3 Sheets—Sheet 1.

R. BROJA.

Traction-Engine.

No. 210,492. **Patented Dec. 3, 1878.**

fig. 1.

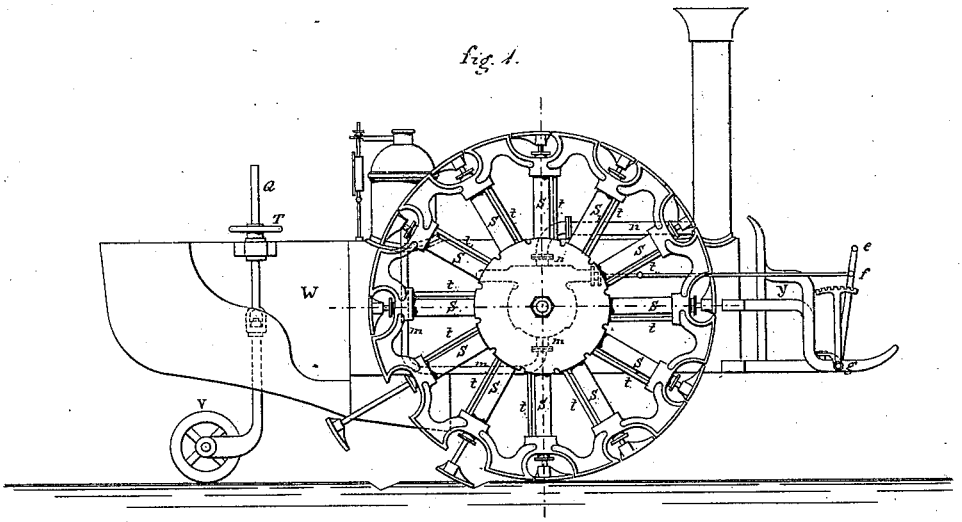
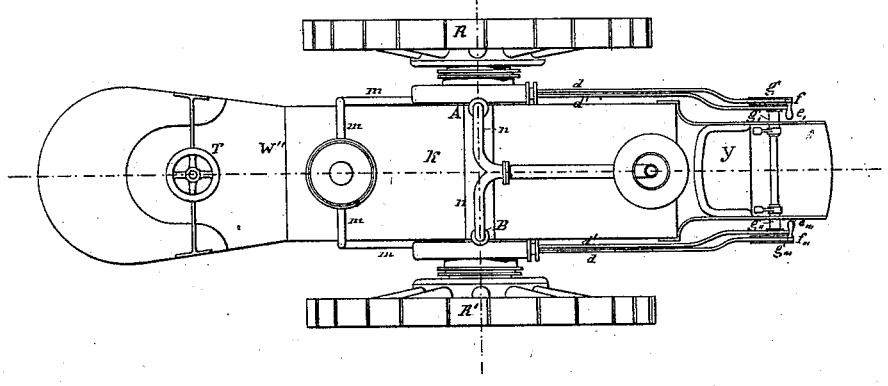


fig. 2.



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3 Sheets—Sheet 2.

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fig. 3.

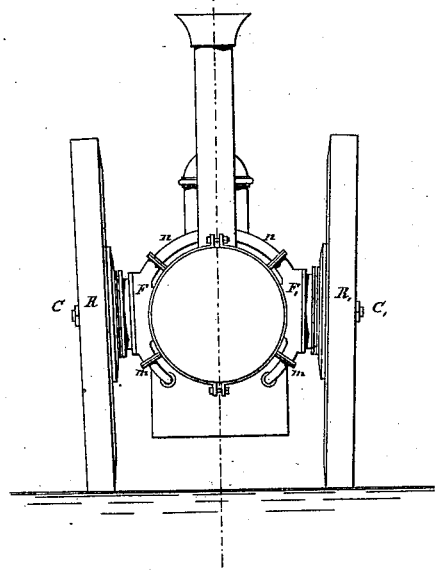


fig. 7.

