

T. Chase,

2. Sheets. Sheet. 1.

Mill Gearing.

No. 105426.

Patented July 19. 1870.

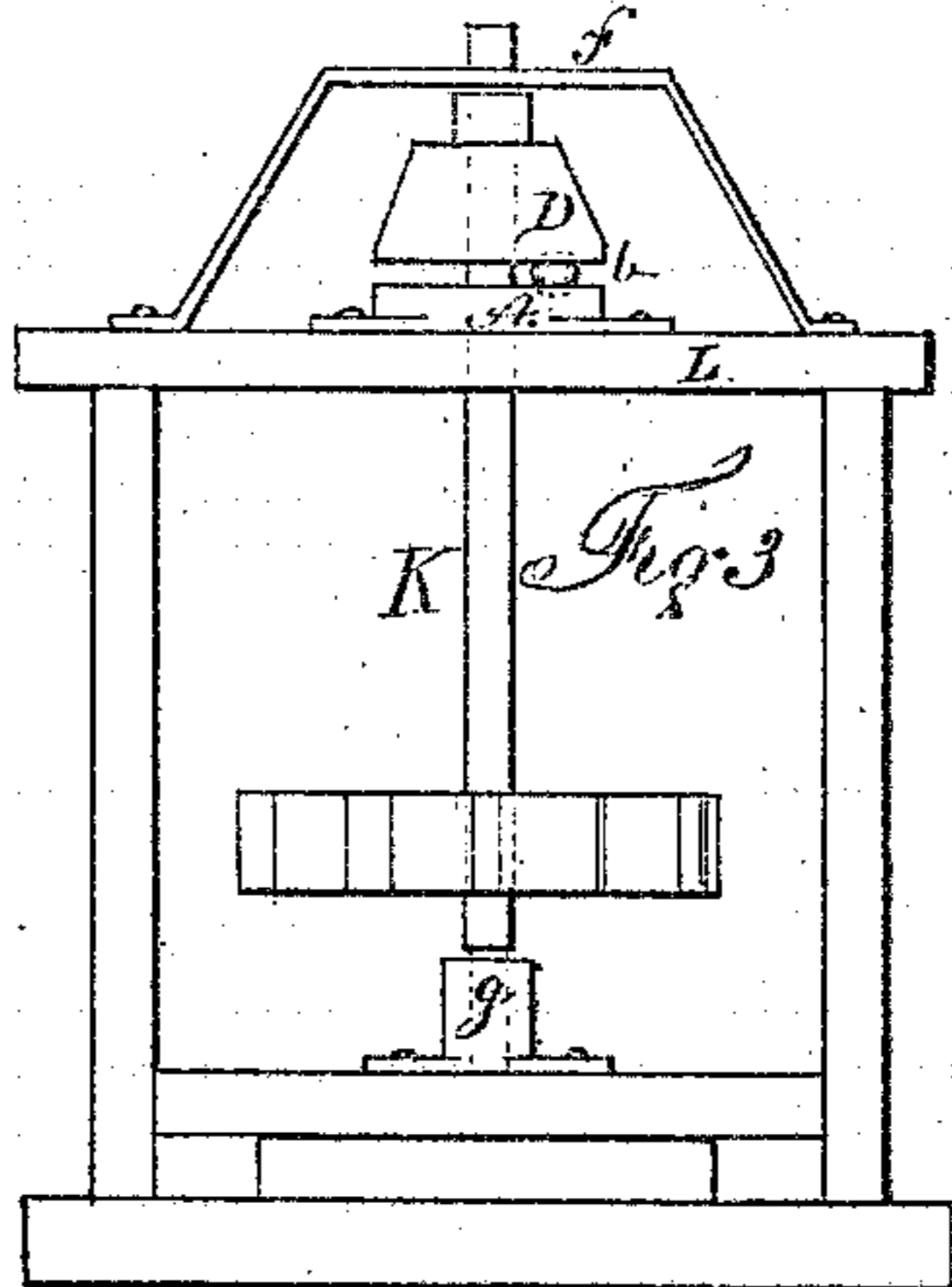
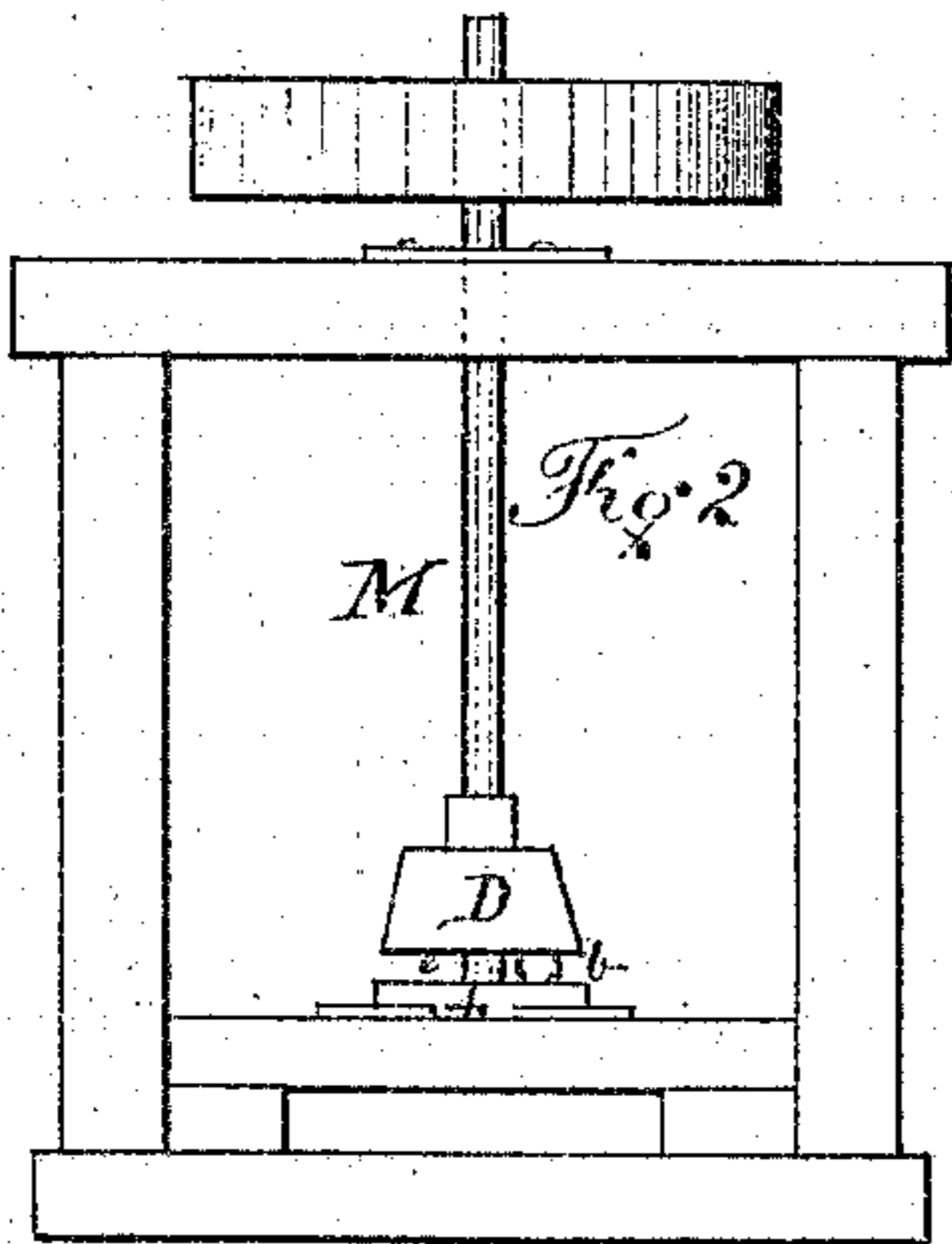
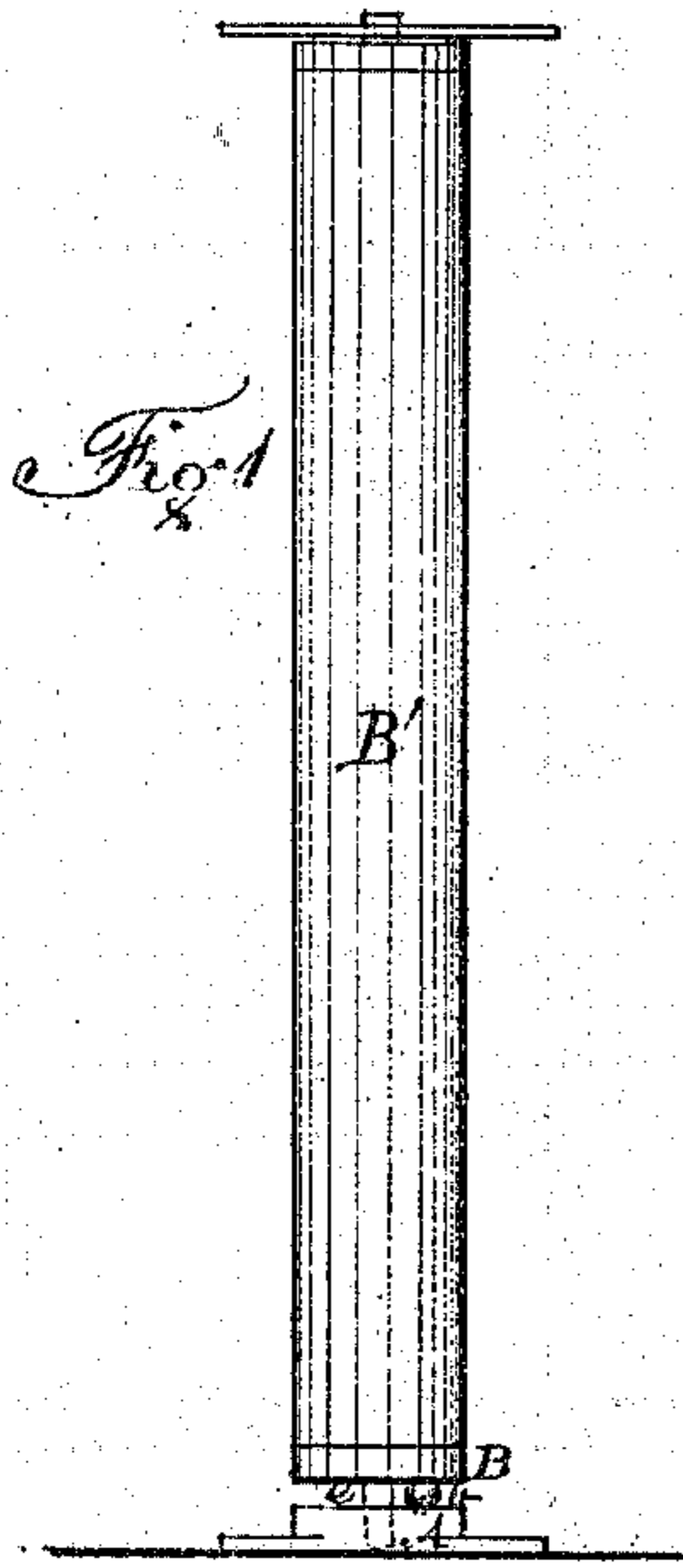


