cars.

No. 220,178. **Patented Sept. 30, 1879.**

Fig. 1.



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Air-Brake for Railroad-Cars.

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Fig. 2.

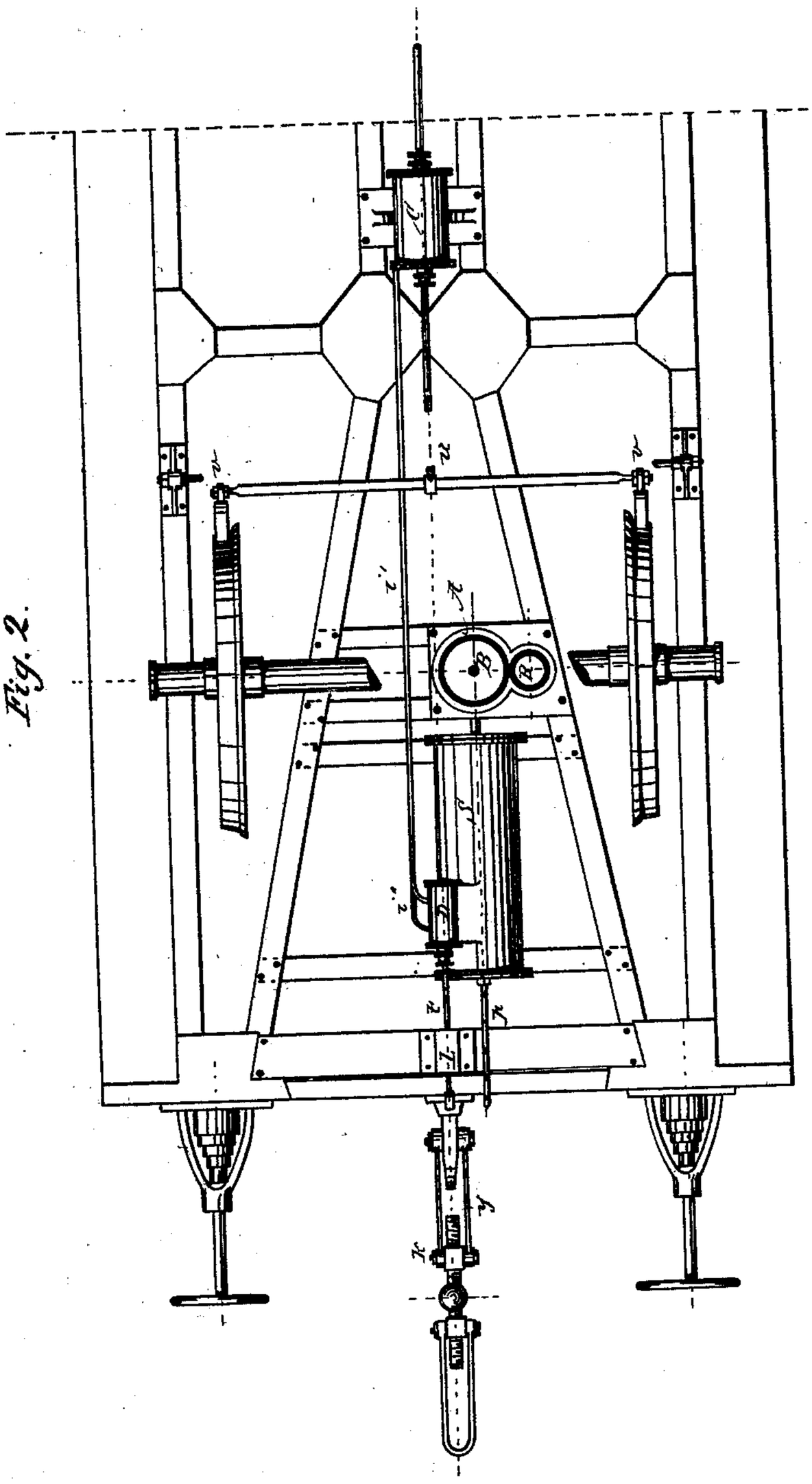

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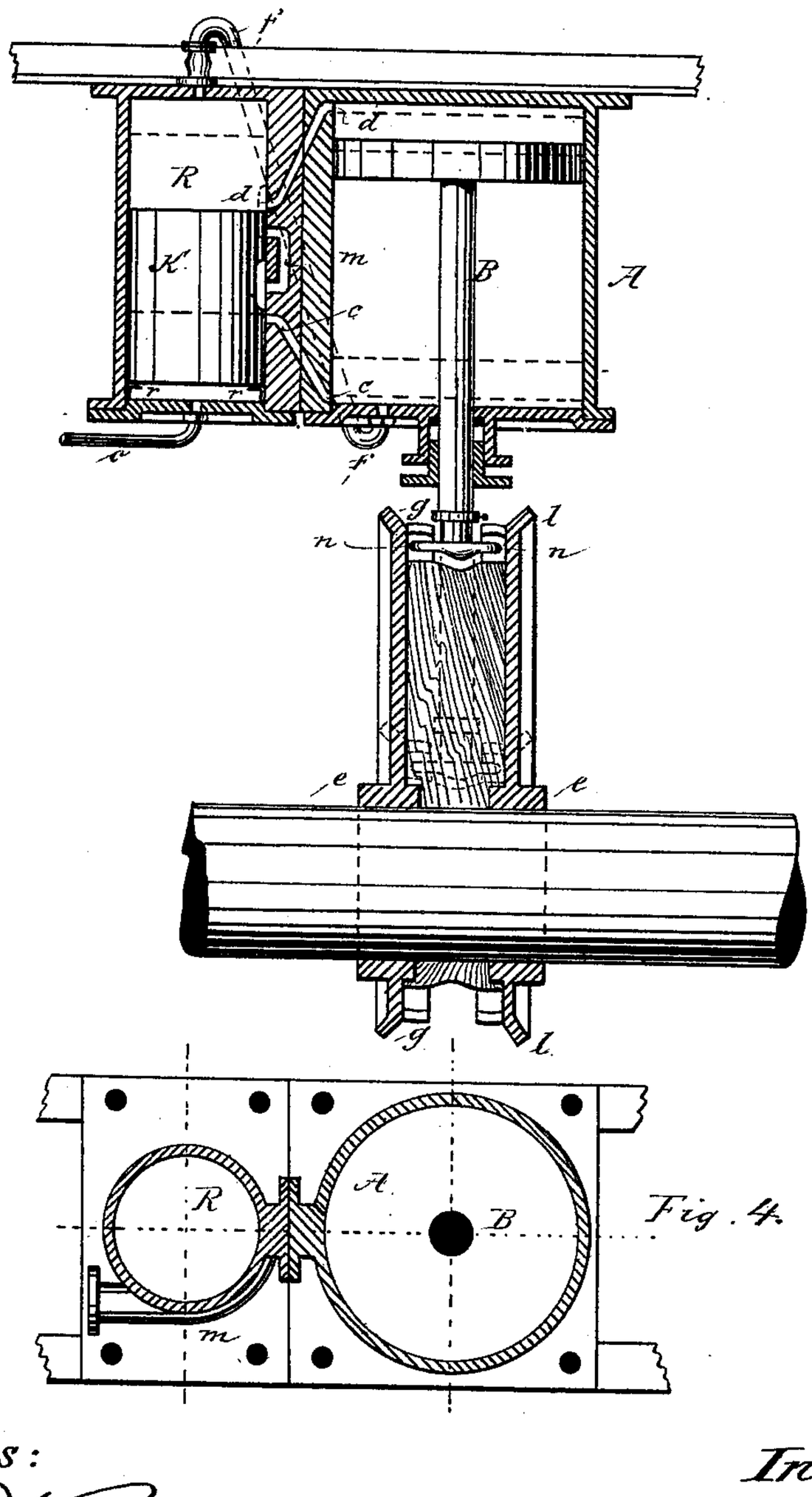
Fig. 3