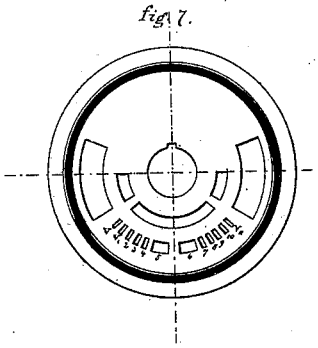


fig. 8.

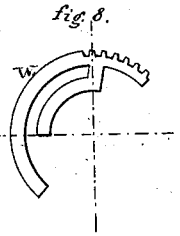
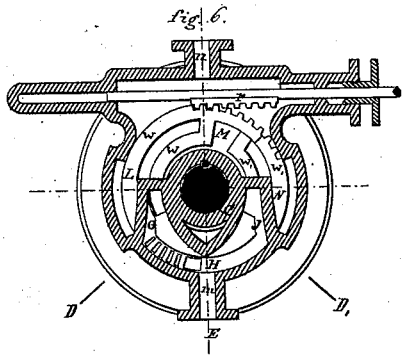


fig. 6.



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3 Sheets—Sheet 3.

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Traction-Engine.

No. 210,492. **Patented Dec. 3, 1878.**

fig. 4.

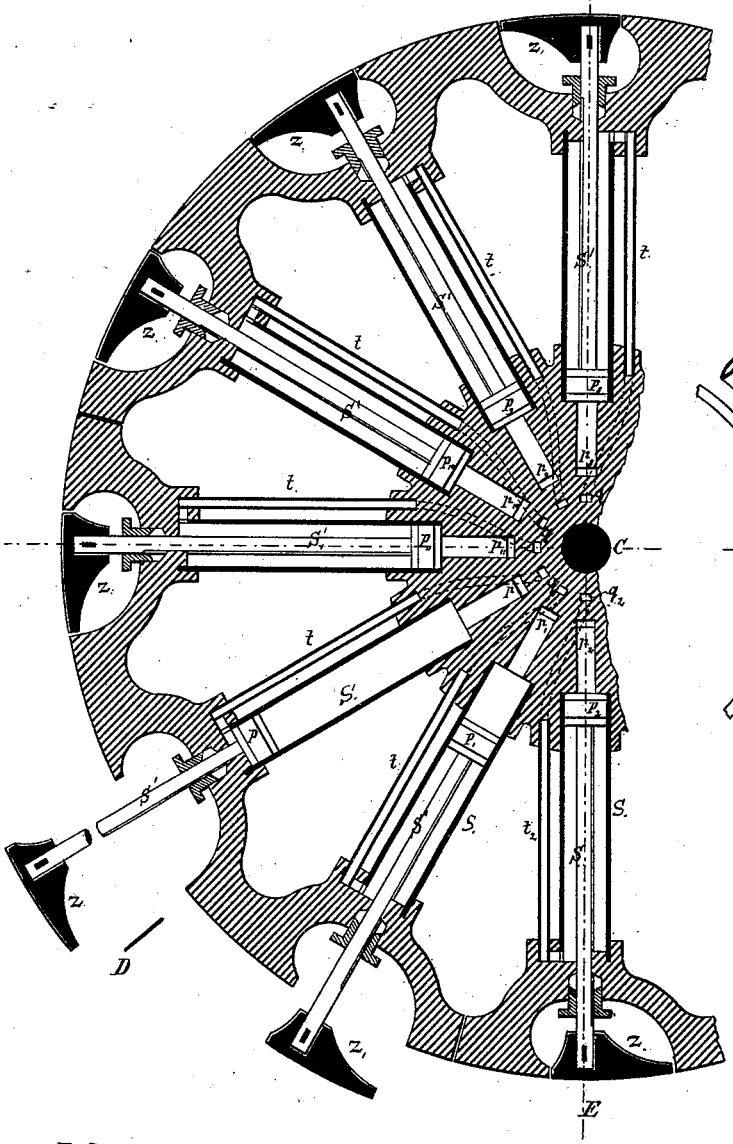
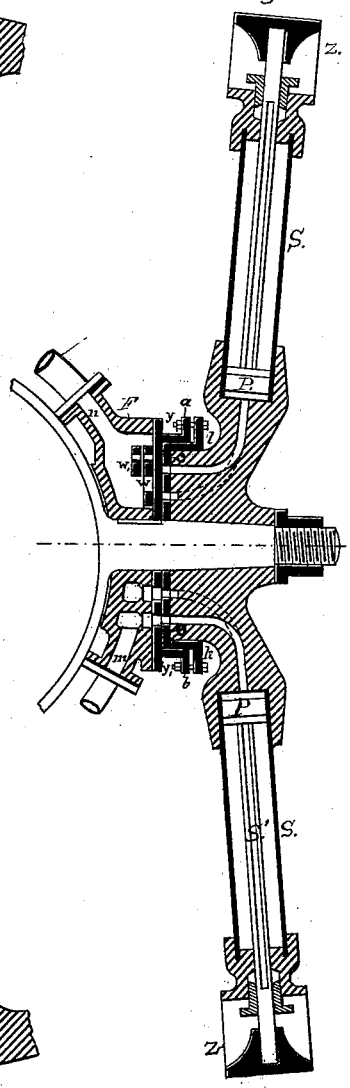


