(No Model.) 3 Sheets—Sheet 1.

R. STANLEY.

TUNNELING OR MINING MACHINE.

No. 504,179. Patented Aug. 29, 1893.

Fig. 1

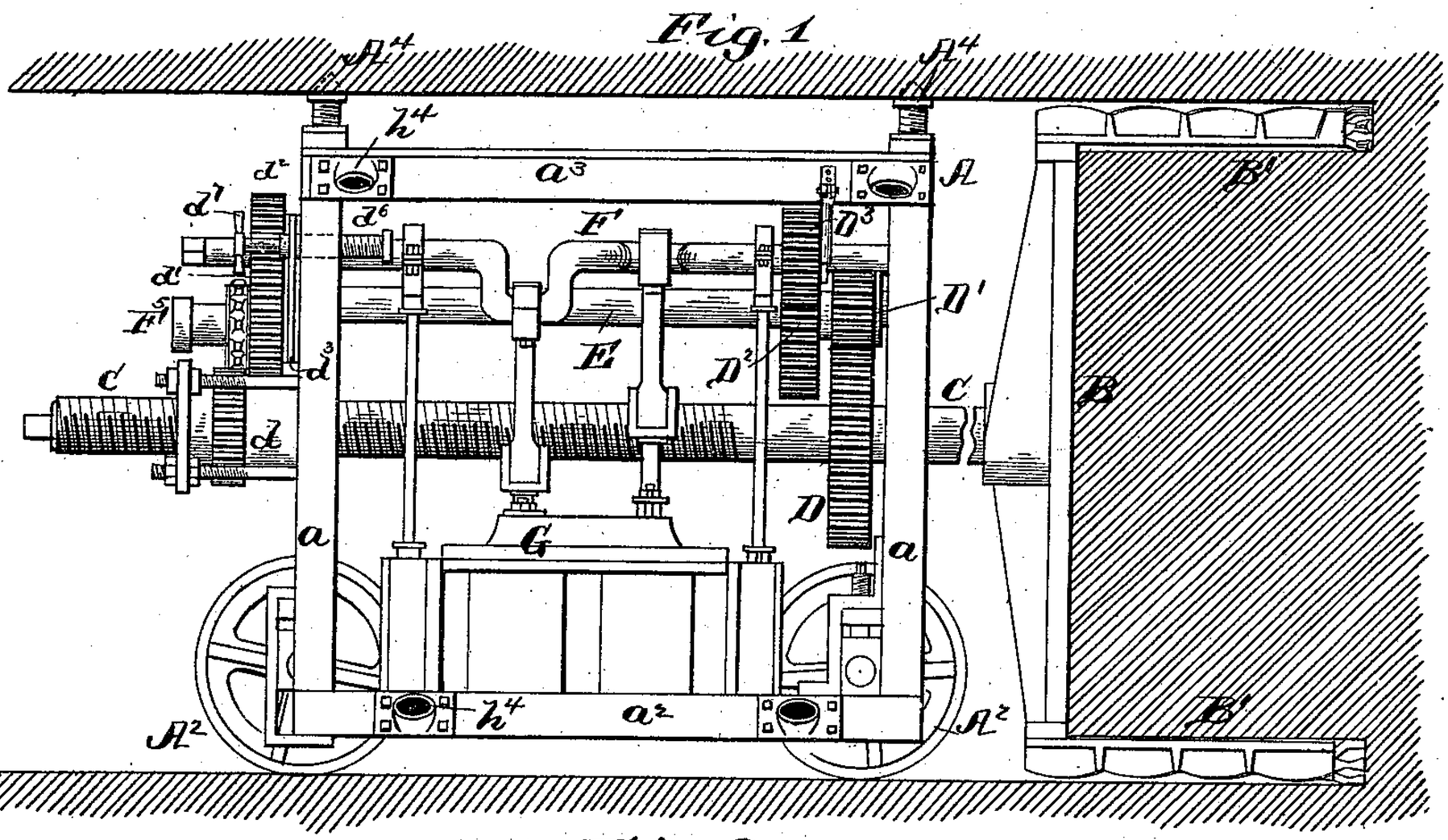


Fig. 2.

