2 Sheets—Sheet 1.

J. DOYLE.

Motors for Propelling Vehicles, or Mechanical Horses.

No. 200,266. Patented Feb. 12, 1878.

Fig 1

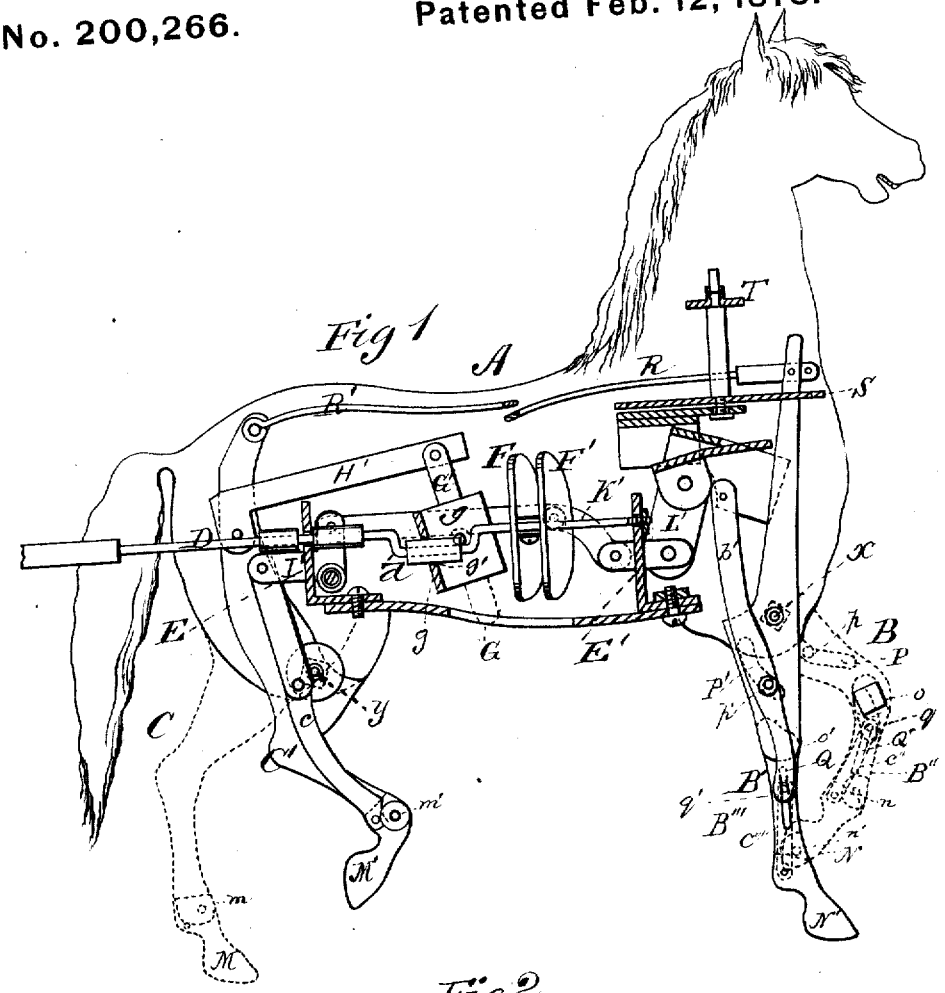
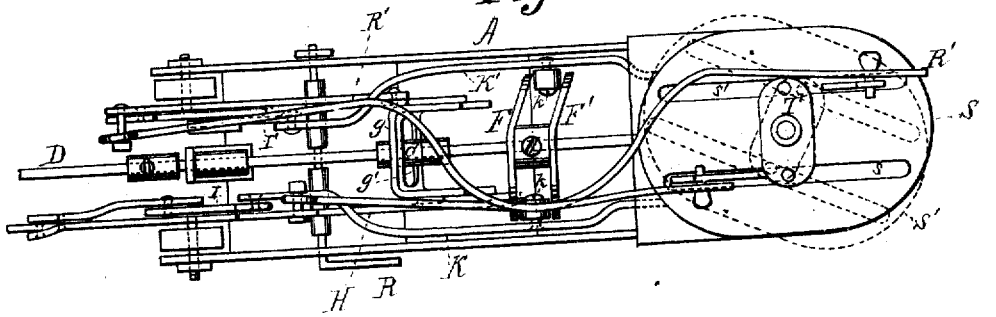


Fig 2.