fig. 5.



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UNITED STATES PATENT OFFICE.

RICHARD BROJA, OF ZABRZE, SILESIA, PRUSSIA.

IMPROVEMENT IN TRACTION-ENGINES.

Specification forming part of Letters Patent No. **210,492**, dated December 3, 1878; application filed November 19, 1878.

To all whom it may concern:

Be it known that I, RICHARD BROJA, residing at Zabrze, Silesia, Prussia, have invented an Improved Traction-Engine, of which the following is a specification:

The present invention relates to improvements in traction or road engines, or locomotives adapted for ordinary roads; and it consists chiefly in the provision or employment of revolving wheels turning independently of each other on a fixed axle, and provided with a series of reciprocating or sliding feet, which are capable of being forced outward from the periphery of the wheels, so as to press upon the surface of the ground, and thereby effect the advance movement of the engine. The traction-feet are secured to sliding rods, which carry pistons, moving in hollow spokes of the wheels, and the latter turn in proper relation with steam chests or chambers, so that steam can be conducted into the hollow spokes, for projecting the traction-feet to produce the effective stroke, and for retracting said feet after their traction force has ceased.

The invention also consists in certain details of construction and arrangement, which will be hereinafter more fully described, and then set forth in the claims.

In the accompanying drawings, forming part of this specification, Figure 1 is a side elevation of a traction-engine constructed according to my invention. Fig. 2 is a plan or top view of the same. Fig. 3 is a front elevation. Fig. 4 is a longitudinal vertical section of one of the traction-wheels. Fig. 5 is a transverse section of the wheel and the steam-chest. Fig. 6 is a cross-section of the steam-chest, representing also the valve mechanism. Fig. 7 represents the front covering-plate of the steam-chest. Fig. 8 is a detail view of one of the valves.

The letter K designates a steam-boiler, which is of the construction commonly employed in locomotives. This boiler is encircled by a broad wrought-iron ring, A B, to which are welded or otherwise secured the axle arms or spindles C of the driving-wheels. Said axle-spindles are inclined a little in a downward direction, so that the wheels mounted thereon will have a tendency to press in an inward direction.

The driving-wheels, designated by the letters R R′, are fitted loosely on the axle-spindles, so as to turn thereon in the manner of ordinary carriage-wheels; and said wheels are secured in place by nuts and friction-washers.