Fig. 13

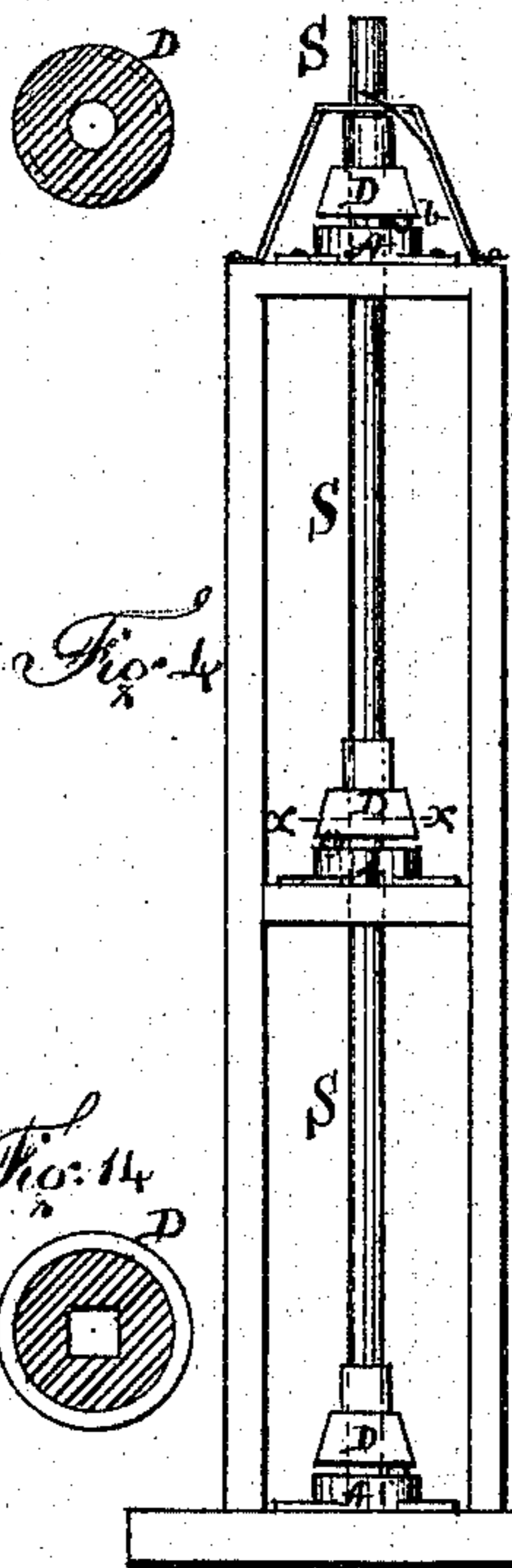
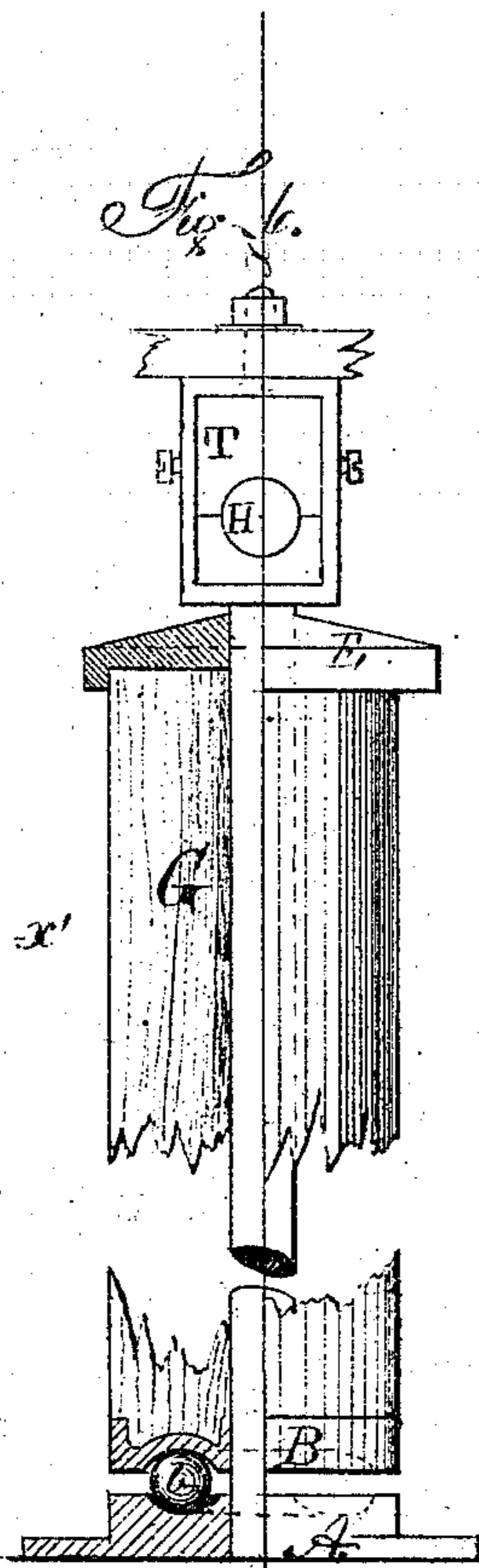
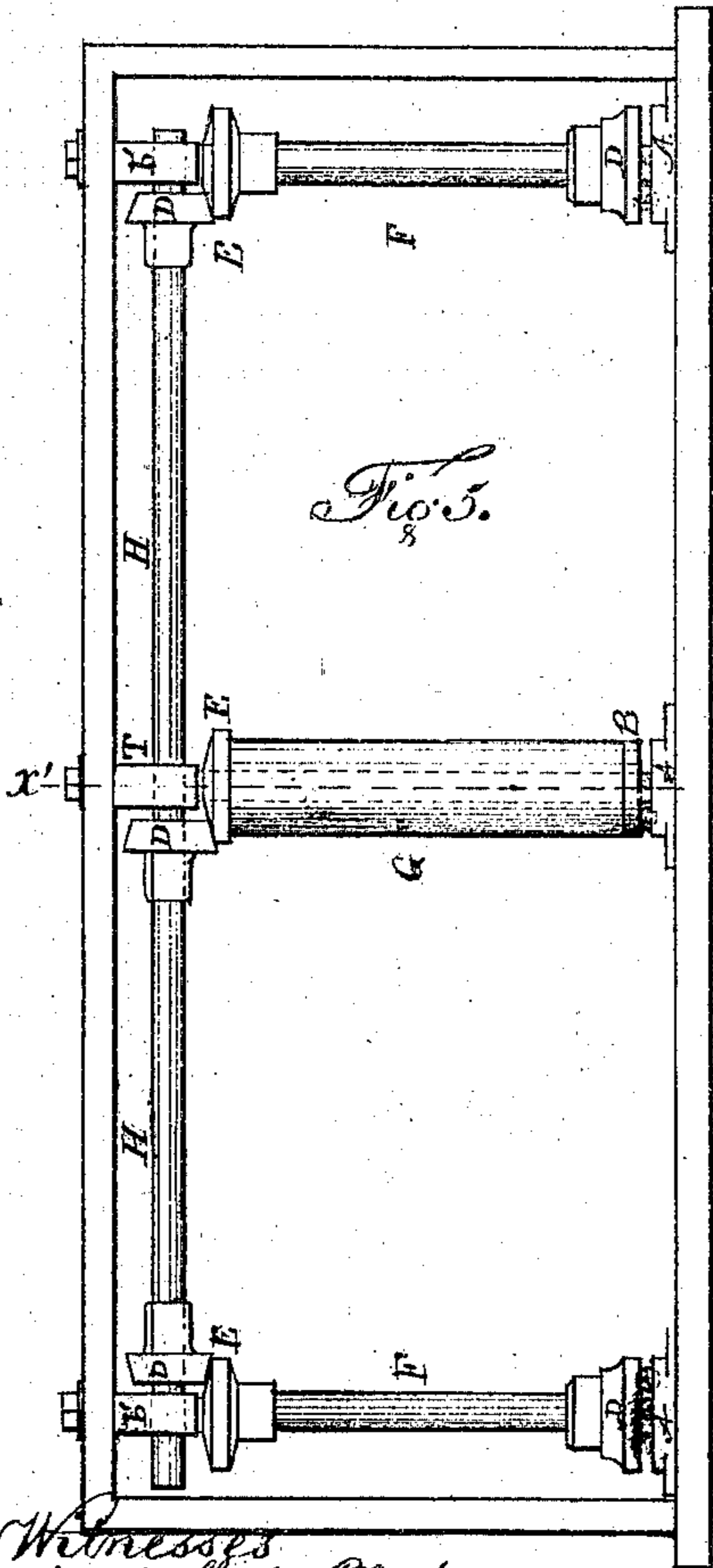
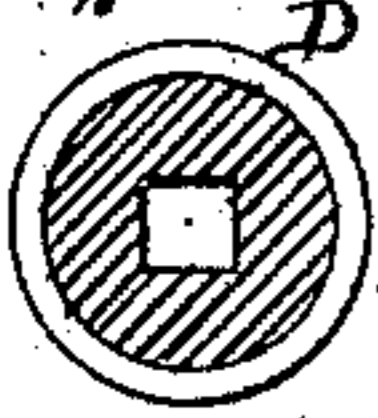


Fig. 14



Witnesses
Benjamin Charles Pile Engineer
[Signature]

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Mill Gearing.

No. 105,426.