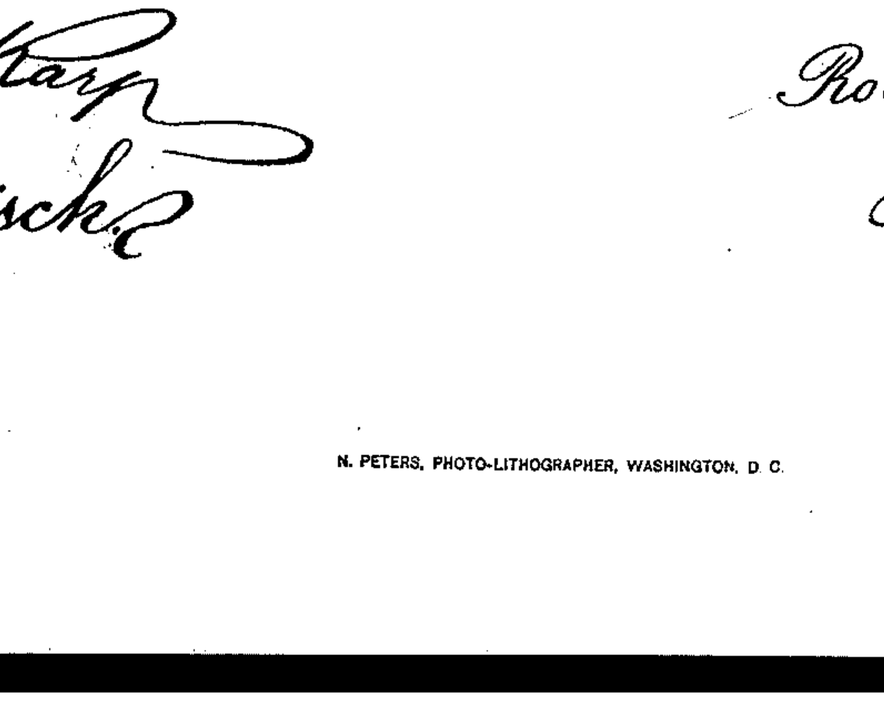


Fig. 4.

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4 Sheets—Sheet 4.

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Air-Brake for Railroad-Cars.

No. 220,178. **Patented Sept. 30, 1879.**

Fig. 5.