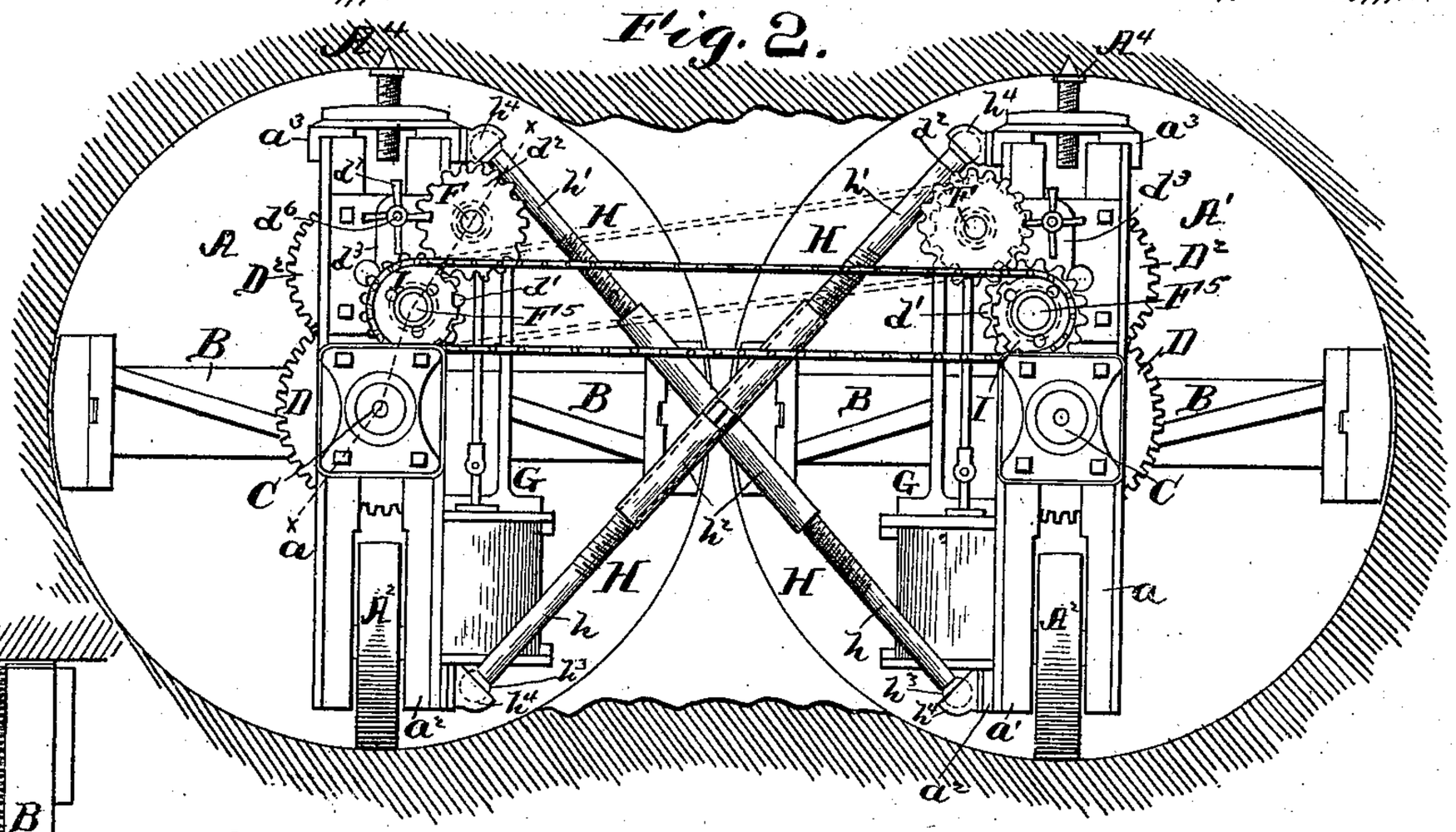


Fig. 3.

