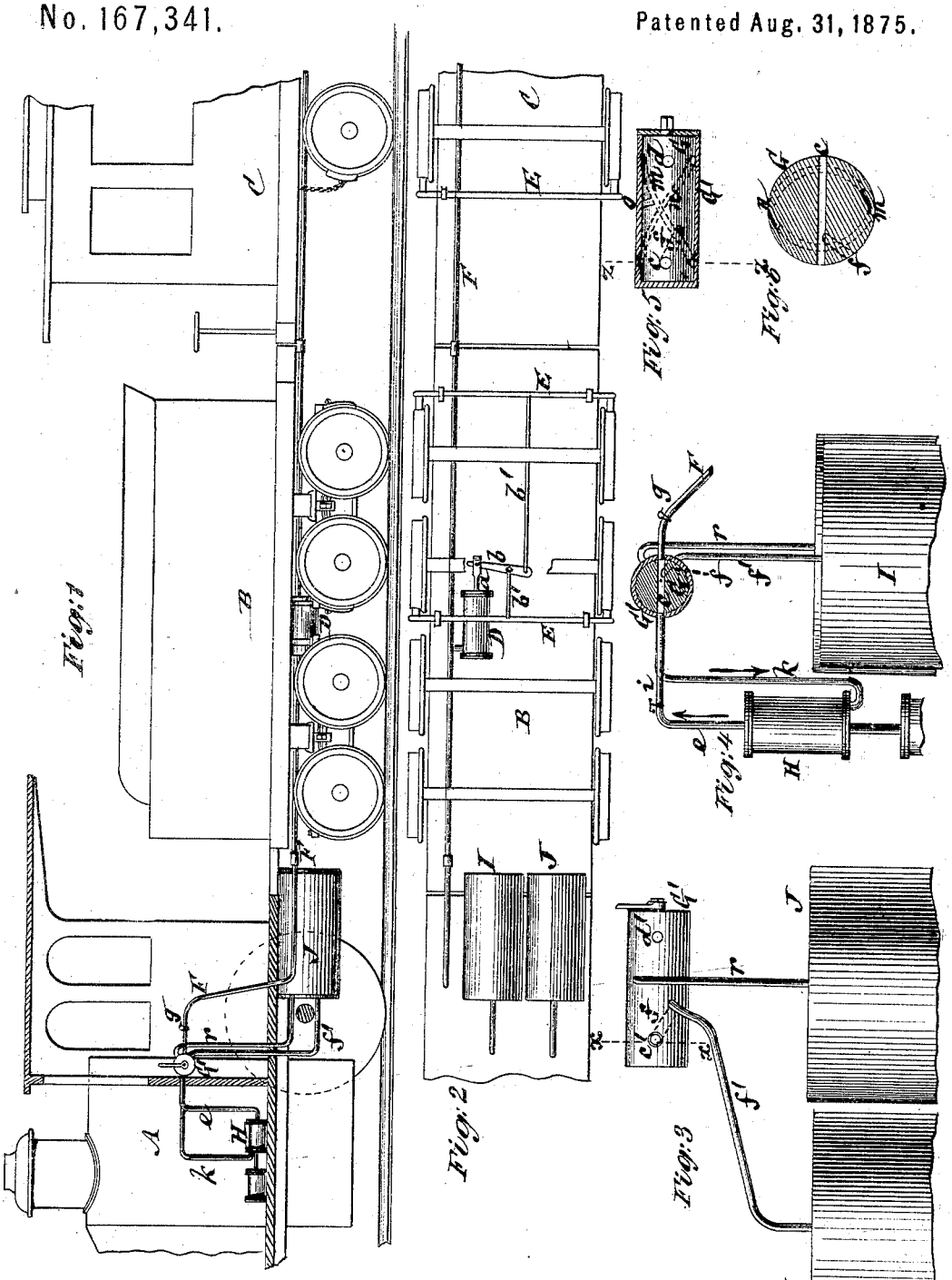
H. F. KNAPP.

Pneumatic Car-Brake.

No. 167,341. Patented Aug. 31, 1875.



Witnesses:
Michael Ryan
Fred Haynes

H. F. Knapp
by his Attorneys
Brown & Allen

UNITED STATES PATENT OFFICE.

HENRY F. KNAPP, OF NEW YORK, N. Y.

IMPROVEMENT IN PNEUMATIC CAR-BRAKES.

Specification forming part of Letters Patent No. **167,341**, dated August 31, 1875; application filed July 6, 1874.

To all whom it may concern:

Be it known that I, HENRY F. KNAPP, of the city, county, and State of New York, have invented certain Improvements in Pneumatic and other Car-Brakes, of which the following is a specification:

This invention relates to brakes for railroad-trains, in which one or more pumps worked by the engine, and operating either by compression or exhaustion, or both, of air or other fluid, are used to apply and take off the brakes, or either, by means of a single or main tube connecting the several brakes throughout the train, or certain of them. The invention, however, will here be described as applied to a pneumatic brake; and consists in a certain combination, with the pump and brake cylinders, of a peculiarly-constructed cock, and of a vacuum or exhaust tank and compressed air or fluid reservoir, for facilitating the action of the brakes independently of or in connection with the pump.