The spokes S of the wheels are made hollow, and each contain a steam-piston, P, and a piston-rod, S′. Said piston-rods project through the periphery or rim of the wheel, and are provided with metallic shoes or feet Z. The admission of steam into each spoke above the piston contained therein is effected by the channels or passages *p*, and a like admission of steam, but in a reduced quantity, below the piston takes place through the channels or passages *q*. The inlet-mouths of these steam-passages are arranged in two concentric circles in the hub of the wheel and around the axle-spindle, as is seen more fully in Fig. 4. The channels *p*, which are made larger or wider than the channels *q*, conduct the steam above the piston, whereby the latter is forced from the center of the wheel toward the periphery thereof. The reverse movement of the piston, or retraction thereof, is effected by steam entering below the piston through the tube *t*, this tube being in communication with its corresponding channel *q* and spoke S.

The movement of the engine or locomotive in a forward direction may be illustrated by Fig. 4, in which an angle of forty-eight degrees, formed by the surface of the ground and a portion of the rim of the wheel, is indicated by the letters D E. All the pistons located within this angle receive steam on their upper surface, whereby the shoes or feet Z carried by the piston-rods are forced against or into the ground, thus pressing or turning the wheel in a forward direction. After the traction-feet have exerted their effective stroke and passed out of the described angle, then steam is admitted below the pistons of the respective shoes, so that the latter are drawn in an inward direction, and caused to enter recesses or seats formed for said shoes in the rim of the wheel. The shoes are held in this inactive position by the friction of the pistons in the cylinders and the piston-rods in their stuffing-boxes.

As the engine advances farther, the entire series of shoes are successively brought into

action in the manner already described, thus causing the rotation of the driving-wheels and progressive movement of the engine.

The admission of steam to the hollow spokes and pistons, so as to produce the above-mentioned results, is effected by the two steam chests or boxes F F′, which are mounted on the axle-spindles, and connected therewith by splines and feathers, so that they can have a limited sliding movement on said axle-spindles without turning thereon. The wheels or the hubs thereof turn in contact with the steam-boxes, and both have flat bearing or contact surfaces, so as to produce a steam-tight joint.

Each steam-box is divided into two chambers, of which the one designated by the letters G H J, Fig. 6, is in communication with the steam-dome of the boiler through the medium of the pipe *m*, and serves for the distribution of live steam to the traction-wheel.

The chamber designated by the letters L M N, Fig. 6, is provided with the pipe *n*, and serves for carrying off the exhaust or waste steam.

Each steam-box is, on the side adjoining the wheel-hub, provided with a covering or face plate, (shown in Fig. 7,) in which are formed slits or openings *v*. These openings can be entirely or partially closed or covered by means of two curved slide-valves, W W′, located one in rear of the other on the inner side of the covering-plate, having the aforesaid openings *v*. By closing part of the steam-inlet openings lying within the angle D E, heretofore mentioned, the pistons located within said angle receive live steam only during a portion of the time in which they may be within said angle, and this steam then acts by expansion as the engine progresses or the wheel revolves. In this manner I provide means whereby by the simple arrangement or position of the valves the steam can be made to act with any desired degree of expansive power.

The steam-tight joint between the steam-boxes F F′ and the hubs of the driving-wheels is effected as follows: A stuffing-box, *a b*, welded to the face-plate of each steam box or chest, receives a stuffing-box cover, *l k*, fitted on the hub of the driving-wheel, and this cover is secured to the stuffing-box by bolts and nuts *y*, as is shown in Fig. 5.

A plate, *c*, fitted to the face of the wheel-hub, is apertured in unison with the steam-passages in said hub, is of the same diameter as the external diameter of the stuffing-box cover, and is forced against the face-plate of the steam-box when the bolts and nuts *y* are screwed up. As the steam-box is capable of sliding on the axle-spindle to a limited degree, it will readily conform itself to or follow the side movements of the driving-wheel, and this without causing an escape of steam, the joint between the hub and steam-box being perfect at all times.

The mechanism for operating each pair of valves in both steam-boxes is constructed as follows, viz: Two levers, *f*, arranged one at each side of a platform or cab, Y, are connected by means of rod *d* with a toothed bar or rack, *r*, which engages with a toothed or rack portion of the valve or slide W. By operating said levers by hand the valve W can be set so as to vary the admission of steam to the hollow spokes during the forward movement of the engine.