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Fig. 1

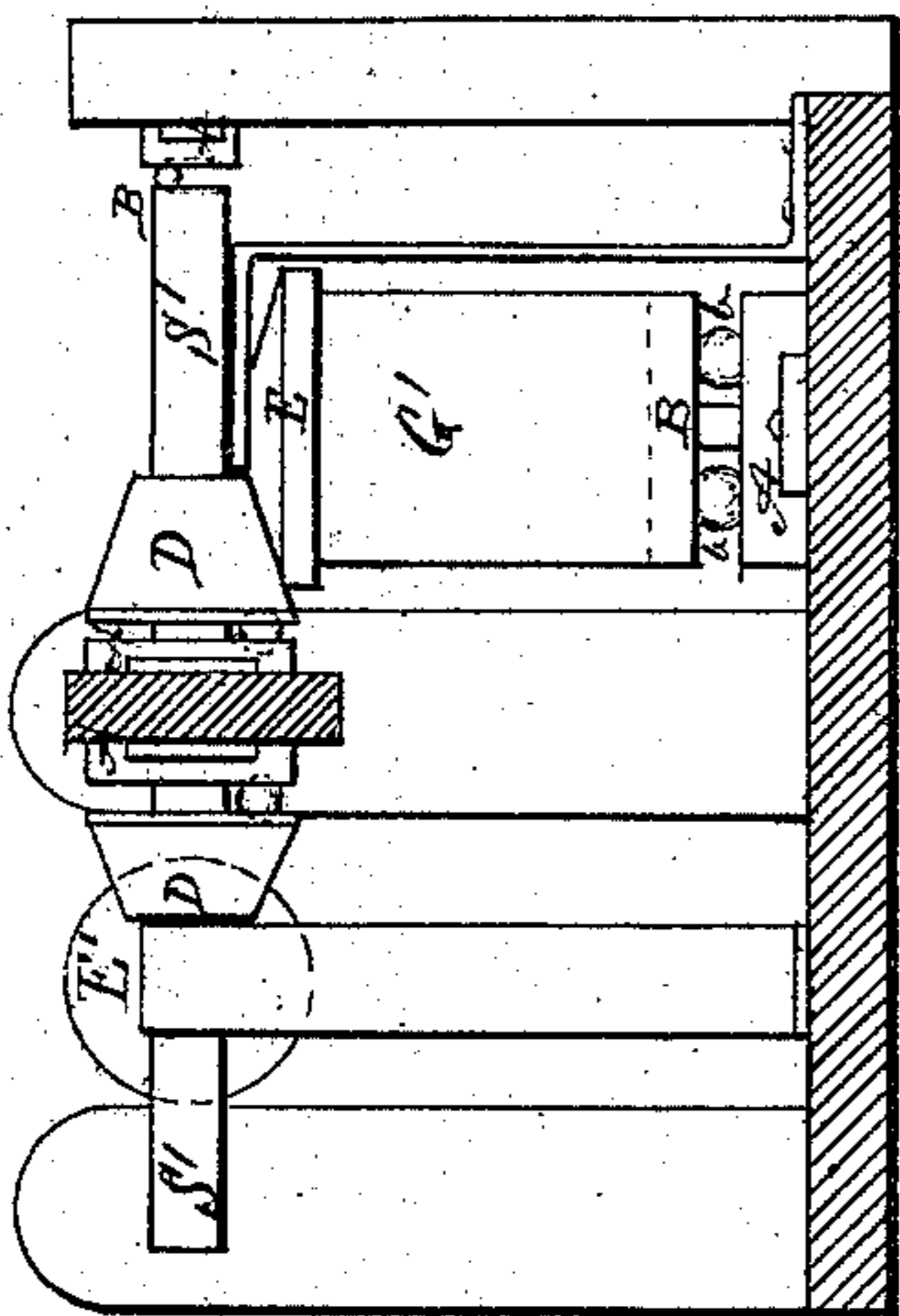