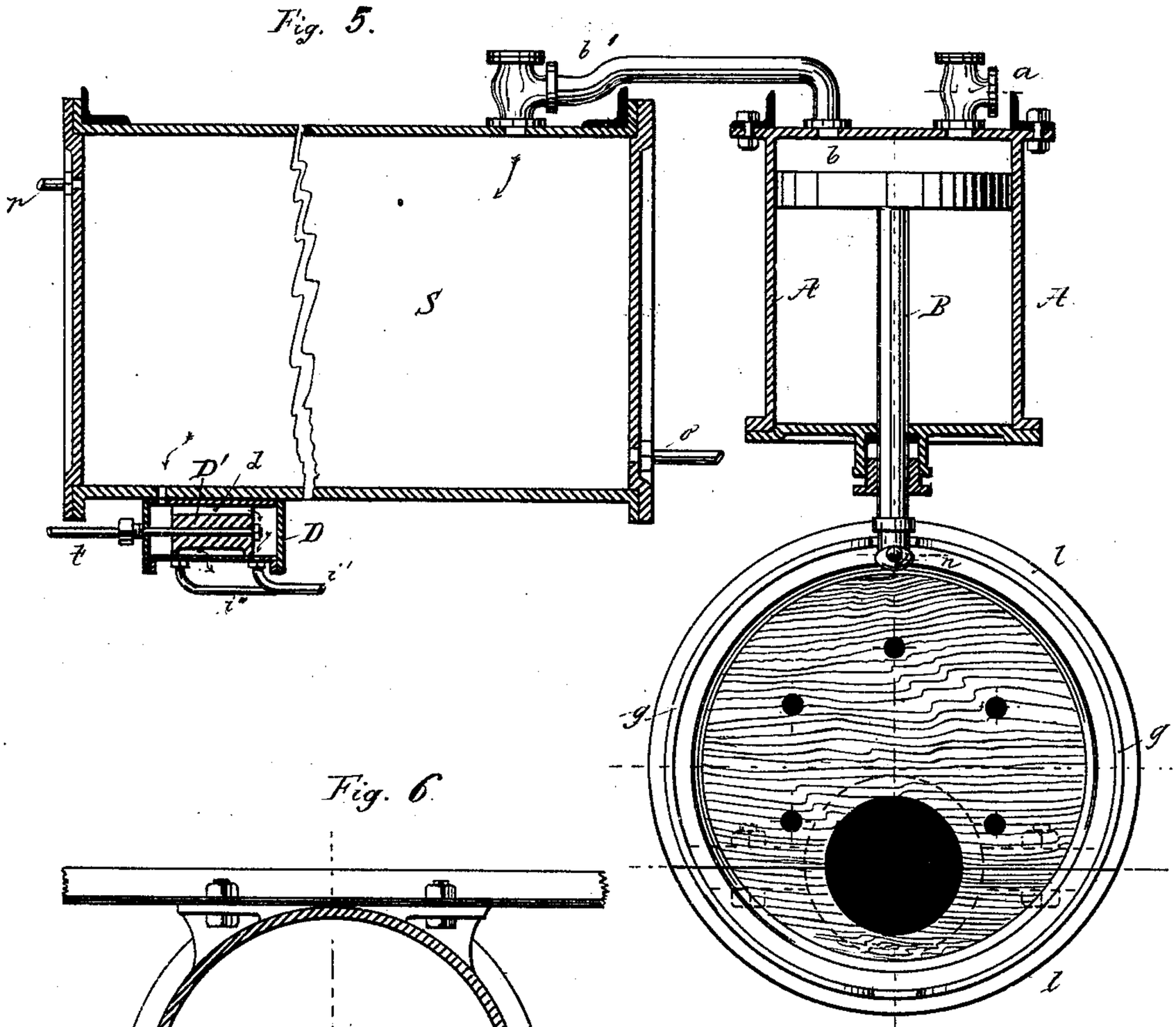


Fig. 6.

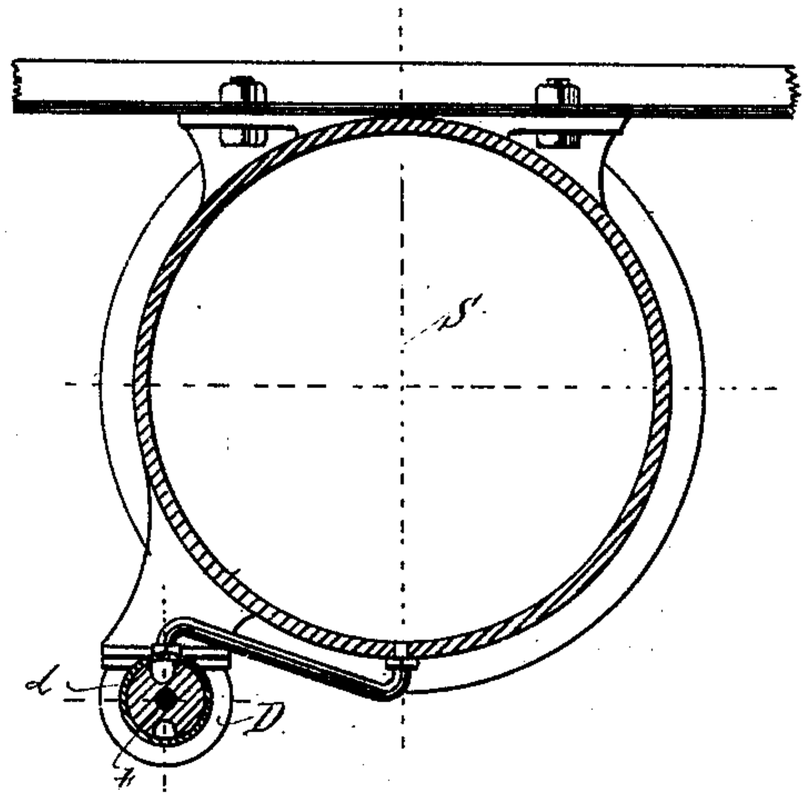
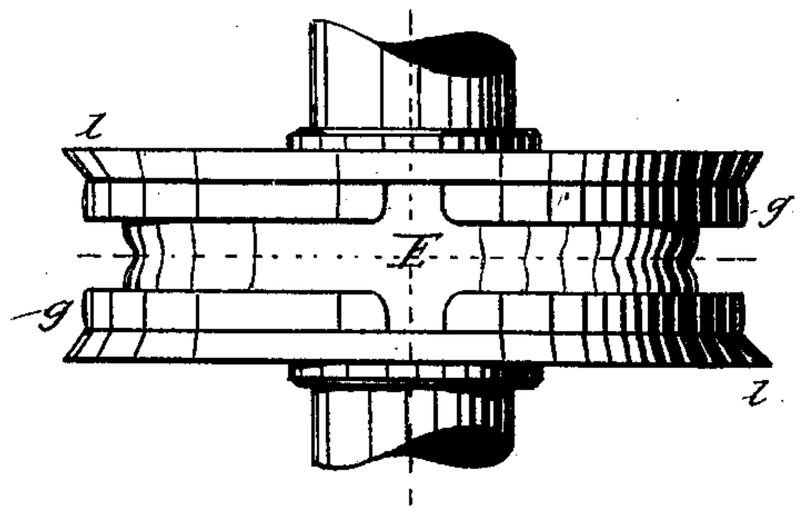


