(No Model.) 2 Sheets—Sheet 1.

R. STANLEY.

TUNNELING OR MINING MACHINE.

No. 476,836. Patented June 14, 1892.

Fig. 1.

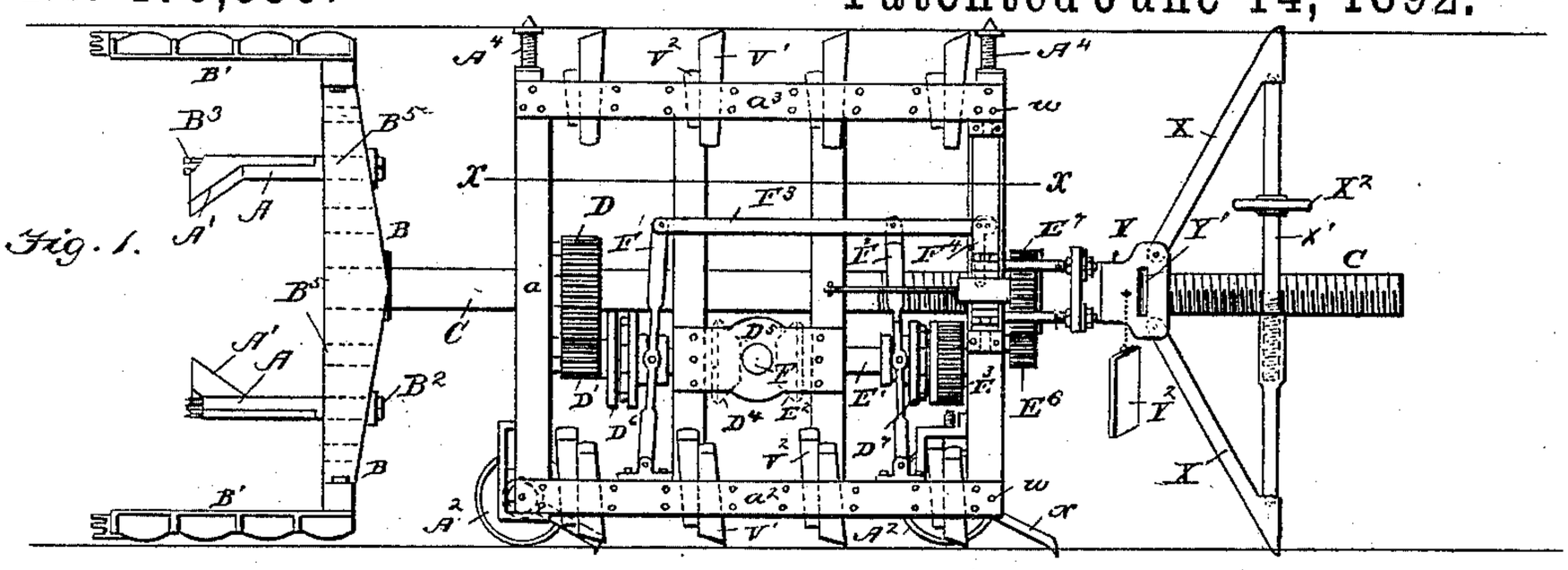


Fig. 2.

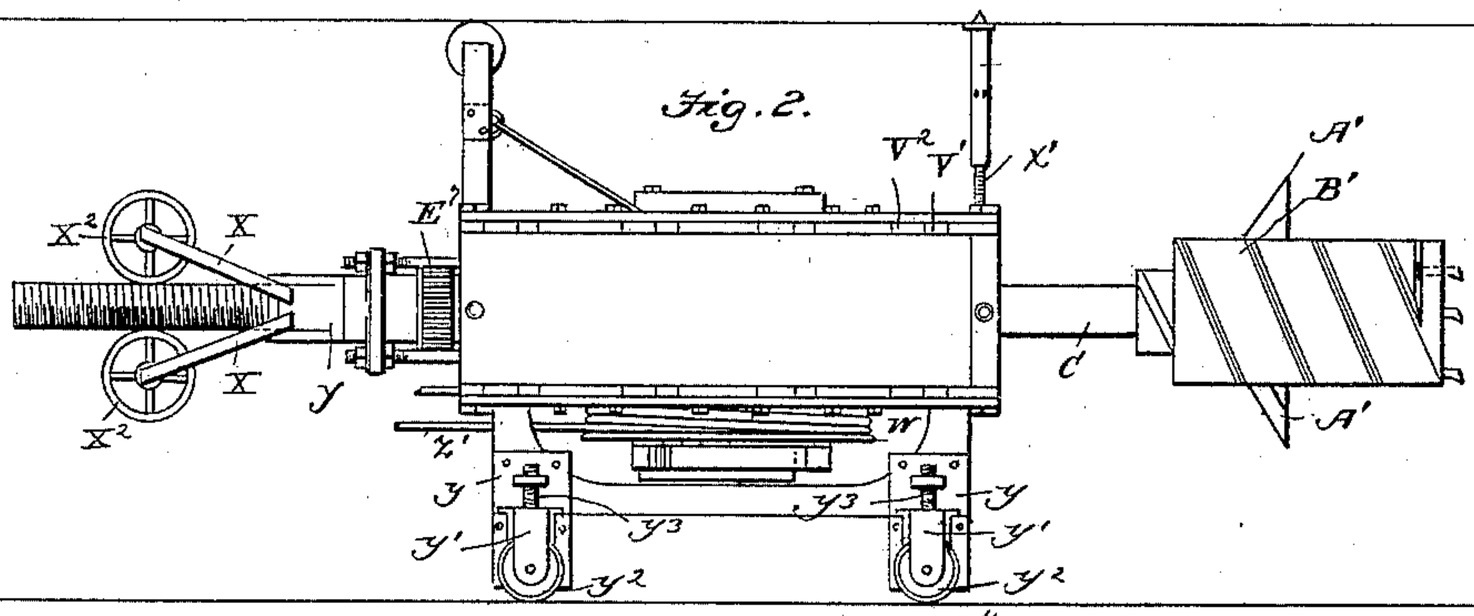


Fig. 3.