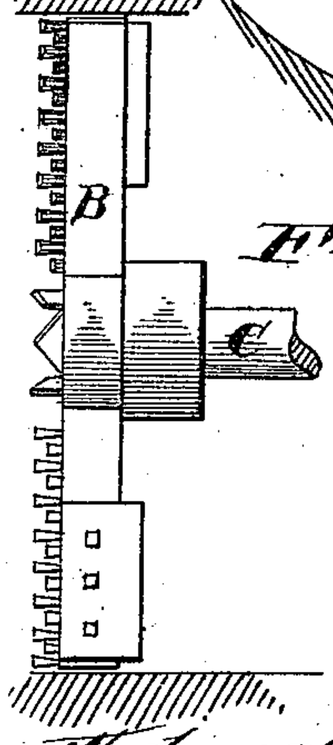
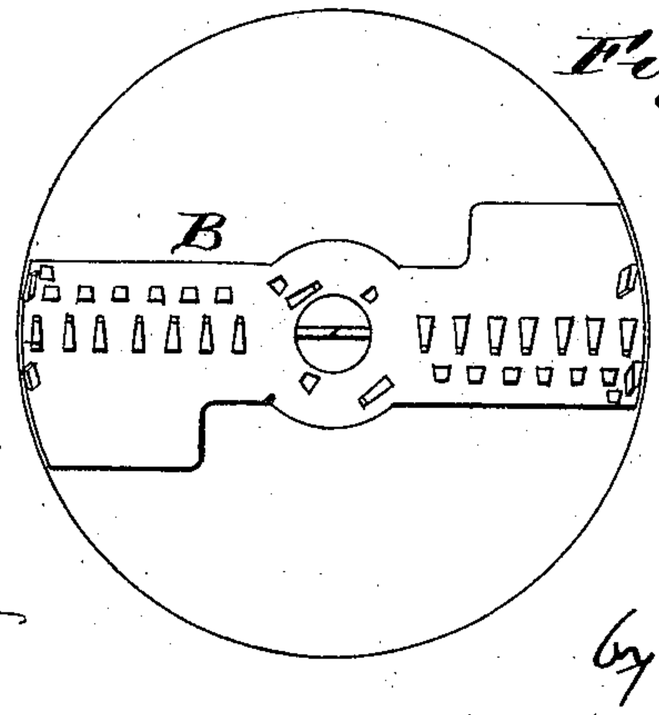


Fig. 4.



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(No Model.) 3 Sheets—Sheet 2.

R. STANLEY.

TUNNELING OR MINING MACHINE.

No. 504,179. Patented Aug. 29, 1893.