Fig. 7.



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UNITED STATES PATENT OFFICE.

ROBERT SCHULTZ, CALLED NIBORN, OF KATTOWITZ, PRUSSIA, GERMANY.

IMPROVEMENT IN AIR-BRAKES FOR RAILROAD-CARS.

Specification forming part of Letters Patent No. **220,178**, dated September 30, 1879; application filed April 29, 1879.

To all whom it may concern:

Be it known that I, ROBERT SCHULTZ, called NIBORN, of the city of Kattowitz, Prussia, in the Empire of Germany, have invented an Improved Automatic Air-Brake for Railroad-Cars, of which the following is a specification.

The main objection to the various automatic systems for braking by compressed air, steam, or other agents was made against the central source of power in the same, by which the brakes of all the cars of a train were controlled, and which rendered a durable and reliable connection difficult and expensive, and for long trains the control of the rear part of the train uncertain and unreliable. Besides, an expensive system of coupling for the communicating pipes is required, which makes, to some extent, the making up of trains, &c., less convenient.

The object of my invention is to provide each car with a separate automatically-working brake mechanism, in which compressed air is employed as the actuating agent, and by which each car of a train is rendered independent of a central source of power. The brakes are thrown automatically into action in case an accident occurs at any part of the train, while also a signaling arrangement may be worked in connection with the compressed-air reservoir, so that a higher degree of safety for the passengers and the independence of each car in making up the train are obtained.

The invention consists, essentially, of an air-pump, whose piston is worked by an eccentric on one of the truck-axles. The air-pump is connected with a reservoir and a regulator, for discontinuing automatically the working of the pump when a certain air-pressure is reached. A slide-valve of the compressed-air reservoir is connected with the coupling and with a brake-cylinder, so as to apply the brakes automatically to the car-wheels as soon as the strain on the car-coupling is released, either by a decrease of speed, or on a descending gradient, or by an accident to any part of the train.

Referring to the drawings, Figure 1 represents a sectional side elevation of a railroad-car, with my improved automatic-brake arrangement shown in vertical longitudinal section. Fig. 2 is a bottom view of the car and brake, partly in horizontal section. Fig. 3 is a vertical axial section of the air-pump with its regulator and actuating mechanism; Fig. 4, a horizontal section of the air-pump and regulator; Fig. 5, a vertical longitudinal section through air-pump, reservoir, and actuating mechanism; Fig. 6, a vertical transverse section of the compressed-air reservoir and slide-valve; and Fig. 7 is a top view of the actuating-eccentric of the car-axle, drawn on an enlarged scale.