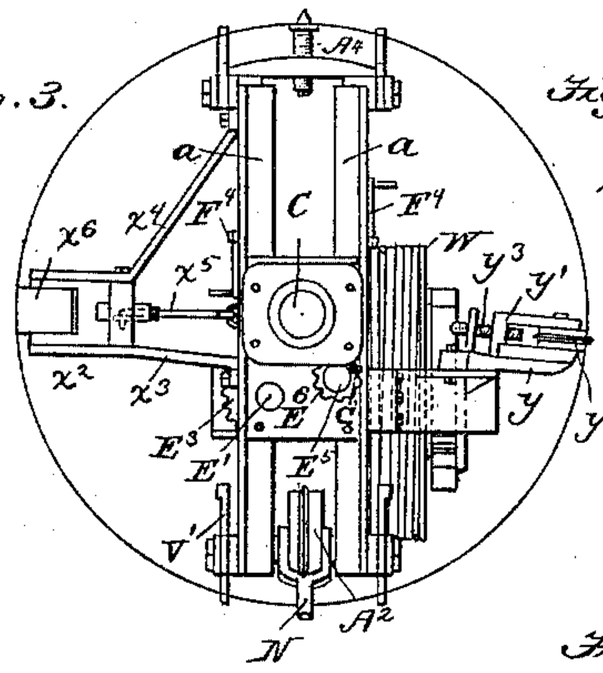
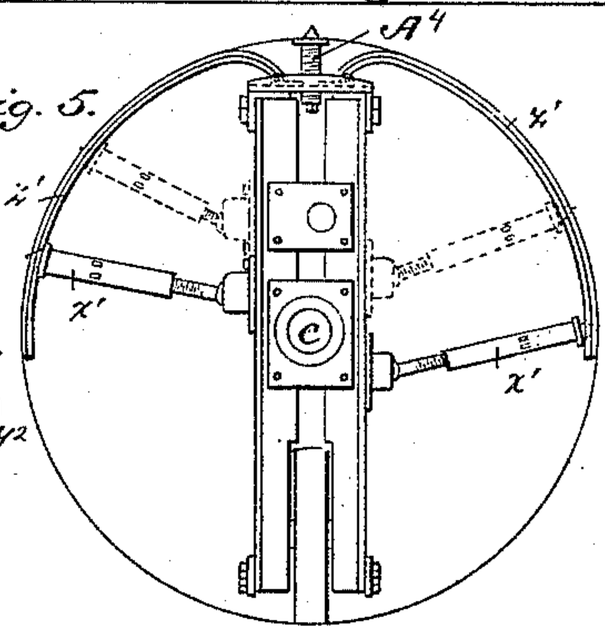


Fig. 5.



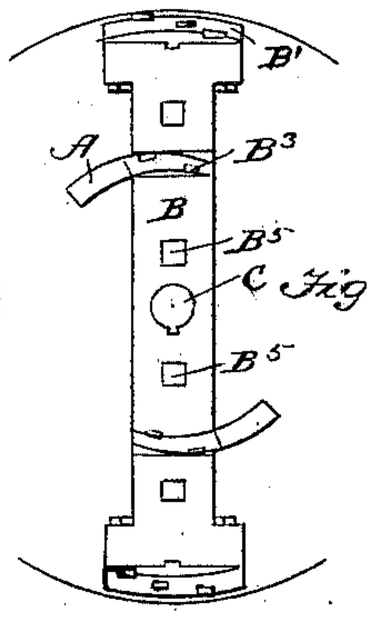
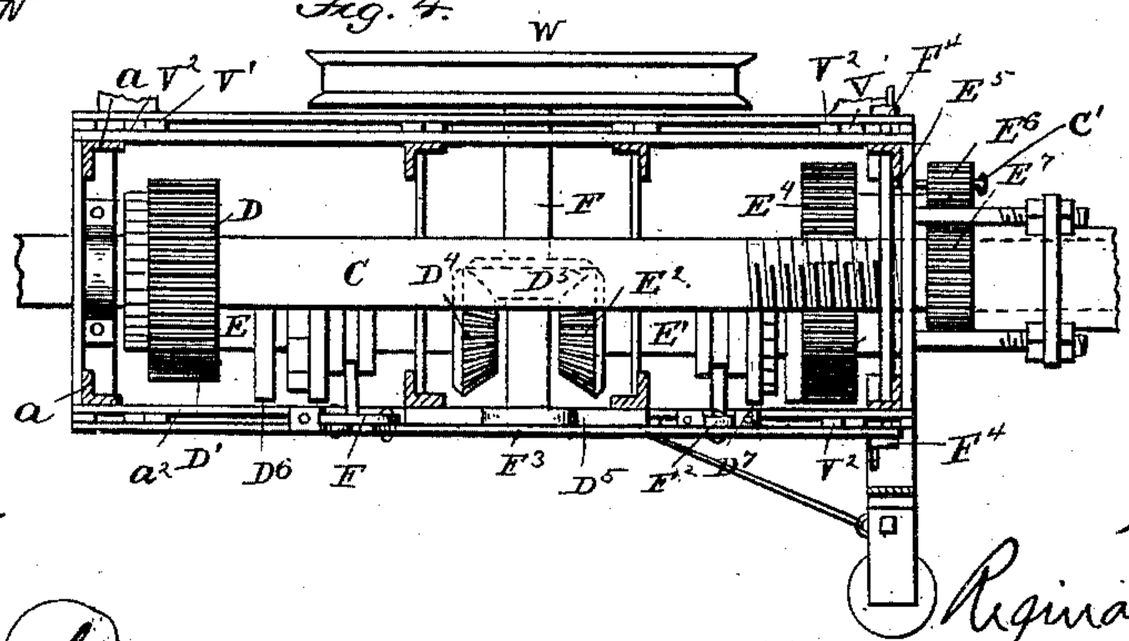


Fig. 15.