Fig. 8

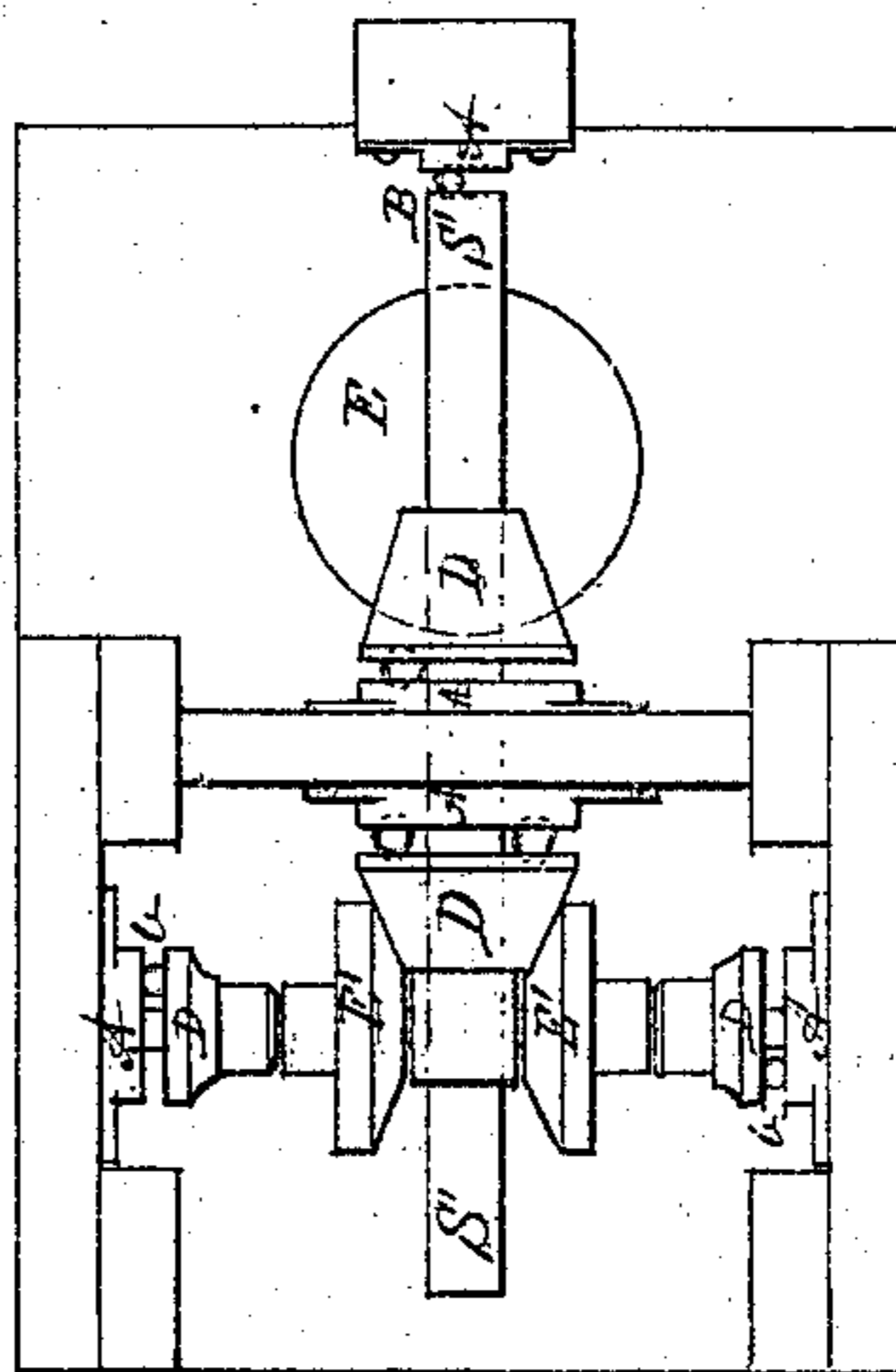


Fig. 9

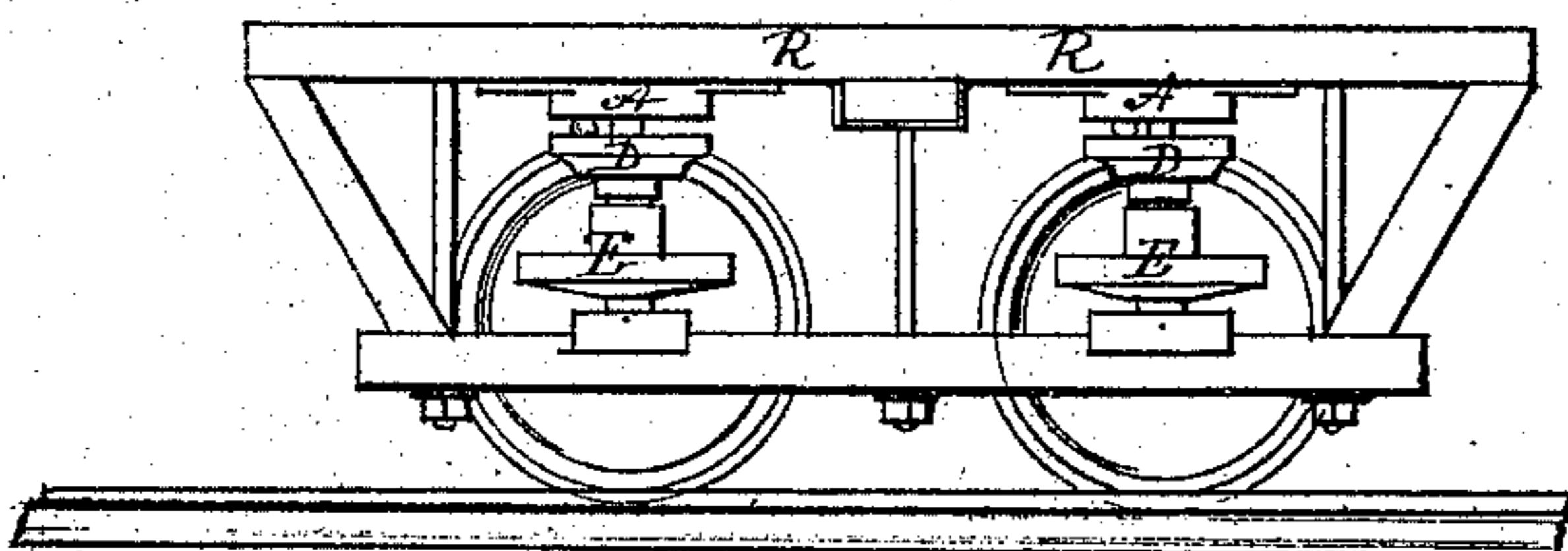


Fig. 10.