Similar letters of reference indicate corresponding parts.

To the bottom of the car-frame are attached, vertically above one of the truck-axles, an air-pump, A, and a reservoir, S, for the compressed air. The piston B of the air-pump is operated by means of an eccentric, E, of cast-iron or oak, which is rigidly keyed to the axle. The greatest length of the eccentric is somewhat (about thirty millimeters) shorter than the maximum stroke of the piston of the air-pump. To both sides of the eccentric E are applied metal disks *e*, which are of somewhat larger diameter than the eccentric, and provided with inwardly-projecting annular flanges or keepers *g*, and with inwardly-inclined circumferential rails *l*. A space of about twenty-five millimeters in width is left between the eccentric and the keepers of the side disks. These flanges or keepers are recessed at the points of maximum or minimum distance from the axle, as shown in Figs. 4 and 7, the width of these lateral recesses being about fifty millimeters.

The inner faces of the flanges are at such distance from each other that the piston-rod, which is somewhat reduced in thickness at the lower end, passes readily through the open space between the flanges.

The lower end of the piston-rod is arranged with a cross-head, *n n*, which fits by its convex under side into a circumferential center groove of the eccentric, and is engaged at both sides by the flanges.

The ends of the cross-head are semicircular, so as to slide readily along the flanges, which are curved somewhat at their inner sides.

The cross-head is inserted between the flanges by means of one of the recesses, and thereby the piston moved up and down by the eccentric as soon as the car is set in motion.

Air is drawn into the air-pump through a

suction-valve, *a*, on the descent of the piston, and is forced through the exit-opening *b* and valve-pipe *b'* into the reservoir S on the upward strokes of the piston. The reservoir S is also connected at its lower part, by pipes *o o*, with a regulator, R, which is arranged alongside of the air-pump, as shown in Figs. 3 and 4.

The regulator R contains a tightly-fitting and weighted slide-valve, K, which is supported on a seat, *r*, near the bottom when in a state of rest. The regulator R communicates by diagonal channels *c* and *d* with the lower and upper parts of the air-pump and by an exterior pipe, *f*, which extends from the top of the regulator to the bottom of the air-pump. Pipe *f* is closed by a spring-valve at its upper end in such a manner that air can pass into the regulating-chamber from the pump, but not in opposite direction from the regulator to the pump.

The weighted slide-valve K closes, when in its lowermost position, the channel *c*, but leaves the upper channel, *d*, open, so that the upper part of the air-pump communicates with the upper part of the regulator. As soon as such a quantity of air is compressed in the reservoir S that the pressure of the same overcomes the weight of the slide-valve K of the regulator and its friction therewith, the slide-valve K will be raised, and thereby the upper channel, *d*, closed. The body of air which is then inclosed in the upper part of the regulator forms an air-cushion, the compression of which produces a gradually-increasing resistance to the upward motion of the piston.

By the gradual increase of the air-pressure in the reservoir S and in the space below the weighted slide-valve K the latter will be gradually raised to such a height that the lower channel, *c*, will be opened. (This position of the piston is indicated in dotted lines in Fig. 3.) The highly-compressed air enters then into the air-pump below the piston, and forces the same in upward direction, which is furthermore assisted by the escape of the air above the piston, as in the same moment when the lower channel is opened the upper channel, *d*, is connected by a side recess of the slide-valve K with an exit-channel, *m*, that communicates with the atmosphere.