Fig. 4.



Witnesses:

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Marcus B. May

Inventor:

Reginald Stanley

By, Doubleday & Bliss

Attorney's

(No Model.) 2 Sheets—Sheet 2.

R. STANLEY.

TUNNELING OR MINING MACHINE.

No. 476,836. Patented June 14, 1892.

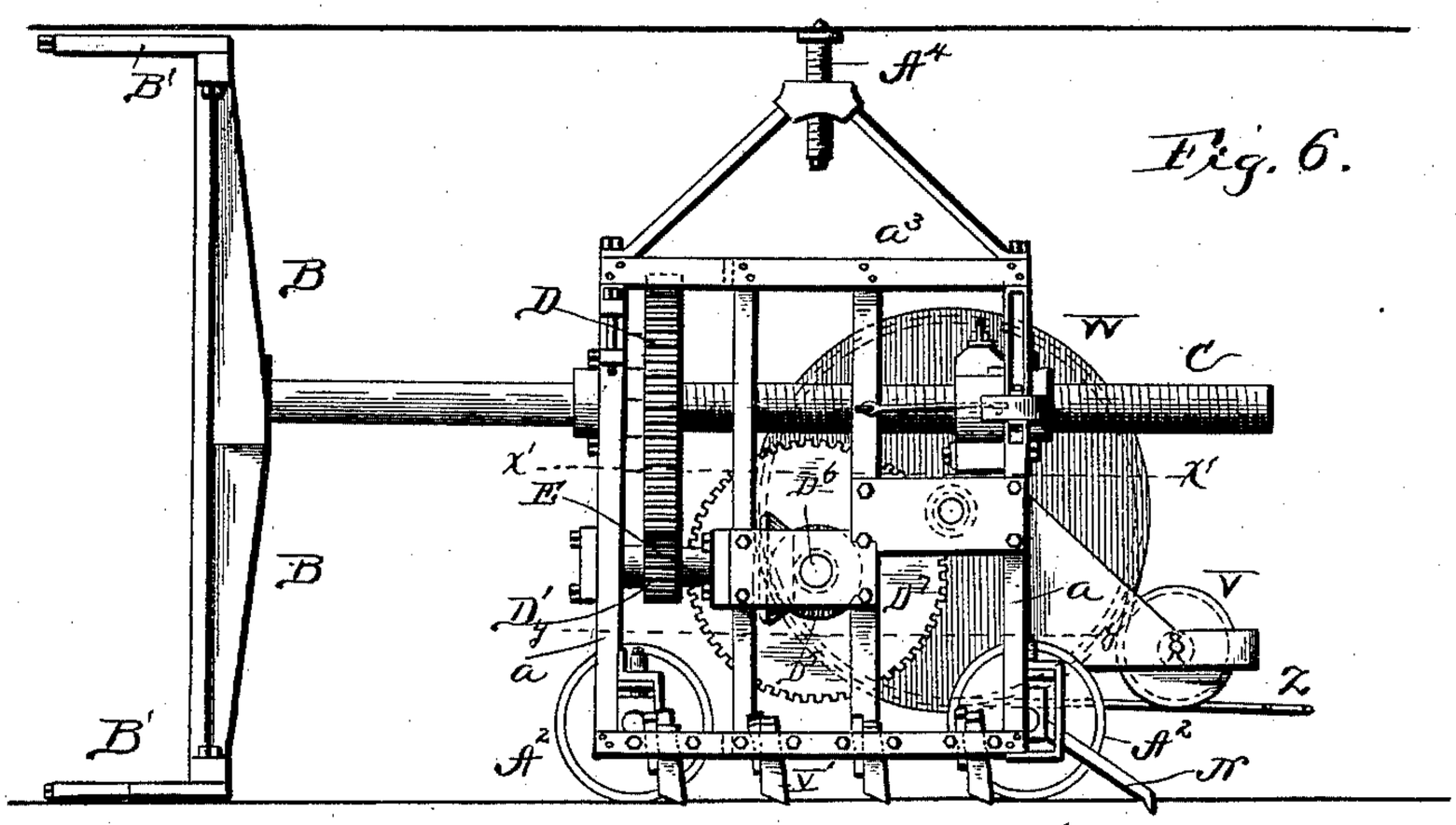

Fig. 6.