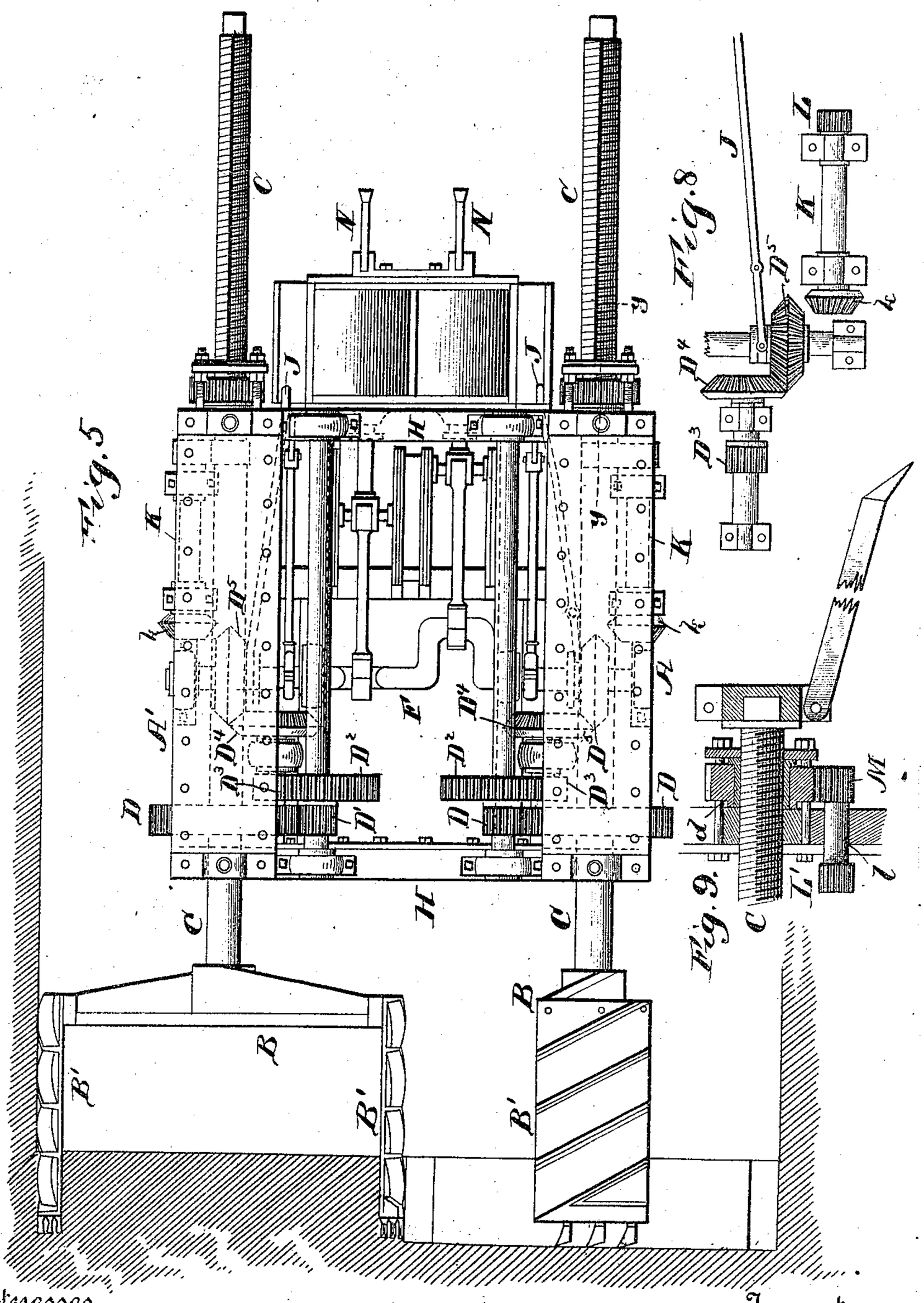

Fig. 5.

Fig. 8.

Fig. 9.

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(No Model.) 3 Sheets—Sheet 3.

R. STANLEY.

TUNNELING OR MINING MACHINE.