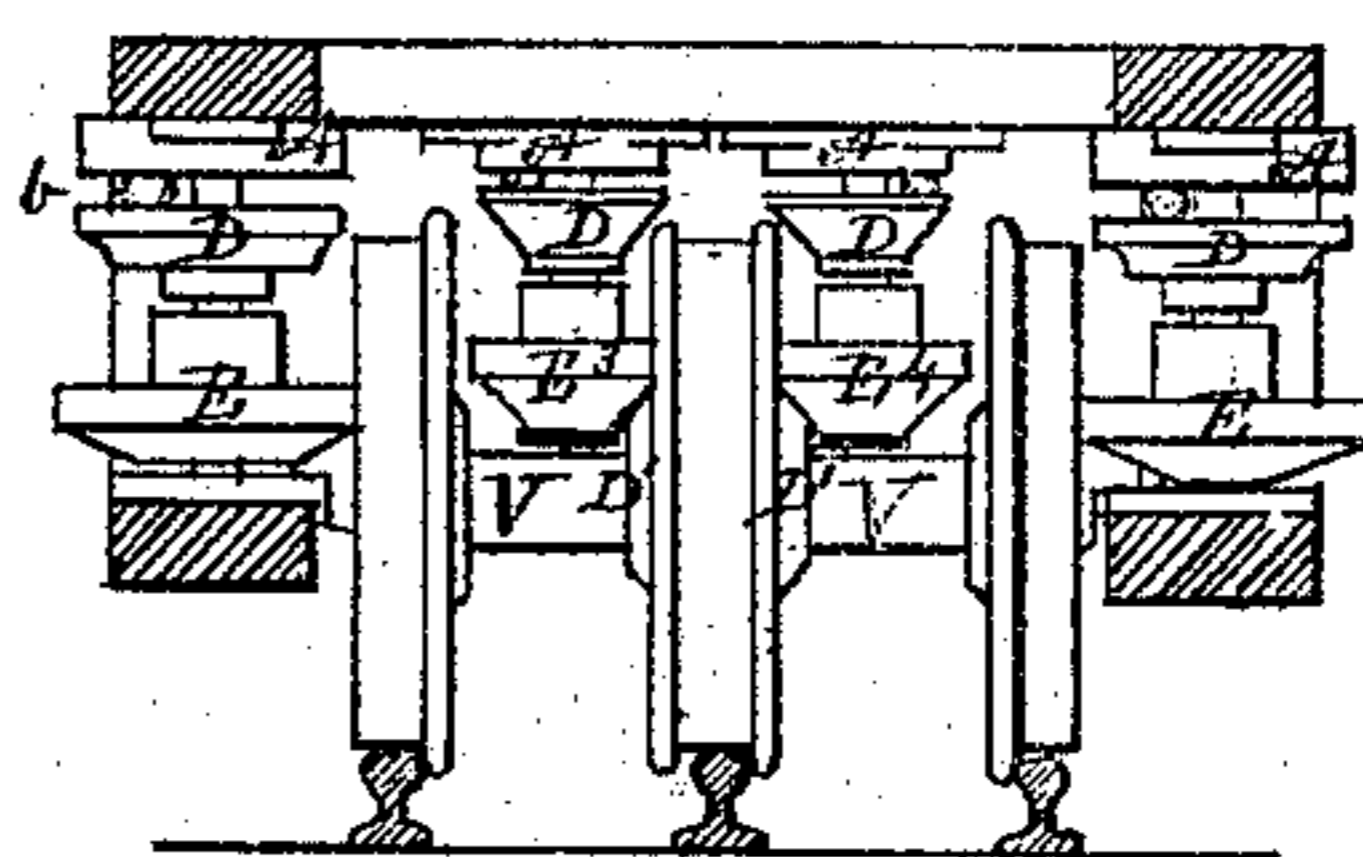


Fig. 11

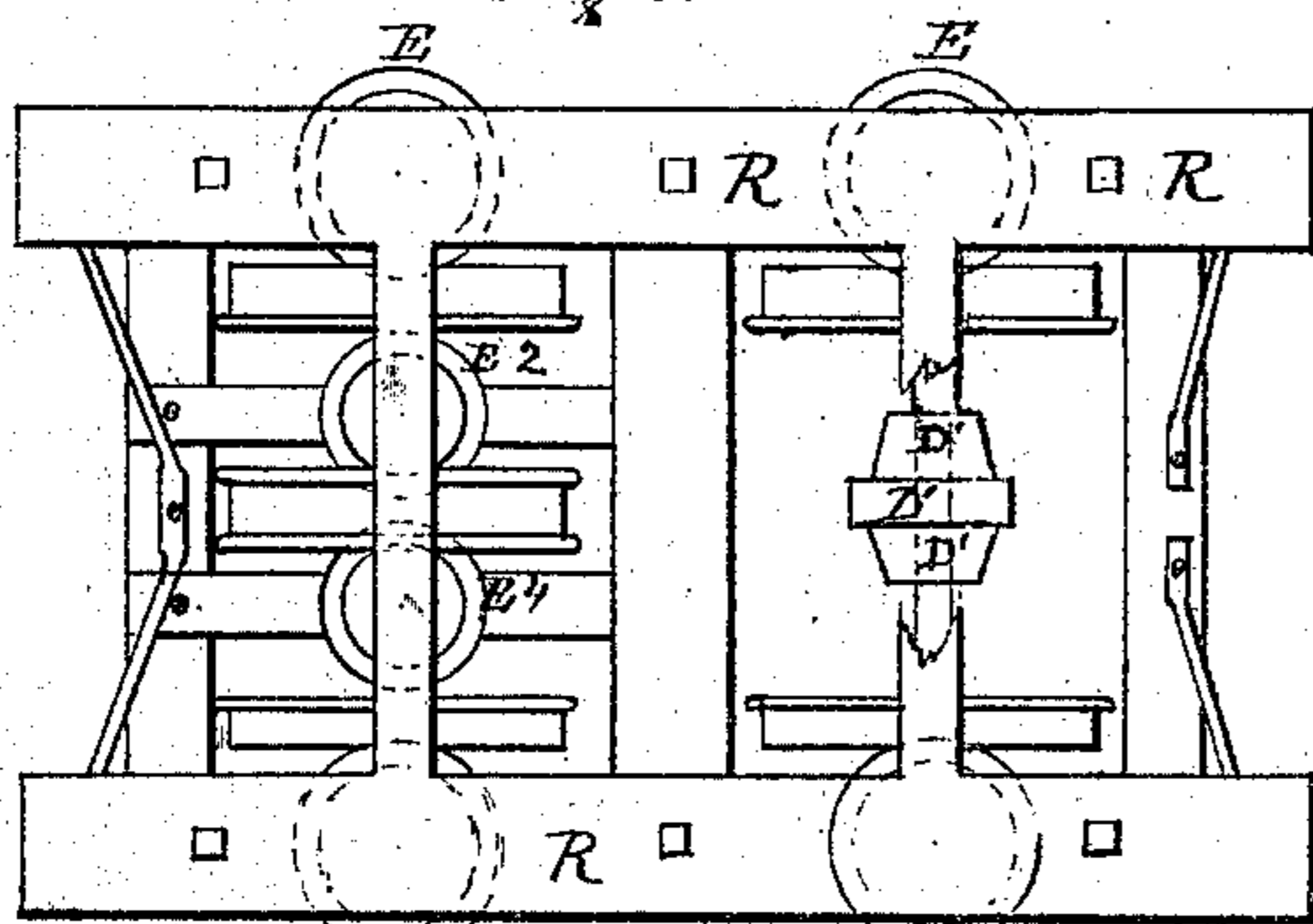
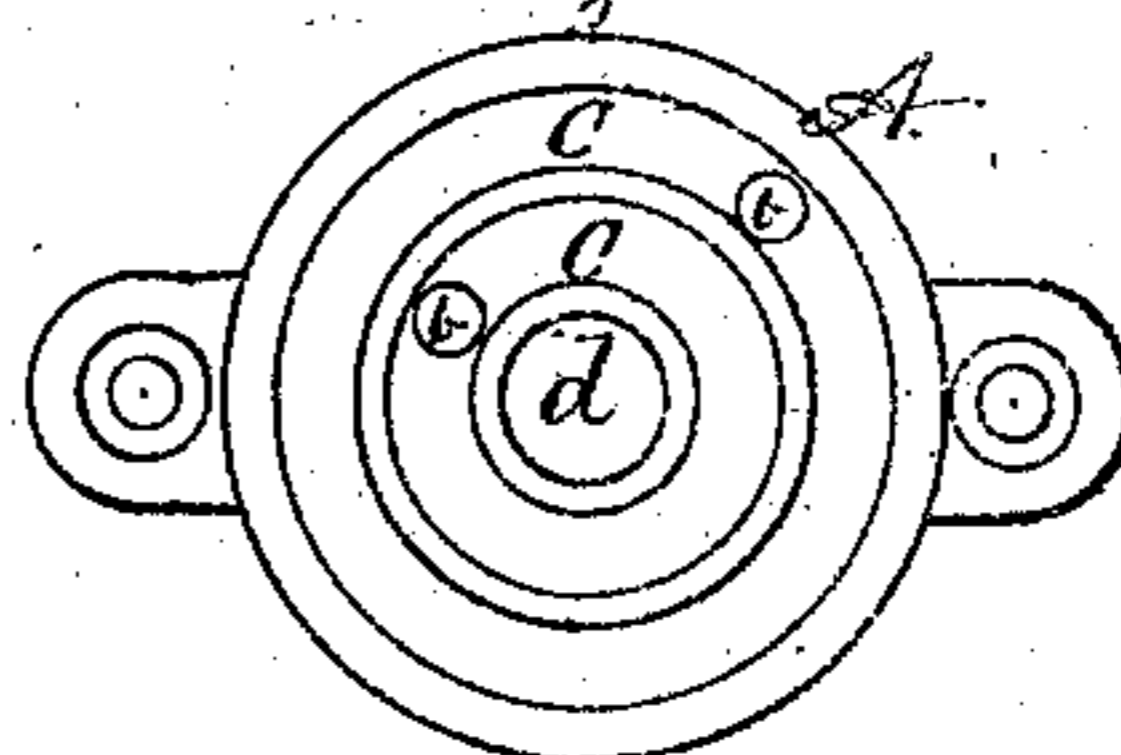


Fig. 12



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THOMAS CHASE, OF WASHINGTON, DISTRICT OF COLUMBIA.