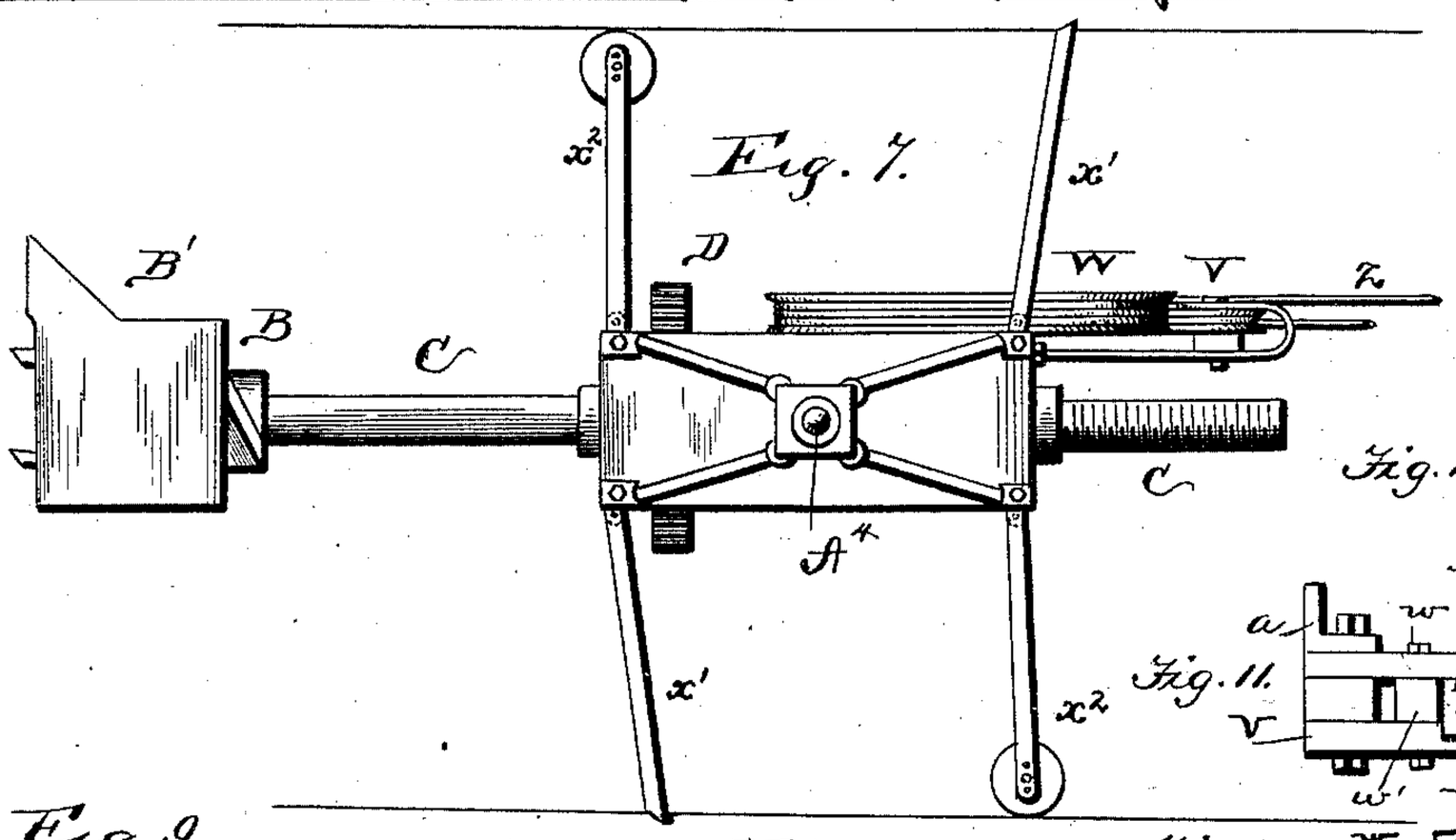

Fig. 7.

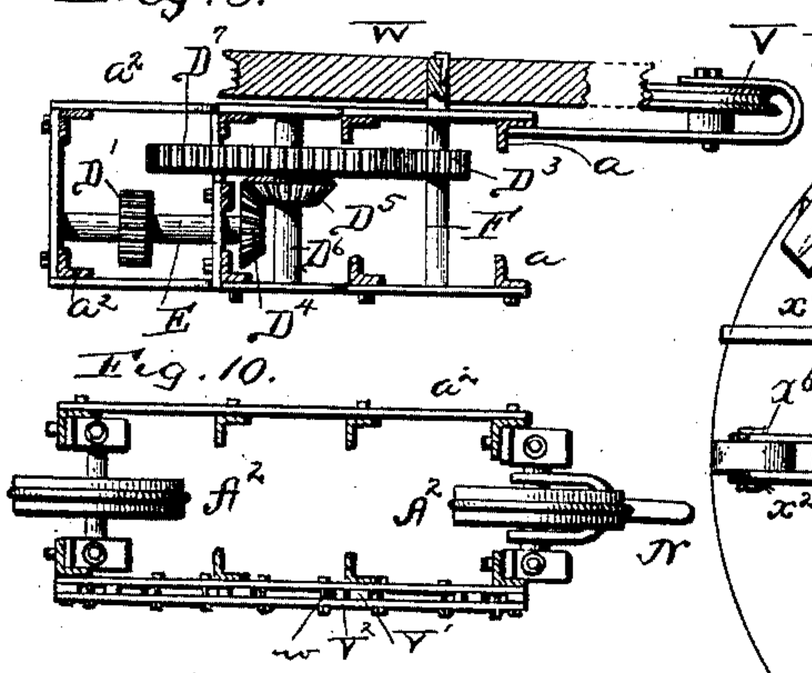

Fig. 9.

Fig. 10.