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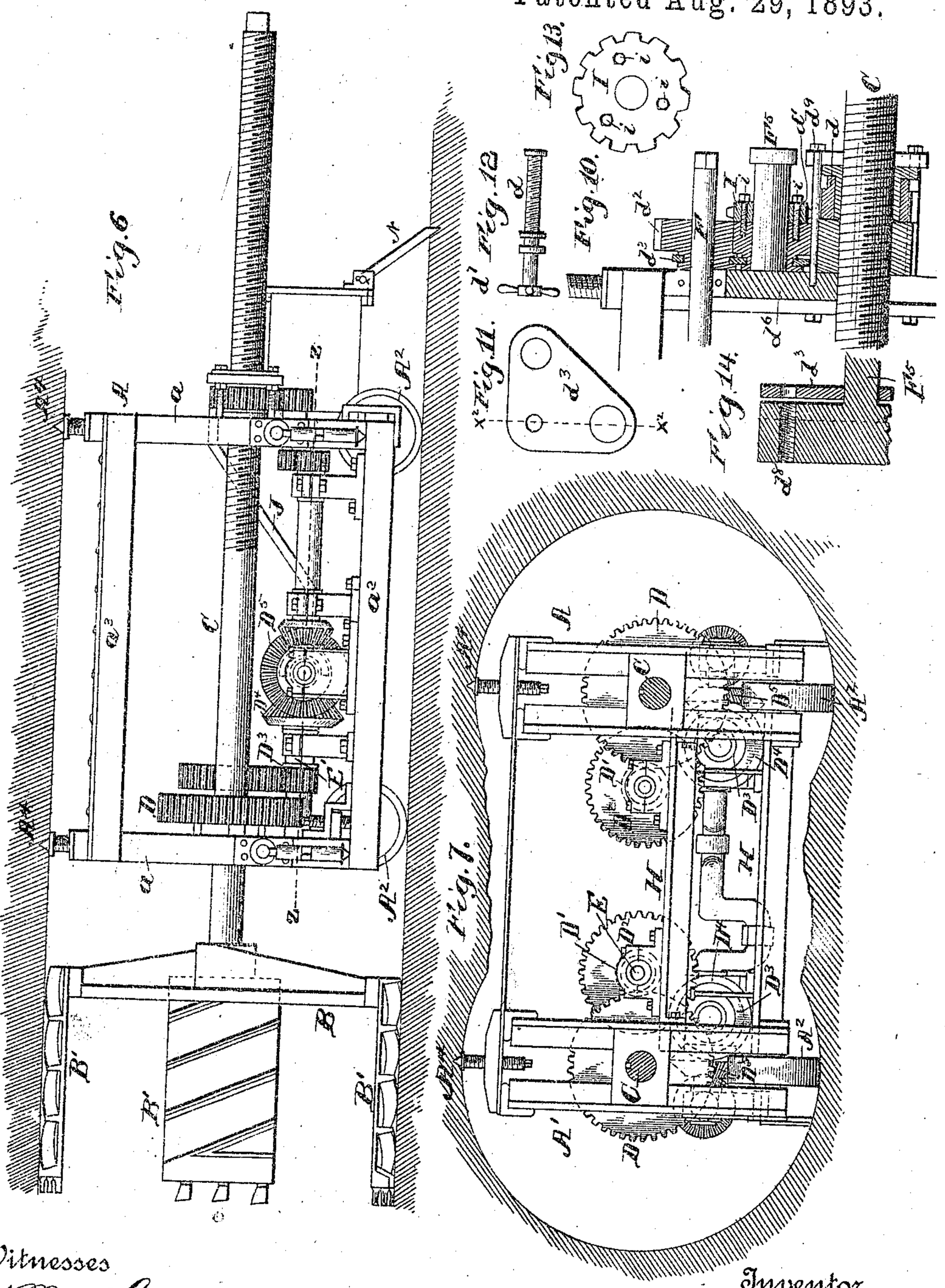

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UNITED STATES PATENT OFFICE.

REGINALD STANLEY, OF NUNEATON, ENGLAND.

TUNNELING OR MINING MACHINE.

SPECIFICATION forming part of Letters Patent No. 504,179, dated August 29, 1893.

Application filed September 5, 1890. Serial No. 364,060. (No model.) Patented in England February 28, 1890, No. 3,595; in New South Wales June 27, 1891, No. 3,082; in Queensland June 29, 1891, No. 1,363; in New Zealand July 6, 1891, No. 5,078; in Canada December 16, 1891, No. 37,971, and in Germany February 5, 1892, No. 60,237.

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, (which improvements are shown and described in the following Letters Patent, to wit: Patent No. 60,237, dated February 5, 1892, granted to me in Germany; No. 3,595, dated February 28, 1890, granted in Great Britain; No. 1,363, dated June 29, 1891, granted in Queensland; No. 5,078, dated July 6, 1891, granted in New Zealand; No. 3,082, dated June 27, 1891, granted in New South Wales, and No. 37,971, dated December 16, 1891, granted in Canada,) of which the following is a specification, reference being had therein to the accompanying drawings.