Letters Patent No. 105,426, dated July 19, 1870.

IMPROVEMENT IN ANTI-FRICTION GEARING.

The Schedule referred to in these Letters Patent and making part of the same.

To all whom it may concern:

Be it known that I, THOMAS CHASE, of Washington City, in the county of Washington and District of Columbia, have invented a new and useful Anti-friction Gearing, which I call "Chase's Friction-Annihilator;" and I do hereby declare that the following is a full, clear, and exact description of the same, reference being had to the accompanying drawing making a part of these specifications, in which—

Figure 1 is a side elevation of perpendicular wooden shaft, with anti-friction device at bottom.

Figure 2 is a side elevation of grist-mill spindle, with anti-friction device attached.

Figure 3, side elevation of shaft of suspended water-wheel, with anti-friction device attached.

Figure 4, perpendicular line-shafting, with anti-friction device attached.

Figure 5, horizontal line-shafting, sustained by passive wheels.

Figure 6, vertical section of hollow shaft, as indicated by line *z z* in fig. 5.

Figure 7, side view of steamer-shaft, with anti-friction device attached, and resting on passive wheels.

Figure 8, top view of steamer-shaft, showing passive wheels arranged to sustain lateral pressure.

Figure 9, side view of railroad carriage, with anti-friction passive wheels attached, inverted.

Figure 10, end view of the railroad carriage, with anti-friction devices attached.

Figure 11, top view of the same railroad carriage.

Figure 12, top view of step-grooved plate.

Figure 13, top view of coupling-box and beveled boot or cone-wheel.

Figure 14, sectional view of cone-wheel coupling-box, as indicated by the line *z z* of fig. 4.

Like letters in the different figures of the drawing indicate like parts of the invention.

Nature.

My invention is designed to avoid friction in heavy gearing, and consists—

First, of an anti-friction device, consisting of a step-plate and a counter revolving plate, each made with circular grooves, in which spheres of proper size are arranged to revolve freely and separately, as arranged and attached at the bottom of an ordinary upright shaft and to a grist-mill spindle, and at the top of the shaft of a turbine water-wheel, where the lower end works under water, and to a horizontal shaft of a steamer, so that the entire weight or pressure of the shafts may be sustained by the anti-friction spheres, thus avoiding all rubbing or sliding friction, and, by turning the spheres loose in the grooves, avoiding the friction caused by the spheres or rollers revolving on axes in a revolving plate or otherwise.

Second, of passive anti-friction wheels, made with proper bevel to fit and revolve with a corresponding bevel on a beveled wheel or boot, attached to the main shaft, horizontal or otherwise, the said passive wheels being arranged to rest and revolve upon spheres in grooved plates. By means of this passive wheel my anti-friction device is applied to horizontal as well as to perpendicular shafting, to railroad carriages, and to steamer-shafts, and to every description of heavy gearing.

Third, of a beveled wheel or boot attached to the main shafting, or to the shafts of the passive wheels. One end or disk of this beveled wheel or boot is provided with circular grooves, corresponding with the grooves in the step and counter-plate before named. The sides are beveled to fit and revolve with the bevels on the passive wheels, and a square hole is made in the center for a coupling-box, thus adapting and designing it to be used for the three-fold purpose of a grooved revolving plate, a beveled wheel, and a coupling-box.

Fourth, of combining and arranging two or more sets of my anti-friction devices with upright line-shafting, so as to avoid the use of spur-gearing, and greatly lessen the friction, by attaching the step-plates to the upper floors or timbers arranged for that purpose, passing the upper end of the shaft through the step-plate and attaching the combined grooved plate and coupling-box to the lower end of each section of the shafting, and thus coupling them together.

Fifth, of the arrangement by which my anti-friction device is applied to screw-propellers and other steamers, by combining two sets of the plates with spheres, and so attaching them to the shaft as that both the forward and backward pressure on the shaft, caused by the forward and backward motion of the steamer, will be sustained by the revolving spheres in the grooved plates, and thus avoiding friction.

Sixth, in the arrangement of the passive wheels to perpendicular or horizontal shafting, so as to sustain and counteract lateral pressure.

Seventh, of the arrangements by which my anti-friction devices are applied to the running gearing of railroad carriages, which I accomplish by inverting the passive wheels, so as to have the bevel at the bottom, and arranged to rest on the axles of the railroad carriage wheels, which axles are properly beveled to fit and revolve with the bevel on the passive wheels, the grooved plates, with revolving spheres, being properly arranged on the top of the passive wheels, by means of which arrangement the entire weight of the car and carriage is sustained by the revolving spheres and passive wheels, thus avoiding friction and the liability of heating, and dispensing entirely with lubricating-oil.

A is a step-plate, and

B, a counter revolving plate, of any required diameter and thickness, according to the weight to be sustained, the diameter of each corresponding, ordinarily, with the diameter of the shaft B', to which the plate B is attached.

Each plate is provided with circular groove or grooves, C, equidistant on all sides from the center of the plate, being thus in the shape of a true circle, the center of which is the center of the plates, in which circular grooves are placed a sphere or spheres, *b*, having no axes, but allowed to revolve freely and independently in the said grooves. These spheres may be of any required size, say from two to six inches in diameter, and they, as well as the plates, may be made of cast-iron, or any other suitably hard material. For railroad carriages, for steamers, and for grist-mills, I should make the plates and spheres of cast steel.

The depth of the grooves in the plates should be no greater than may be required to secure the spheres in place, and the width of the grooves should be sufficient to afford easy, free play to the spheres. A depth in each plate of one-eighth of the diameter of the sphere will probably be sufficient, and if, by use, it is found that a less depth will suffice, it would be preferable, so as to allow as much as possible of the surface of the spheres to be free and exposed to the air. For illustrations of the plates and spheres, see figs. 1 and 12 of the drawing.

D is a beveled wheel or boot, the bottom or larger face of which is provided with circular grooves, corresponding exactly with the grooves in plates A and B, and the sides are properly beveled to fit and revolve with a corresponding bevel on the passive wheels, and the center is provided with a square hole, to form a coupling for the shafting, (see fig. 14,) being thus designed and adapted for a three-fold purpose, viz: for a revolving grooved plate, for a bevel-wheel or boot, and for a coupling-box, as seen in the different figures of the drawing.

E represents the passive wheels, the upper disks of which are properly beveled to fit and revolve with the corresponding bevel on the cone-wheel or boots D, which are attached to the horizontal shafts H H, and elsewhere, as required, and shown in the drawing.

The shafting H H has proper bearings, *b' b'*, to merely steady it laterally, the entire weight of the shafts being sustained by the passive wheels, as shown in fig. 5.