The pressure on the lower part of the piston of the air-pump sustains the piston in the upper part of the pump, and causes the disconnection of the cross-head of the piston-rod from the keepers of the eccentric as soon as the cross-head arrives at one of the lateral recesses of the flanges. The pressure of the compressed air in the reservoir retains thus the piston B in the uppermost position, (shown in dotted lines in Fig. 4,) and keeps thereby the cross-head clear of the greatest eccentricity of the flanges, so that they are prevented from engaging the cross-head. The air-pump is thus placed out of action for a time; but as soon as by the decreasing pressure in the reservoir S the weighted slide-valve in the regulating-chamber R slides downward again it will close the lower channel, *c*. The highly-compressed air below the piston of the air-pump is then forced through the pipe *f f*, and acts with a considerable but gradually-decreasing pressure on the weighted slide-valve until the same arrives again in its lowermost position, so as to open the upper channel, *d*. The air can then pass from the upper part of the regulator to the upper part of the air-pump, above the piston, and will force the same down, so that the cross-head will drop on the flanges and slide along the same until it can drop through the recesses into the annular space below the same. The air-pump is thereby in perfectly automatical manner set into operation again, and serves to charge the reservoir until the pressure therein is capable of raising again the weighted slide-valve, so as to interrupt the functioning of the air-pump, and so on alternately.

To secure the vertical motion of the piston of the air-pump, the piston-rod may be arranged with additional side guide devices, while in practice it may be advisable, for securing the proper working of the pump, to place the stuffing-box of the pump as far as possible toward the inside of the pump, and eventually to inclose the entire pump by a sheet-metal casing, so as to protect the same as much as possible against dust.

As long as the car is in motion a constant air-pressure will be obtained by the action of the air-pump, the pressure being regulated by a proper construction and weight of the regulating slide-valve.

The compressed air which is thus obtained for each car by the mechanism described may be utilized as a motive power for the purpose of actuating the brakes, as well as for signaling purposes. For the latter purpose a pipe, *p*, leads from the reservoir S upward to a point above the roof of the car, and is there arranged with a whistle, *s*, in the nature of a steam-whistle. The escape of the compressed air is prevented by a double lever-valve, *g*, and the latter opened by a lever-arm, *h*, which is connected with a cord, *z*, that passes inside or outside of the car, according to the construction of the same.

By a prearranged system of signals the conductor, brakemen, or passengers may in each car communicate with the engineer, so as to guard against accidents and furnish a complete control over all the cars of the train.

For employing the compressed air of the reservoir for the brakes, a small brake-cylinder, C, is arranged intermediately between the truck axles. The piston-rod of this cylinder is extended in both directions, and pivoted to the levers *u* of the brake-shoes *v*, which are applied to the wheels or removed therefrom, according as the compressed air acts on one side or the other of the piston. The supply of air to the brake-cylinder may be governed by a common slide-valve that is arranged in a valve-casing, D, below the reservoir S, the casing being connected by pipes i^1 and i^2, re-

spectively, with the front and back of the brake-cylinder. The slide-valve may be readily controlled by the brakeman by means of a common elbow-lever, and thus the brakes be applied easily and quickly with full force.

As by this method, however, but a comparatively small advantage over the old method of braking the cars would be obtained, it is preferable to use a slide-valve construction, by which the brakes are controlled by purely mechanical means in an entirely automatical manner. This may be obtained by connecting the guide-rod of the slide-valve by a rigid forked rod or link with a pivot-pin, *k*, of the coupling-link *y*, so that as long as the coupling-link is kept by the strain in horizontal position the slide-valve is held in its foremost position, the slide-valve being thereby drawn away from the wheels.

As soon as, however, the cars are crowded up against each other, owing to a descending gradient in the track, or to a sudden braking of the locomotive, or to the throwing of a car from the track, the position of the coupling-link is changed from its horizontal position, describing an arc of a circle, and pushing the slide-valve back. This admits the compressed air to the other side of the piston of the brake-cylinder and applies the brakes, removing the same again as soon as the coupling-link is drawn up into a horizontal position again.