In the machine which I have devised there are two sets of cutters; a main frame or bed comprising two parts, one part for each set of cutters; means for connecting the two parts of said frame; two carriers, one for each of said sets of cutters and adapted to be moved relatively to the bed; a train of cutter actuating gearing on each part of said frame; another train of gearing on each part of the bed frame for advancing the cutters relatively to the bed; and one or more engines supported upon the bed frame and adapted to actuate either of said sets of cutters, or both simultaneously. Preferably the cutters of each set are arranged to rotate around a horizontal axis, and are held by arms secured to their carrier. It is also preferable that the two sets of cutters should be arranged on substantially the same horizontal lines, transverse of the machine, so that they shall be available for producing a relatively wide cut. There are numerous reasons why a cut of this sort should be of greater dimensions horizontally than vertically. For instance, in the entries in coal mines, it is allowable, and necessary in most veins, to have them from nine to twelve feet wide. In a six foot vein a single set of cutters of the sort herein described, while it may reach from top to bottom of the vein, will not open up more than half or two thirds of the entry horizontally, and another operation by hand or machine is necessary. It is desirable to take the material out from the whole entry at one operation. In the smaller veins the room is so constructed, if a single cutting apparatus is used, that it is impossible to readily manipulate the machine and get out the cuttings and remove them to points behind the machine. An apparatus of the sort herein provided I can not only work over a larger area of the heading but with it can provide more room for the manipulation of the machine and of the materials removed thereby.

Again, whatever be the depth of the machine, or the dimension of the cut made by the machine, it is frequently found that it is necessary to apply hand tools, of the nature of levers, wedges, drills, or the like, for the purpose of removing the central core left by the cutter. By forming two grooves or cuts, either overlapping or independent of each other, I am enabled to apply to greater advantage tools of the sort referred to, and can more easily attach, break down, and remove, any coal or other material which may resist the operation of the cutters on the machine, or which may be left as the core.

Another important advantage incident to having two sets of more or less independent cutters, one or which can be thrown out of operation while the other is acting, is this, namely, that the two cutters can be employed alternately; that is to say a cut may be made with one of them, and then while the other cutter is being advanced, the core and débris produced by the first cutter can be carried back, and the intervening web can be attached. Therefore there is plenty of room at all times for getting at and removing the loosened material.

It is further preferable that the two sets of cutters should revolve in opposite directions in order that they shall balance each other in respect to the strains and the re-actionary thrust which they exert upon the machine generally, and upon the braces or devices by which the bed frame is held stationary during the cutting.

With tunneling or mining machines of all

sorts, one of the most difficult problems has been to construct and arrange the parts so that there should be no re-actionary thrust, either in a line directly backward, or toward one side, or the other, horizontally, or upward, or downward. Such thrust, and the disadvantageous strains incident thereto, have been experienced in using all machines provided with a single cutter or set of cutters. By furnishing the machine with two sets of oppositely moving cutters, as is herein provided for, I, to a large extent, overcome the difficulties which have been incident to other machines from this cause.

I am aware of the fact that machines have been heretofore devised comprising two sets of oppositely moving chain cutters, mounted to move on horizontal lines, and also aware that two sets of oppositely reciprocating saw cutters have been used, in horizontal lines, and I do not claim such mechanisms. But I believe myself to be first to have arranged two vertically revolving cutters so as to move oppositely and simultaneously and produce a kerf of such dimensions that the entire machine can follow the cutters.

The main frame or bed of the machine may be so constructed as to have its two parts permanently united rigidly together, or so as to have them separable or divisible. Again the two parts of the main frame may be so joined together by connecting and bracing devices that they shall be more or less adjustable in relation to each other, that is adjustable forward and back, laterally and vertically, and yet have the connecting devices so arranged that they shall join the two parts of the frame with sufficient rigidity, the one part of said frame in this case acting to support and steady the other.