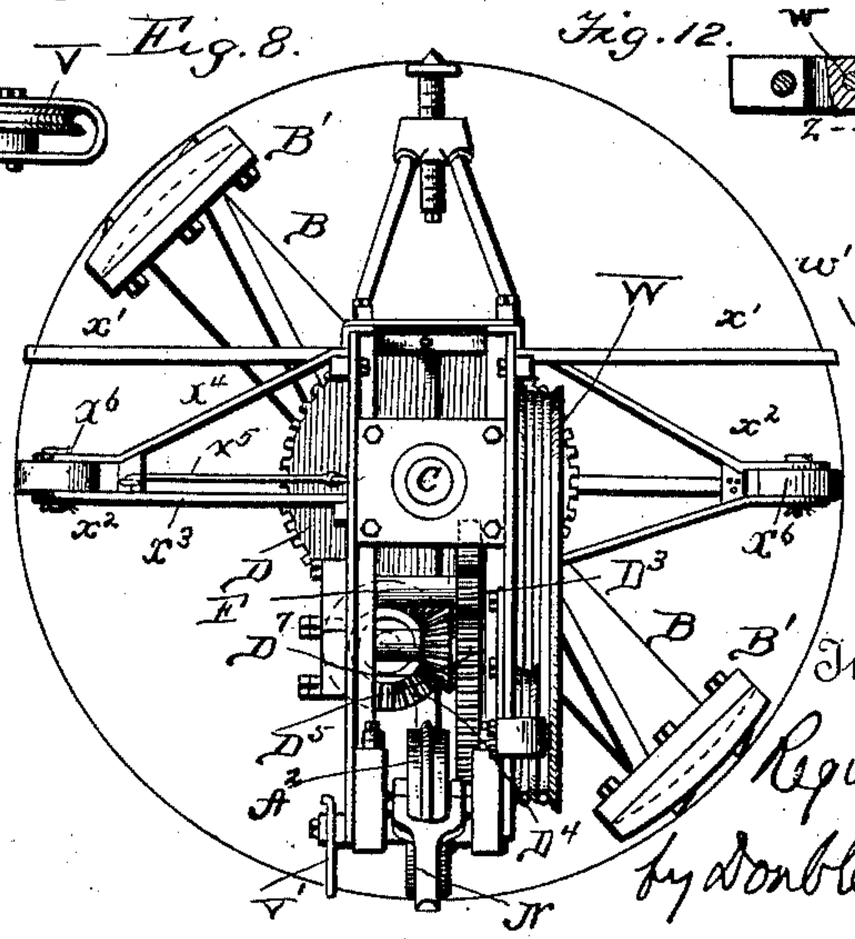

Fig. 8.

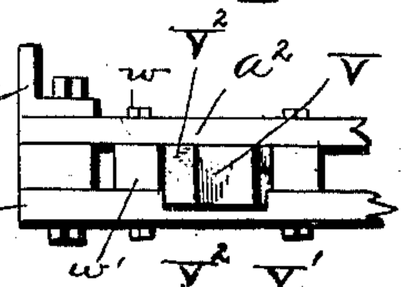

Fig. 11.

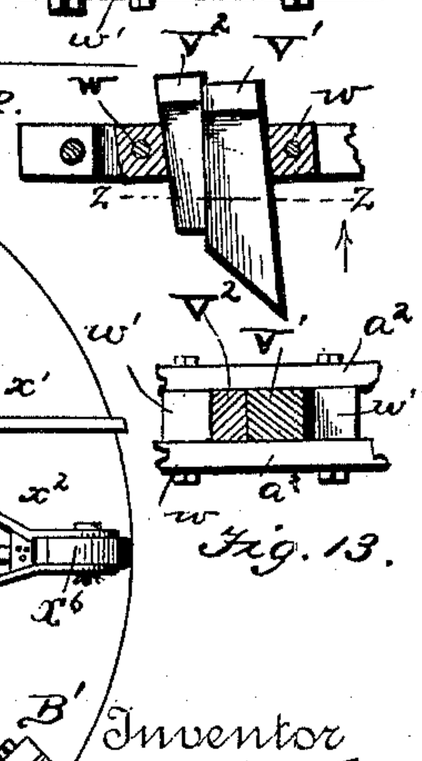

Fig. 12.

Fig. 13.

Witnesses
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Reginald Stanley
by Donbleday & Bliss
Attorney

UNITED STATES PATENT OFFICE.

REGINALD STANLEY, OF NUNEATON, ENGLAND.

TUNNELING OR MINING MACHINE.

SPECIFICATION forming part of Letters Patent No. 476,836, dated June 14, 1892.

Application filed May 3, 1891. Serial No. 383,645. (No model.) Patented in England March 6, 1890, No. 3,595.

To all whom it may concern:

Be it known that I, REGINALD STANLEY, a subject of the Queen of Great Britain and Ireland, residing at Nuneaton, in the county of Warwick, England, have invented certain new and useful Improvements in Tunneling or Mining Machines, of which the following is a specification, reference being had therein to the accompanying drawings.

This invention relates to improvements in machines for boring tunnels, such as are used in the excavating of rock, mining coal, &c., and was patented in England March 6, 1890, No. 3,595. As shown, the parts are particularly well adapted for coal-mining.

Figure 1 is a side elevation of a machine embodying my improvements. Fig. 2 is a top plan view. Fig. 3 is a rear elevation. Fig. 4 is a partial sectional view on the line *x x* of Fig. 1. Fig. 5 is a front view of the machine, showing the shield. Fig. 6 is a side view of a modified form of machine. Fig. 7 is a top plan view of the same. Fig. 8 is an end view. Fig. 9 is a section on line *x' x'*, Fig. 6. Fig. 10 is a section on line *y y*, Fig. 6. Fig. 11 is a top view of the devices at the bottom of the machine for preventing it from moving backward. Fig. 12 is a view of the same with the outer bar removed. Fig. 13 is a section on line *z z*, Fig. 12. Fig. 14 is an edge view of one of the fasteners. Fig. 15 is a front view of the cutting apparatus.