WITNESSES

Villette Anderson

F J Masi

INVENTOR

John Doyle

by E W Anderson

ATTORNEY

2 Sheets—Sheet 2.

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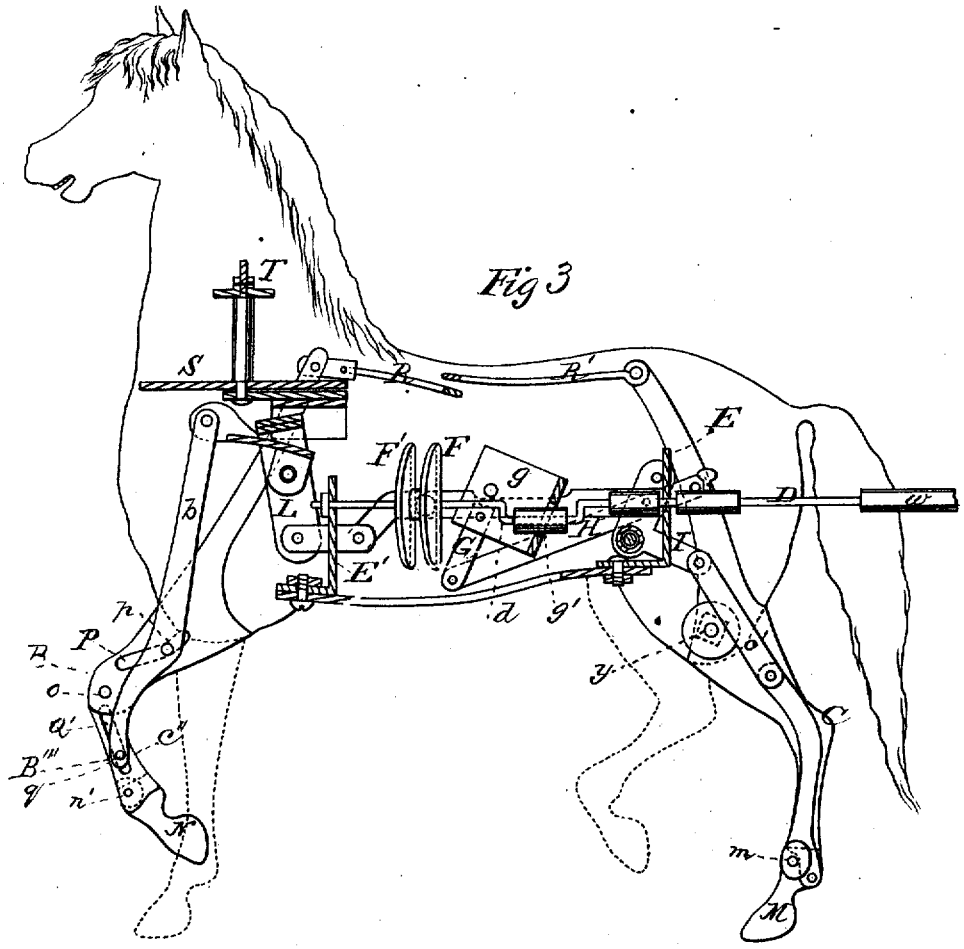

Fig 3

WITNESSES

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UNITED STATES PATENT OFFICE.

JOHN DOYLE, OF HOBOKEN, NEW JERSEY.

IMPROVEMENT IN MOTORS FOR PROPELLING VEHICLES OR MECHANICAL HORSES.

Specification forming part of Letters Patent No. **200,266**, dated February 12, 1878; application filed August 4, 1877.

To all whom it may concern:

Be it known that I, JOHN DOYLE, of Hoboken, in the State of New Jersey, have invented a new and valuable Improvement in Power-Horses; and I do hereby declare that the following is a full, clear, and exact description of the construction and operation of the same, reference being had to the annexed drawings, making a part of this specification, and to the letters and figures of reference marked thereon.