As the main object of this construction is to apply the brakes as soon as the strain of the coupling is but slightly released, it is preferable for overcoming any frictional resistance in the distribution of the air to employ not a common slide-valve, but a piston-valve, D′, of the construction shown in Fig. 5. This piston-valve remains in the position shown as long as the train is in motion, and as long as the coupling-link and the guide-rod are drawn taut. In this position the pipe i^2, which leads to the part back of the brake-piston, is placed in communication by a recess of the piston-valve with the atmospheric air, while the compressed air acts not alone on the front face of the piston-valve D′, but also by a channel, *d*, of the same, and the pipe i^1, on the front of the brake-piston, so as to keep thereby the brakes by direct pressure away from the wheels. The pressure of the compressed air on both sides of the piston-valve balances the same, though there is a tendency to push the piston-valve back. The piston-valve, however, cannot follow the air-pressure on its front face until the coupling-link, for some reasons or other, is dropped from its horizontal position, and allows thereby the backward motion of the piston-valve. The piston-valve places then the pipe i^1 in communication with the atmospheric air and admits the passage of the compressed air to the brake-cylinder, so as to instantly apply the brakes. This construction does not require the rigid connection between guide-rod and coupling-link, but admits a flexible connection by a chain, as shown in Fig. 1, which is superior to the rigid rod, as by the breaking of the coupling, for instance, in that case the slide-valve had to be made of a length corresponding to that of the coupling-link *y*.

By the automatical functioning of the piston-valve, in connection with the automatic working of the air-pump and reservoir, it is possible to apply the brakes in a more reliable and powerful manner than heretofore.

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

1. The combination of an air-pump, compressed-air reservoir, and pressure-regulating mechanism with an actuating mechanism of the car-axle that is adapted to throw the air-pump out of action when a maximum pressure is obtained in the reservoir, substantially as set forth.

2. The combination of an air-pump having a piston-rod and a cross-head at its lower end with a fixed eccentric of the truck-axle, arranged vertically below the air-pump, the eccentric having side disks, with annular flanges or keepers, that engage the cross-head of the piston-rod, substantially as and for the purpose specified.

3. An air-pump having a piston-rod and a cross-head, convex at the under side, in combination with an eccentric that is keyed to the truck-axle vertically below the air-pump, the eccentric having a central guide-groove and side disks, with annular flanges and circumferential inwardly-inclined rails, for retaining and guiding the cross-head, substantially as specified.

4. The combination of an air-pump having a piston-rod and a cross-head at its lower end with an eccentric of the truck-axle that is provided with side disks, having flanges or keepers that are laterally recessed at one or more points, to admit the entrance or escape of the cross-head of the piston, substantially as and for the purpose set forth.

5. The combination of an air-pump with a reservoir for the compressed air, and with a regulator and weighted slide-valve, arranged sidewise of the air-pump, the regulator being connected to the air-pump and reservoir in such a manner that the functioning of the air-pump is interrupted when the maximum pressure is reached, substantially as described.

6. The combination of the air-pump and reservoir S and regulator R, having a weighted slide-valve, K, the air-pump and regulator having communicating channels *c d*, valved communicating pipe *f*, and an exit-aperture, *m*, substantially as set forth.

7. The combination, with an air-pump operated intermittently by actuating mechanism of the car-axle, of a compressed-air reservoir, of an automatically-working pressure-regulator between air-pump and reservoir, of a slide-valve connected with the air-reservoir, and of a brake-actuating mechanism connected with the slide-valve, so as to apply or remove the brakes by working the slide-valve, substantially as specified.

8. The combination of the compressed-air reservoir, having a slide-valve, connected to the car-coupling, with a brake-cylinder, piston, and brakes, so as to apply the brakes automatically when the strain on the coupling is relaxed, and remove them when the coupling is drawn taut, substantially as set forth.

9. The combination of a compressed-air reservoir, having a balanced piston-valve, that is connected to the car-coupling, with a brake-cylinder, piston, and brakes, and with pipes that connect the front and back of the piston-valve casing, respectively, with the back and front of the brake-cylinder, to automatically apply or remove the brakes on the relaxing or restoring the strain on the coupling, substantially as and for the purpose specified.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

ROBERT SCHULTZ, CALLED NIBORN.

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