In the accompanying drawings, Figure 1 represents a side elevation of an engine and car, in part, with my improvement applied thereto; Fig. 2, an inverted plan of the same, in part; Figs. 3, 4, 5, and 6, views of details on a larger scale, Fig. 3 showing a side view of a general cock for controlling the action of the invention, and showing the compressed-air reservoir and vacuum-tank as arranged vertically, instead of, as in the previous figures, horizontally; Fig. 4 showing a vertical section of the same, mainly on the line *x x;* and Figs. 5 and 6, longitudinal and transverse sections of the cock, the latter section being on the line *z z.*

A is the locomotive-engine of a train; B, its tender; and C, one of the cars. On the under side of the tender and each car is arranged a cylinder, D, the piston-rod *a* of which connects by a lever, *b*, and rods *b' b'* with the cross-bars E of the brakes. F is a flexible tube running throughout the length of the train beneath the several cars, and connecting by branches with the several brake-cylinders D, said tube being joined together by suitable couplings where the cars connect, and in communication at its forward end, through the intervention of a cock, G, with a steam or other pump, H, on the engine. It is proposed to force air by the pump H through the tube F, compressing said air within the cylinders D when it is designed to apply the brakes and to exhaust the air from such cylinders when relieving the brakes from action, so that by reversing the action of the pump, as regards its connection with the flexible tube F and brake-cylinders, the necessary reversal and control of the brakes are obtained.

Any suitable construction of cock or cocks may be used to convert the tube F either into a suction or compression duct, and to charge a reservoir, I, with compressed air; also to exhaust the air from a vacuum-tank, J, by means of the pump to aid the latter in its action; likewise to collect a power available to working the brakes when the pump is stopped. It is preferred, however, to use a single cock, G, with which the several connections may be made either through its sides or ends, but which are here shown as made through the sides thereof. Thus the cock G, which works within a case or shell, G', has two straight or direct transverse passages, *c d*, through it, and the shell G' corresponding openings *c' d'*. The one *c* of these passages, when the cock is in the position represented in the drawings, passes compressed air by a pipe, *e*, from the pump H into and through the tube F, connecting with the brake-cylinders; also, by a branch, *f*, from the passage *c* and a pipe, *f'*, into the compressed-air reservoir I, to aid the pump in its action on starting and at other times, or to accumulate power for use, independently of the pump, for working the brakes by closing a cock, *g*, in the tube F. The closing of the cock *g*, when the pump H is at work, serves to accumulate power by compression of air in the tank I, to assist the pump or to anticipate its action on the brake-cylinders D, and the tank J has a like action, and serves, by a proper adjustment of the valve G, to relieve the brakes in anticipation of the action of the pump, or to aid the latter.

A safety-valve, *i*, may be applied to the pipe *e* to prevent injury or accident. The other straight or direct transverse passage *d* in the cock, when the latter is in the position represented in the drawings, connects, by a pipe, *k*, on the one side of the shell G', with the in-

let end of the pump, while such transverse passage *d* is open on the other side of the shell G′ to the atmosphere to supply the pump with air.

By slightly turning the cock G all the passage-connections are shut off. By further turning the cock G, however, a full quarter of a circle, then the action of the pump on the brakes is reversed, as regards exhausting instead of compressing the air within the brake-cylinders, and exhausting air from the vacuum-tank J to keep up a supply of power. This is effected by means of reversely-arranged diagonal passages *m n*, the one, *m*, of which is then made to connect with the inlet-pipe *k* of the pump and flexible tube F, leading to the brake-cylinder, thereby producing a suction in the latter, and such diagonal passage *m* also made to connect, by a branch, *o*, with the vacuum-tank J by a pipe, *r*.

Under this disposition of the parts, the other diagonal passage, *n*, connects at its one end with pipe *e* of the pump, and with the aperture *d′* in the shell, thus causing the air discharged by the pump to pass out through said diagonal passage *n*.

By having two pipes communicating with the brake-cylinder (one on each side of piston) a compound power may be obtained for working the brakes by exhausting the air from one end of the brake-cylinders and compressing it into the other end, reversing the operation, as desired, by cock.

Instead of rigid brake-cylinders, having pistons within them, flexible and collapsing cylinders, operating alternately by exhaustion and compression, in connection with the pump, cocks, and other necessary attachments, may be used.

The ends of the tubing running under each car should always carry the male couplings, and the flexible connecting-tube should always carry the female couplings at its ends, so that it makes no difference which ends of the cars come together the couplings will always fit.

Furthermore, should it be desirable to avoid throwing the full force of the compressed air in the brake-cylinders onto the pump when taken off the brakes, an additional port may be made to open through the cock G into the passage *m*, which passage may be elongated at its lower end, where it connects with the pipe F, so that it will allow the bulk of the compressed air to escape through the cock just before the other ports are open, and thus avoid throwing it into the vacuum-tank and air-pump; but when the other ports are opened, this port will invariably be closed.

Likewise, either in connection with said means or otherwise, a flat or puppet valve may be arranged in the inlet-pipe K, and be fitted so that it will rise and permit of the escape of compressed air in said pipe K, but will close tight against a vacuum in said pipe.

Again, in applying the invention to roads on which the grade is heavy, and it is necessary to do much pumping to exhaust air from the vacuum-tank to hold the brake-shoes off from the wheels, it may be advisable, in order to insure a constant maximum of pressure in the reservoirs, to provide an additional tube, connecting the reservoir I with the compressed-air pipe *e* of the pump, so that compressed air may be permitted to flow into the reservoir independently of the cock G, said additional tube being provided with a check or stop valve to prevent back flow of air into the pump.

I claim—

1. The cock G, constructed with diagonal passages *m n*, and transverse passages *c d*, having branches *o f*, for operation in alternate relation with the pipes *e* F and *k* F, connected with the pump and brake-cylinders, and with the pipes *f′ r* of the compressed-air reservoir and vacuum-tank, substantially as specified.

2. The combination of a vacuum-tank and compressed-air reservoir with the pump and brakes, substantially as and for the purposes described.

HENRY F. KNAPP.

Witnesses:
MICHAEL RYAN,
VERNON H. HARRIS.