The engine or other motor may be so constructed and arranged as to be practicably inseparable from either of the parts of the bed frame without requiring separation from the other also; or it may be made in two, more or less, independent parts, each capable of action and each supported on one of the aforesaid parts of the main frame or bed.

Figure 1 is a side view of one of the parts of a machine embodying my improvements. Fig. 2 is a rear view of one of the machines. Fig. 3. is a side view, and Fig. 4 a face view of one form of cutter head with the cutters attached. Fig. 5 is a plan view of a modified form of machine. Fig. 6 is a side view and Fig. 7 is a front view of the machine shown in Fig. 5, with the cutters removed. Fig. 8 shows the clutch for the feed mechanism in Figs. 5, 6, and 7. Fig. 9 shows the feed nut and the adjacent parts in Figs. 5, 6, and 7. Figs. 10, 11, 12, 13 and 14 show the details incident to the feed nut in the machine shown in Figs. 1 and 2.

The main frame or bed as shown in the drawings is made up of two parts A A'. The details of this bed may be of any sort dictated by preference or circumstances, so long as certain requisites are preserved.

In the mechanism shown in Figs. 1, 2, and 3 the parts A A' are substantially duplicates, and possess many of the features of construction shown in my earlier patent, No. 414,893, dated November 12, 1889, and reference may be made to said patent for an understanding of the details of these parts of the frame. Here, it is sufficient to remark that each is composed of uprights $a\,a'$ joined at the bottom by sills a^2, and at the top by girders a^3, together with any additional connecting bars and braces which may be found necessary. There are supporting wheels A^2 preferably situated on the central longitudinal plane of each part A A', of the frames; and at the top there are binding screws or jacks A^4 for engaging with the roof and for fastening the machine firmly in position.

The machine considered as a whole is provided with two independent cutting mechanisms. In respect to these also there may be modifications, as the principle of construction and operation embodied in the mechanism herein can also be applied if other forms of apparatus be used. That selected for illustration comprises a cutter carrier of the form of a cross-head or arms B, secured to a shaft C. At B' there are forwardly extending arms or bars which have applied to them cutters or scrapers. The shaft C imparts rotary motion to the cutters and also advances them into the material. It is rotated by a train of gearing comprising the wheel D, pinion D', engaging therewith, wheel D^2, and pinion D^3. The pinion D' and wheel D^2 are on a counter shaft E which is driven from the engine shaft F by said pinion D^3. The shaft C and wheel D are connected by groove and feather or in some equivalent way, so that the former can advance while rotating. G indicates generally the engine connected to the shaft F, it and its connection being of any suitable sort.

The mechanism for advancing the shaft C, may also be of any of several well known sorts. As shown it consists of a nut d, held in place upon the bed frame, and having teeth formed either integral with or separately from the threaded portion; a gear wheel d' engaging with said toothed nut d; and a spur wheel d^2 on the crank shaft F adapted to be engaged with the last said wheel d'. d^3, is a plate having apertures through which pass the shafts F, and F^2 of the wheels d^2, d'. This plate d^3 can be caused to move toward and from the nut wheel at d. It is so moved by a screw rod d^6, having a hand wheel d^7, and engaging with a nut at d^8. The shaft F^5 is secured to and projects from the plate a^6, secured to the frame. When the nut is to be held stationary so that the cutters will advance relatively to the frame, a bolt or locking device at d^9 is used to fasten the nut in place, and at such time the plate d^3 is forced forward by the screw d^6, and the plate car-