There are some of the features of the present machine which may be used in connection with machines of other sorts. Thus I have illustrated devices for forming an annular cut; but the gearing, shafting, and other power-transmitting devices, as well as those for converting the power, can be used in producing cuts of other sorts.

B B are radial arms carrying forward-projecting cutter-arms B' B' and secured to a rotating screw-threaded shaft C, all now well known.

In addition to the annular cutter-arms B' B', I provide other cutter-arms A A, in order to remove part of the core left thereby. The radial arms B B have apertures at intervals in their faces, in which the tongues of the auxiliary cutters are secured by bolts or otherwise. In the drawings but two auxiliary cutter-arms are shown; but it is obvious that as many as desired may be used, so as to cut away the whole face of the material. As shown, the said arms A A are wider at their front ends and have a tapered nose or projection, which cleans away the slack in front of the cutters B^3. It will be seen that these cutter-arms may be readily detached and secured at any distance from the center of the radial arms B B, as the nature of the material may require, or they may be left off entirely. While I have shown and described these adjustable cutter-arms, I do not herein claim them, as they are shown and described in my pending application, Serial No. 298,690, filed July 7, 1891.

A frame is provided having the vertical standards *a a*, preferably made of angle-irons, bottom girts a^2, and top girts a^3. This frame is mounted upon wheels A^2 A^2 of the central longitudinal plan of the machine. At the top it is provided with one or more screw-jacks A^4, preferably with one at each end. The machine is prevented from yielding backward by means of the hinged brace N, adapted to engage with the floor of the mine.

I provide in the present construction for an additional bracing of the machine, this being accomplished by wedge-like bars V'. These can be driven by a hammer or similar instrument tightly into the floor and roof and be then clamped in place by means of locking-wedges V^2. They are supported between one of the longitudinal bottom frame-bars a^2 and a supplemental outside bar held thereto by bolts *w w*. The catch-bars V' are pointed or chisel-shaped, as shown in Fig. 12, so as to readily engage with the floor or roof, and the clamp V^2 binds the part V' tightly between two blocks or plates *w' w'*, held in place by the said contiguous bolts *w w*. As a further bracing of the machine, as it is desirable to keep the cable by which power is applied quite taut, I provide arms or sprags X X, hinged to a sleeve Y on the screw-shaft of the machine. The sprags are forced apart into holes cut in the tunnel by means of telescope-screws X' X', swiveled to the said sprags and carrying wheels X^2, by means of which the said screws are elongated and contracted. The sleeve Y slides loosely on the

central shaft and when the machine is making a cut abuts against the rear of the machine. Through the sleeve from side to side is an aperture or slot Y′, into which may be slid a plate Y^2, which is shown in Fig. 1 as hanging by a chain to the sleeve. When a cut has been made and the shaft has been moved forward its length—that is to say, until the end of the shaft has just passed the slot Y′ in the sleeve—the plate Y^2 is slid into the said slot and prevents the shaft from being pushed back in the heading or tunnel while the machine is being advanced.

As shown in Fig. 5, hinged shields Z′ may be used to keep the rock and dirt from falling on the machine and operatives. These shields may be made of sheet metal and are forced out against the roof of the tunnel by side stays x' x', the points of which penetrate through holes in the shields and shoulder against them. These shields not only protect the machine, but also when the sides of the heading are broken and irregular, as is sometimes the case, through the practically uniform pressure they exert the machine is kept upright and steady.

Lateral braces and guides for the central part of the machine are shown at x^2 x^2, these comprising pivoted vertical frames having bottom bars x^3 and top bars x^4, hinged to the main frame, and holding-links x^5 for locking the swinging parts in place. At the outer ends of these frames there are rollers x^6 arranged to bear against the vertical walls of the tunnel, so that the machine can be held firmly upright and at the same time be moved forward or backward without serious resistance.

Additional braces to keep the machine upright may be used. In Fig. 3 they are shown as being comprised of the rigid grooved plates y y, sliding parts y' y', fitting in said grooves, and ribbed wheels y^2 y^2, mounted on said sliding parts, the said wheels bearing against the side walls of the heading or tunnel. The wheels are adjusted in relation to the machine by means of screws y^3, which are provided with right and left hand threads.

Power is applied to the machine as follows: Z is a rope or cable, which extends outward along the tunnel or heading to any point suitable for applying motion and power. It is passed several times around a grooved wheel W and extends thence to the point whence the power is applied. The wheel W is mounted on one end of a shaft F, which is mounted in suitable bearings in the sides of the machine and has on the other end a bevel-wheel D^5, which actuates both the cutter-driving and the advancing mechanism.

I will first describe the cutter-driving mechanism. On one end of a shaft E, mounted in bearings at the side of the machine, is a bevel-wheel D^4, meshing with the said bevel-wheel D^5, and on the other end is loosely mounted a pinion D′, which meshes with a wheel D, having a spline or feather which engages with a groove in central shaft C. At D^6 is a clutch mechanism for connecting and disconnecting the pinion D′ to the shaft E. When a cut has been made, the frame is advanced as follows: The pin C′ is withdrawn from wheel E^6 and the supporting-plate, thereby unloosing said wheel from its stationary position. Then the nut-wheel, being thereby unloosed, is driven by a pinion E^6, rigid on one end of a shaft E^5, which carries at its other end a pinion E^4. Meshing with the pinion and actuating it is a wheel E^3, which is loose on a shaft E′, mounted on the side of the machine and carrying on one end a bevel-wheel E^2, which is driven by the bevel-wheel D^5 on the power-shaft. A clutch mechanism is shown at D^7 for connecting and disconnecting wheel E^3 to and from shaft E′. The clutches D^6 D^7 are shifted by levers F′ F^2, respectively, said levers being pivoted to the side bar a^2 of the machine and also to the bar F^3, which is moved forward and backward by means of L-shaped handles F^4 F^4. It will be seen that by the same movement of bar F^3 wheel D′ and shaft E are connected and wheel E^3 and shaft E′ are disconnected, and vice versa, when the bar F^3 is moved backward.