These passive wheels are properly arranged and fastened to the upper ends of the shafts F G G', to the lower ends of which shafts are attached revolving grooved plates B D, which revolve on the spheres *b* in the grooves in step-plates A A A, as shown in figs. 5 and 7.

Shaft G is made hollow, so as to revolve around a spindle or inner shaft, which extends the entire length and above and below the shaft, the lower end passing through plate A, and resting upon the timber under the plate, and the upper end extending above, and is widened so as to form the bearing T for the shaft H, which passes through a hole therein, as seen in figs. 5 and 6. This hollow shaft is preferable to shaft F for supporting heavy pressure.

The step-plates A are made with a hole, *d*, in the center, as shown in fig. 12, into which hole the center journals or points, *e*, on the lower ends of shafts B' F G, &c., extend far enough only to hold these shafts in position laterally.

K represents a turbine or other water-wheel shaft, passing entirely through step-plate A, which is secured upon a cross-beam, L, the counter revolving plate D being attached near the upper end of the shaft, which is held in position laterally by the brace *f*.

The lower end of this shaft extends into the bearing *g* far enough only to steady it laterally, but not so as to bear upon the end, the entire weight of the shaft and wheel being suspended upon and sustained by the

revolving spheres *b* in the plates above, and thus is avoided the extra friction and inconvenience of bearings at the lower end of the shaft, under water.

S represents upright shafting, coupled together by the combined grooved plate, beveled boot, and coupling-box D.

The step-plates A are attached to the floors of the building, or to timbers properly arranged for that purpose, and the upper end of each section of the shafting passes entirely through step-plates A, and, being made square, enters the square hole in coupling-box D, which is properly secured to the lower end of the next section of the shafting, and so on. Thus each section of the shafting rests and revolves upon the spheres, in its respective step-plate, thus dispensing entirely with spur-gearing, and nearly annihilating the friction.

S' represents the shaft of a screw-propeller, having a double set of plates, A D, and spheres *b*, so arranged as that both the forward and backward pressure upon the shaft, caused by the forward and backward motion of the steamer, will be received and sustained by the spheres in the grooved plates.

The entire weight of the shaft is sustained by the passive wheels E, as shown in fig. 7, and the lateral pressure upon the shaft is sustained by the passive wheels E' E', as shown in fig. 8.

Where the shaft of the steamer is of sufficient diameter, the end of the shaft may be provided with the circular grooves C, so as to form the counter revolving plate B on the end of the shaft, and thus dispensing entirely with the extra plate D, as represented in figs. 7 and 8.

The arrangement above described for screw-propellers is equally applicable to side-wheel steamers, and in all cases where the shafts, upright or horizontal, are of sufficient diameter, the counter revolving plate B may be formed on the end of the shaft, thus dispensing with the extra plate D where the beveled boot or cone-wheel is not required.

R R represent a railroad carriage with my anti-friction gearing attached, the passive wheels E being inverted, so that the beveled part thereof rests upon the axles V of the railroad carriage, which axles are properly beveled at the ends to fit the bevel on the passive wheels, as seen in figs. 9 and 10.

The grooved plates A D, with their spheres *b*, are arranged on the top of the passive wheels, plates A and D being also inverted, and plate A attached to the upper timbers of the carriage, and D to the upper end of the shaft of wheel E. Thus the entire weight of the carriage and car is sustained by the revolving spheres *b* and wheels E, avoiding friction and the liability of heating, and dispensing entirely with the use of lubricating-oil.

I have arranged to use two or more passive wheels, as may be desired.

Two extra wheels, E' and E', are placed near the middle of the carriage-axle, which wheels rest upon properly beveled boots or cones, D' D', attached to the carriage-axle, as shown in figs. 10 and 11, the whole machinery supported and kept in place by suitable frame-work.

The arrangement for sustaining and operating line-shafting, as described, is equally applicable to a single drum-shaft, as represented by either section of the line-shafting, and also as may be seen in fig. 10, inverted, showing a single railroad-axle, with wheels inverted, which may represent the single shaft, with drum or drums attached.

Operation.

The spheres being arranged to revolve freely and independently in the grooves, and the circumference of the outer edge of the grooves being greater than the inner edge, they are constantly changing the line

of their axes, and thus wear equally on all sides, maintaining a perfectly spherical shape, thus avoiding the friction caused where the sphere revolves upon axes, and also avoiding the necessary result in that case, of the spheres being changed by wearing into elongated rollers.

Wherever friction would be produced by lateral pressure, the passive wheels may be used to counteract the same, as shown by wheels $E^1 E^1$, in figs. 7 and 8.

Any required length of perpendicular or horizontal line-shafting may be constructed, and the two may be united and operated together by the proper arrangement and use of the anti-friction devices and passive wheels, as described, without using any spur-gearing.

Railroad carriages constructed with my anti-friction devices, as described, will not be liable to heat, as is the case with the old plan, and very much of the friction will be avoided, and lubricating-oil entirely dispensed with, and thus a very large portion of the expense of operating the rolling stock of railroads may be saved, and especially in the number of carriages required, as it will not be necessary to change the carriages to avoid the heating, and it is believed that, with these anti-friction devices attached as described, a railroad train may be run with safety at a much higher rate of speed.

Claims.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. The anti-friction grooved plates A B D and spheres b , arranged to revolve freely and separately in the grooves of said plates, in combination with center journals e , all as arranged and operated with and upon shafts B', M, K, and S', substantially as described.

2. The passive wheels E, arranged to revolve upon the anti-friction spheres b in grooved plates A B D,

in combination with horizontal shafts H H, provided with cone-wheels D D D, substantially as described.

3. The combination of a grooved plate, cone-wheel, and coupling-box, as shown in D, substantially in the manner and for the purposes as described.

4. The combination and arrangement of two or more sets of the anti-friction plates A D and spheres b with upright shafting, so as to avoid the use of spur-gearing, substantially as described.

5. The combination of two or more sets of the anti-friction plates and spheres, reversed, and so arranged and attached to a steamer-shaft, S', as to sustain forward and backward pressure, the weight of the shaft being sustained by passive wheels E, revolving upon the spheres b in plates A D, substantially as described and shown in the drawing.

6. The arrangement of one or more passive wheels, E^1 , in combination with cone-wheel D, upon a perpendicular or horizontal shaft, so as to sustain lateral pressure, substantially as described.

7. Passive wheels E E, inverted, and with beveled disks at the bottom, and having anti-friction grooved plates A D and spheres b arranged to revolve freely and separately in the grooves of the plates arranged at the top of the wheels, in combination with a beveled railroad-axle, V, with or without cone-wheel D', and with or without wheels E^3 and E^4 , substantially as described.

In attestation of the foregoing specifications of my friction-annihilator, I hereunto subscribe my name in the presence of subscribing witnesses, this 10th day of June, A. D. 1870.

THOMAS CHASE.

Witnesses:

H. M. BROWN,
G. B. TOWLES.