The levers *f* are loosely mounted on a transverse rock-shaft, *g*, and have pawls, engaging with toothed segments, for locking said levers. The rock-shaft has foot-treadles and vertical arms or levers at each end, which levers are connected, by rods *d′*, with rack-bars located in rear of the aforesaid rack-bars *r*, and engaging with the toothed valves W. These last-mentioned valves can thus be operated by the feet of the engineer, and serve for controlling the flow of steam which is to serve for braking or arresting the engine or moving the same in a backward direction. When steam is unequally admitted to both driving or traction wheels the latter will turn with different velocities, and therefore cause the engine to pursue a curved line or path. This result is accomplished by admitting a larger quantity of steam to one of the traction-wheels than to the other. As the driving-wheels are capable of revolving independently of each other, the engine can travel in a path of any desired curvature.

When the engine is lightly ballasted and running on a level or horizontal road, then the expansive action of the steam will be sufficient to furnish the necessary propelling force. A full steam-pressure, however, is required on ascending or bad roads. In descending an inclined road, the steam-pistons, before entering the angle in which they cause the shoes to make their effective stroke against the ground, will receive a small quantity of steam by manipulating the inner valves, and this steam, acting against the tops of the pistons, will cause the shoes to be projected to a sufficient extent for enabling the same, by their frictional contact with the ground, to act as a brake upon the wheels. Simultaneously with this projection of some of the shoes, those shoes located within the angle D E will be operated by the expansive action of the steam, and thereby cause the engine to move forward at a uniform rate of speed.

In case it is found necessary to arrest the movement of the engine, this can be accomplished very quickly by moving the inner valves, W′, to their full extent, whereby the shoes located within the angle D E are projected against or forced into the ground. By simultaneously forcing back the valves W and drawing up the valves W′, steam is admitted to the hollow spokes for causing the engine to move in a backward direction.

A traction-engine of the described construction can be managed by an experienced engineer or driver in the same manner as a vehicle drawn by horses, and is adapted for all kinds of roads, as it is capable of ascending and de-

scending inclined planes and turning curves. It is also possible to arrest the engine when at full speed almost instantaneously; but obviously the engine must be of a firm construction.

In order to enable the engine to readily pass over ordinary defects in roads, such as ruts and ridges, the driving-wheels must be made of the largest diameter possible.

In order to maintain the steam-boiler in the same plane whether the engine be ascending or descending inclined planes or traveling on a level road, I propose to weight the rear portion of the boiler, or to hang the latter in such a manner that a preponderance of weight shall exist at the rear end of the boiler. Furthermore a caster-wheel, V, mounted on a vertical screw-spindle, Q, can be raised and lowered by means of a hand-wheel, T, so as to preserve the proper level of the boiler and attached parts.

W″ is the platform for the fireman, who can also manage the last-described parts.

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

1. In a traction or road engine, a pair of revolving wheels turning independently of each other on a fixed axle, and provided with a series of sliding feet or shoes projected radially outward from the periphery of the wheels, so as to exert a traction force upon the ground and a radial pressure upon the wheel-axle, substantially as herein shown and described.

2. In a traction or road engine, a revolving driving-wheel having a hub provided with steam-passages, hollow spokes, sliding pistons, piston-rods carrying shoes or feet, and steam-tubes, in combination with a stationary steam box or chest having means for regulating the admission of steam to the driving-wheel, substantially as herein set forth.

3. The steam-chest provided with an apertured face-plate and divided into steam inlet and exhaust compartments, and having slides or valves and suitable devices for operating the latter, in combination with the fixed axle and the revolving traction-wheel, having steam-channels corresponding with the apertures in the steam-chest, and radially-sliding traction feet or shoes, substantially as and for the purpose set forth.

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

RICHARD BROJA.

Witnesses:
GERARD VON NAWROCKI,
BERTHOLD ROI.