When the machine has been secured in the tunnel by means of the braces and stays, the nut-wheel E^7 is locked relatively to the frame by inserting pin C′ through an aperture in wheel E^6 into the supporting cross-plate, and the clutch-levers are moved forward, and power is applied to the wheel D in the way just described, whereupon the central shaft C is caused to rotate and advance. After a cut has been made the nut-wheel E^7 is released, (the plate Y^2 being in place in the slot Y′,) power is applied to the wheel E^7, and the frame is advanced.

In Figs. 6 to 10 a modified form of machine is shown possessing the same general principles of construction and arrangement. In this construction the machine is provided with a jack-screw A^4 directly over the center and adapted to bear downward through a frame secured to the top of the machine. Referring to Fig. 6, it will be seen that the cable Z first passes under a guide-pulley V, then one or more times around a grooved wheel W, and thence again under the wheel V and back or out to the source of power. The wheel V is supported in a frame, which can be vertically adjusted, so as to regulate the tension of the cable immediately adjacent to the power-wheel W. The latter is secured to a shaft F, which, by means of a pinion D^3, rotates a wheel D^7 and a shaft D^6, which carries it. The shaft D^6 has a bevel-wheel D^5, which engages with a second bevel-wheel D^4 upon shaft E. The latter has a pinion D′ engaging with the main wheel D, by which the cutter-shaft C is rotated. Shaft C is grooved, and with it

engages a spline or feather in wheel D. It will be readily seen that the gearing thus arranged is compact and simple.

It will be understood that a frame-advancing mechanism may be used on this machine, although I have shown only the gearing necessary for driving the cutters. When a cut has been made, the whole machine may be moved forward by hand-power; but I have found it often preferable to use a mechanism, as shown in Fig. 1.

There are many circumstances under which it is desirable to use power of the sort herein provided for, as there are many collieries where it is either not practicable or is too expensive to provide steam-power or compressed air, and yet wherein use can be made of horses in such way as to provide the power necessary for operating the cutting-machine.

I am aware that drills have been used in which vertically-sliding loosely-supported stays have been utilized for fastening purposes and that there have been numerous ways devised for locking the same; but in such drills the stays are necessarily the vertical supports, and when they are removed the machine cannot be used. In some cases these stays have been driven into the roof and floor of the heading, and nuts, hand-wheels, or set-screws have been used to lock them, and in other cases locks, each consisting of a lever and dog and rack, have been used, and I do not wish to be understood as claiming such devices. My stays differ greatly from these. In the first place, the machine is supported independently of the said stays, and, secondly, only one may be used or a dozen may be driven in if one is not enough to stand the strain. The stay is driven with a hammer as far into the floor or roof as desired, and then with a few blows of the hammer the wedge is inserted, tightly clamping the stays in place.

I do not herein claim any of the subjects-matter set forth in the claims of my other applications, Serial No. 347,238, filed April 9, 1890; Serial No. 364,060, filed September 5, 1890; Serial No. 389,690, filed July 7, 1891, and Serial Nos. 414,708 and 414,709, filed January 22, 1892, wherein are shown machines of this general class.

What I claim is—

1. In a tunneling-machine, the combination of the main frame, the relatively-advancing cutting mechanism mounted on said main frame, cutter-driving gearing, the frame-advancing gearing, a transversely-arranged power-shaft engaging with both said gearings, a rope-wheel on said shaft, and clutch devices for alternately connecting and disconnecting the two gearings and the said transversely-arranged power-shaft, substantially as set forth.

2. The combination, with the main frame, the cutting apparatus, the rope-wheel rotating in one direction only, the cutter-driving gearing, and the frame-advancing gearing, said cutter-driving gearing and frame-advancing gearing being actuated alternately, of the clutch devices for simultaneously engaging and disengaging the continuously-revolving rope-wheel with said gearings alternately, substantially as described.

3. The combination of the main frame, the relatively-advancing cutter-driving shaft, the transversely-arranged power-shaft, the rope-wheel for imparting motion thereto, two longitudinally-arranged continuously-moving shafts geared to said power-shaft, gearing connected to one of said two shafts for driving the cutters, gearing connected to the other of said shafts for advancing the main frame, and clutch devices for alternately connecting and disconnecting the said continuously-moving shafts and the said gearings, respectively, substantially as set forth.

4. In a tunneling-machine, an upright centrally-arranged main frame, a tunnel-forming cutter, a longitudinally-moving cutter-carrying shaft, a transverse initial power-shaft, cutter-rotating gearing, frame-advancing gearing, a longitudinally-moving clutch for alternately engaging said gearings with said power-shaft, and the clutch-shifter for simultaneously connecting one of said gearing and disconnecting the other, substantially as set forth.

5. The combination of the cutting apparatus, the main frame, the wheels or supports for the main frame, the guides on the main frame, a series of stays independent of the supports and adapted to be driven endwise into the roof or floor of the mine, and locks for clamping the stays tightly in place, substantially as set forth.

6. The combination, with the main frame, the cutting apparatus projecting from said frame, and the wheels or supports for said frame, of the wedge bars or stays V′, independent of said frame-supports, adapted to be driven into the floor, and the wedges for clamping the parts V′ tightly against the machine, substantially as set forth.