Figures 1 and 3 of the drawings are representations of longitudinal vertical sections of my invention, and Fig. 2 is a top view thereof.

My invention relates to improvements in mechanical horses or road-engines; and it consists in certain devices and combinations thereof for mechanically imitating the step of a horse and producing an ambulatory movement in an apparatus for pulling vehicles.

In the accompanying drawings, the letter A designates the body of a horse; B B′ are the fore legs, and C C′ the hind legs. The upper joints of the fore legs are fulcrumed, as at *x*, to the frame A, and said joints extending above the top of the frame, are pivoted to rods R R′, which extend rearward and are bent so that each rod will connect with the top of the hind leg located on the opposite side of the frame from the fore leg to which said rod is pivoted. The hind legs are fulcrumed, as at *y*. D is a shaft, journaled in standards E E′ in the center of frame A. Upon this shaft, near its front end, are arranged two parallel cam-disks, F F′, the function of which will be hereinafter explained. G G′ are bell-cranks or elbow-levers, pivoted or fulcrumed within and on opposite sides of frame A. The short arms of these elbow-levers are connected by a slotted plate, *g*, in the slot *g′* of which plays a crank-bend, *d*, formed in shaft D. To the long arm of elbow-lever G is pivoted one end of a link, H, the other end of which is pivoted to the upper part of hind leg C, and to the long arm of elbow-lever G′ is pivoted a link, H′, the other end of which is pivoted to the upper part of hind leg C′.

Near the rear end of frame A, and on opposite sides thereof, are fulcrumed elbow-levers I I′, the short upper arms of which are jointed to rods K K′, the front ends of which are jointed to the short lower arms of elbow-levers L L′, which are fulcrumed on opposite sides of the front part of frame A. From these rods K K′ pins *k k′* project inwardly between the cam-disks F F′, before referred to, and are provided with friction-rollers. The shape of these disks is such that when rotated they, through the pins *k k′*, force one of the rods K K′ forward and the other rearward, alternately; but a certain portion of these disks is not bent, (say, about half,) and stands practically at right angles to shaft D, forming thus a dead motion with respect to the rods K K′.

The long arms of the rear elbow-levers I I′ are jointed to the tops of hoof-rods *c c′*, the lower ends of which are pivoted to the rear edges of hoofs M M′, the front edges of which are pivoted to the bottoms of hind legs C C′ at *m m′*.

The upper and long arms of the forward elbow-levers L L′ are jointed to the knee-rods *b b′*, the lower ends of which are jointed to the hoof-links *c″ c‴*, which are also jointed to the rear edges of the fore hoofs N N, the front edges of which are pivoted to the bottoms of the lower joints B″ B‴ of the fore legs, as at *n n′*, the upper ends of said lower joints being pivoted to the upper joints of the fore legs at *o o′*, in order to accomplish the knee movement in the operation of the apparatus. P P′ are curved guide-slots in the fore legs C C′, a short distance above the knees. Through these guide-slots project pins *p p′* from the knee-rods *b b′*. In the lower joints B″ B‴ of the fore legs are straight slots Q Q′, through which project the pivot-pins *q q′*, which connect knee-rods *b b′* with hoof-links *c″ c‴*.

The shaft D projects to the rear of frame A, and its rear portion is composed of two or more links, connected by universal joints, as at *w w′*. Motion is communicated to the apparatus by the rotation of shaft D, which may be connected with a steam-engine, spring-power, or other motor located in the vehicle which the horse is intended to pull.

On top of the front part of frame A is pivoted to a cross-bar a plate, S, provided with slots *s s′*, through which project the tops of the fore legs B B′. The pivot of plate S projects upward from said plate, and is provided

with a cross-head, T, by which it may be turned by means of lines or rods attached to the ends of said cross-head, and extending rearward to the vehicle. When the plate S is turned to one side or the other, as shown in dotted lines, Fig. 2, the direction given to the slots *s s'* is communicated to the movement of the fore legs B B' by torsion of said legs, and a corresponding change of direction in the horse's progress will result.

Having now fully described the various devices and arrangements which constitute my invention, I will explain the operation of the same.