7. The combination of the main frame, the supporting-wheels arranged in the central vertical longitudinal plane, the cutting apparatus extending forward from the frame, the hinged bracing-frames projecting laterally from the main frame, rollers on the ends of said frames, and the locking links or bars for said swinging frames, substantially as set forth.

8. The combination of the main frame, the rotary cutter-shaft mounted on said frame, the rope-wheel at the side of said frame, the shaft for said wheel extending across the frame, the swinging brace-frames extending laterally from the main frame, the lateral braces for the upper portion of the frame, and the series of adjustable wedges or relatively-sharp bars V′, adapted to be driven downward into the floor, substantially as set forth.

9. The combination of the main frame, the cutting apparatus, the movable abutment against which said main frame and cutting apparatus bear, sprags hinged to said abutment, and an extensible bar connecting said sprags independently of said abutment, substantially as set forth.

10. In a mining-machine, the combination, with the main frame and the longitudinally-arranged threaded shaft carrying the cutting apparatus, of a sleeve or abutment behind said frame and loosely sliding on said threaded shaft, sprags hinged to said sleeve or abutment, and an extensible bar connecting said sprags independently of the abutment, substantially as set forth.

11. The combination of the main frame, the cutting apparatus, the cutter-driving gearing mounted in the main frame, the nut secured to the main frame, and the abutment bearing against the frame and supported independently of the nut and the frame, substantially as set forth.

12. The combination of the main frame, the cutters, the nut secured to the frame, the threaded shaft engaging with the nut, and the abutment surrounding the shaft loosely in the rear of the nut and supported independently of the frame and bearing against it when the cutters are at work, substantially as set forth.

13. The combination of the main frame, the cutting apparatus, the cutter-driving gearing supported on the main frame, a feed mechanism for the cutters, and an abutment supported independently of the frame and the feeding mechanism and behind and bearing against the frame when the cutters are at work, substantially as set forth.

14. The combination, with the main frame, the cutting apparatus advancing relatively thereto, the cutter-driving gearing mounted thereon, and means for fastening the frame to the surrounding walls, of the abutment supported independently of the main frame and bearing against it when the cutting apparatus is advancing, substantially as set forth.

15. The combination of the frame, the cutters advancing relatively to the frame, means for fastening the frame to the surrounding walls, the threaded shaft, the nut, and the abutment in rear of the machine, adapted to receive alternately the thrust of the cutters and the thrust of the frame, substantially as set forth.

16. The combination of the frame, the cutters advancing relatively to the frame, means for fastening the frame to the surrounding walls, the abutment engaged with the surrounding walls, the nut, and the screw-shaft secured to the cutters, said shaft and nut bearing alternately against the abutment, substantially as set forth.

17. The combination of the frame, the cutters, the nut, the abutment separate from the nut and mounted independently of the frame and bearing against the frame when the cutters are at work, and the oppositely-projecting extensible sprags connected at their ends to said abutments and adapted to be driven into the roof and floor of the mine, substantially as set forth.

18. In a mining-machine, the combination, with the main frame and the cutting apparatus, of the movable abutment behind said frame, sprags X X, hinged thereto, telescopic screws X′, and hand-wheels X², substantially as set forth.

19. In a mining-machine, the combination, with the main frame and the cutting apparatus, of the movable abutment behind said frame, against which said frame and cutting apparatus alternately bear, sprags hinged on opposite sides of said abutment and projecting outwardly therefrom, telescopic screws secured in the outer ends of said sprags for forcing said sprags into engagement with the adjacent walls, and hand-wheels for turning said screws, substantially as set forth.

20. The combination, with a main frame and the rotary cutter-shaft projecting rearward from said frame, of an abutment, as at Y, mounted loosely on said shaft and abutting against said main frame and said shaft alternately, sprags hinged to said abutment, and telescopic screws for forcing said sprags apart and into apertures in the walls of the heading, substantially as set forth.

21. The combination, with a main frame and the rotary cutter-shaft projecting rearward from said frame, of an abutment mounted loosely on said shaft, said abutment having an aperture or slot extending through the sides thereof, a plate adapted to slide in said aperture, and means for making said abutment stationary relatively to the rotary shaft and main frame alternately, substantially as set forth.

22. The combination, with the main frame and the cutting apparatus adapted to be alternately made stationary and each adapted to be advanced relatively to the other while the latter is stationary, of the nut mounted in the frame and the movable abutment behind the machine, against which the main frame and the cutting apparatus alternately bear, substantially as set forth.

23. The combination, with the main frame and the rotary cutter-shaft adapted to be alternately made stationary and each adapted to be advanced relatively to the other when the latter is in rotation, and the nut secured on the frame, of the movable abutment on said rotary shaft, against which the main frame and the rotary cutter-shaft bear alternately, substantially as set forth.

24. The combination of the main frame, the cutting apparatus, and the gearing therefor, and vertically-adjustable shields secured to the frame and adapted to be extended over the machine, substantially as set forth.

25. In a tunneling-machine, the combina-

tion of the main frame, the cutting apparatus, the gearing, and shields hinged to the frame and adapted to be extended over the machine, substantially as set forth.

26. In a tunneling-machine, the combination of the main frame, the cutting apparatus, the gearing, shields secured to the frame and extending over the machine, and extensible stays secured to the frame and adapted to press the shields against the sides of the tunnel, substantially as set forth.

In testimony whereof I affix my signature in presence of two witnesses.

REGINALD STANLEY.

Witnesses:
WILLIAM BRAMLEY,
FRED FELLOWES WIGGINS.