The horse is placed between the shafts of a vehicle, the said shafts being connected to the vehicle by loose joints, in order that the pulling may be effected through shaft D. When rotary motion is communicated to shaft D the crank-bend *d*, playing in slot *g*, moves said plate up and down, causing a back-and-forth motion of the elbow-levers G G', which, through links H H', communicates an alternate back-and-forth vibration to the hind legs, which, in turn, effects a similar and corresponding movement to the fore legs through rods R R', which, as before explained, connect each hind leg to a fore leg on the opposite side of the frame from said hind leg.

Referring to the drawing, the horse is represented in the act of making a step forward. Now, when, by a further movement of shaft D, the elbow-lever G' is moved forward, the upper end of hind leg C', moving forward also, will cause the lower part of said leg to move backward, and the hoof M', its toe striking the ground, will be caused to turn on pivot *m'* until said hoof rests flat upon the ground, like hoof M; and when it assumes this position the pin *k'* of the rod K' is, by the turning of shaft D, in the "dead motion" of the cam-disks F F', in order that the hoof may rest firmly on the ground while a propulsive effect is produced by the said hind leg, and it assumes a position similar to that shown by hind leg C in the drawing. While it is taking this position it throws forward, through rod R', the upper end of the fore leg B, and causes a backward movement of the knee of said fore leg. At this time the rod K is driven backward by the cam-disks F F', and through the elbow-lever L the knee-rod *b* is forced downward, causing, through its connection with hoof-link *c''*, the lower joint of the fore leg B and the hoof N to move forward the curved slot P and pin *p*, and straight slot Q and pin *q*, so guiding the motion of rod *b* and link *c''* that the toe of hoof N strikes the ground, the hoof turning on pivot *n*, and the entire leg assuming the position shown in the drawings by leg B'.

While the top of hind leg C' moves forward, the top of hind leg C moves backward, and raises the lower part thereof to the position corresponding to that shown by leg C' in the drawings, and as soon as the hoof M' rests flat upon the ground the cam-disks begin to force rod K forward, and cause elbow-lever I to lift rod *c*, which it continues to do until, in its forward and upward movement, the lower part of leg C arrives at a position corresponding to that shown by leg C' in the drawings, and hoof M to a position similar to that shown by hoof M'. The backward movement of the top of leg C produces, through its connections, assisted by the operations of cams F F' and their connections, a movement in fore leg B' the reverse of that described by leg B, as will be readily understood, for the arrrangement of the parts is such that they cause a precisely-corresponding but alternately-reverse movement of the opposite legs.

The changing of the direction of the progress of the horse by plate S has already been explained.

Having now fully described the construction and operation of my invention, I claim and desire to secure by Letters Patent—

1. The combination of shaft D, having crank-bend *d*, elbow-levers G G', links H H', rods K K', and the fore and hind legs of the apparatus, substantially as described.

2. In combination with the vibratory legs of a mechanical horse or road-engine, the shaft D, cam-disks F F', rods K K' pins *k k'*, elbow-levers I I' and L L', hoof-rods *c c'*, and knee-rods *b b'*, substantially as described.

3. The combination of elbow-lever L, knee-rod *b*, hoof-link *c''*, hoof N, and the upper and lower joints of leg B, having slots P and Q, in which move pins *p* and *q*, substantially as and for the purpose set forth.

4. The combination of cam-disks F F', rod K, pin *k*, elbow-lever I, hoof-rod *c*, pivoted hoof M, and leg C, substantially as specified.

5. The combination of cam-disks F F', rod K, pin *k*, elbow-lever I, hoof-rod *c*, hoof M, leg C, link H, and elbow-lever G, substantially as described.

6. In combination with the shaft D, having crank-bend *d*, the elbow-levers G G', connected by the slotted plate *g*, and the cam-disks F F', all connected with and operating the legs and joint-rods thereof in a mechanical horse or road-engine, substantially as specified.

7. The pivoted plate S, having slots *s s'*, in combination with the fore legs B B', substantially as described.

In testimony that I claim the above I have hereunto subscribed my name in the presence of two witnesses.

JOHN DOYLE.

Witnesses:
DANIEL F. TYLER,
J. M. POTTER.