ries the wheels d' d^2 away from the wheel d. When, on the other hand, the frame is to be advanced relatively to the cutters, the bolt or locking device at d^9 is withdrawn, and the wheels d' d^2 are drawn out by the plate d^3, and the threaded rod, until the wheel d' engages with the wheel on the nut at d. Then the engines being in motion, and the shaft being stationary, the nut will be caused to revolve, and from its engagement with the threaded shaft and its bearing against the frame, the latter will be pushed forward. The two parts A A′ of the bed are connected by joining braces H H. These may be either rigidly secured to said parts A A′ or loosely. If a loose connection is employed it may be of such sort that various adjustments can be attained. As shown in Figs. 1, 2 and 3 these connecting parts at H are each formed of two oppositely threaded bars or rods h h' joined by a central sleeve h^2 having threaded ends to engage with the rods h h'. At the ends of bars h h' there are ball and socket joints h^3 h^4 by which they are connected to the parts A A′ of the bed. Of these devices H there may be as many as occasion requires. Preferably I use two at the front end and two at the rear, and arrange those of each part so that they cross each other, that is to say so that each one engages with the top of one of the parts of the bed frame, and with the bottom of the other. It will be seen that by means of such devices the parts of the bed can be braced in any ordinary way desired. If, for any reason, it is desirable that either part of the frame should be slightly in advance or in rear of the other parts, this can be provided for when the parts are constructed and arranged as shown, as there is more or less forward and back movement permitted when the intermediate brace-rods are loosened, because of the loose connection of said rods. Again, by having the main frame divisible longitudinally into two sections, the machine can be manipulated much more readily as concerns getting it to or from the places of working. These machines are necessarily heavy in order to have them sufficiently strong to withstand the severe strain exerted upon them; and as the tunnels which they form approximate so closely the through dimensions of the machine, there is trouble and inconvenience incident to the handling of them. When made as described above, they can be adjusted or moved in parts and yet without dismantling them materially. Another important end at which I aim can be attained under this construction and arrangement, though it is not limited thereto, namely, the provision for cutting a wider or narrower tunnel as may be desired. I provide for this by having the two cutter carriers, which are here of the form of two longitudinally-arranged shafts, so arranged that they and their bearings can be laterally adjusted toward and from each other. It is the work of but few moments to change the machine so as to form a narrower heading if the nature of the material demands it, or a wider one if circumstances permit.

The cutter heads or carriers B of the two cutting mechanisms of the machine can be arranged so as to alternate with each other in their rotation, that is so that one will be in vertical position at the time the other is in horizontal, or they can work together, that is, be in vertical positions and horizontal positions at the same time. But in either case the two sets of cutters revolve in opposite directions, by preference, so that they will throw the cutting and débris to the outer sides of the machine. If they rotated in the same direction, more or less of the cuttings and débris would be delivered on the central longitudinal line of the machine. By delivering them at the outer sides they can be easily reached for removal to the rear of the machine.

In order to have the two sets of shafting and gearing work in proper relation to each other, I connect them together positively by suitable devices, such as a cross shaft and gearing or sprocket chain gearing, or equivalent. In Figs. 1, 2, and 3 a sprocket chain is shown, it connecting two sprocket wheels I′ I², one on each of the side parts A A′ of the frame and preferably secured to proper shafts. As shown, these chain wheels are connected to the shafts through the medium of the gear wheels d' d', to which they are respectively connected by bolts or pins i passing through apertures in the chain wheels, as illustrated in Figs. 2 and 13. Whenever desired, either or both bolts or pins can be removed so that the two parts of the machine, will be independent of the other; or one or more clutches of the ordinary sort such as is shown in my previous patent No. 414,893 can be used. The chain is shown in Fig. 2, by dotted lines as connecting the secondary shaft of one engine with the crank shaft of the other, and by means of full lines it is shown connected with the secondary shaft of the other engine. When motion of both cutters in the same direction is desired the chain will be placed in one or other of these positions, and when opposite movements are wanted, the other position can be used. By means of the above described connecting bars or rods H H one part of the bed or main frame serves to strengthen, steady and keep upright the other. The sleeve nuts h^2 can be turned by wrenches so as to, lengthen or shorten the connecting bars H to make the connection perfectly rigid. If the binding or jack screws A⁴ be loosened, the upper parts of the frame can be moved out or in as may be desired by the connecting rods H. When two cutting mechanisms and a two-part frame are thus employed, a machine is provided which is much more rigid than when a single cutting apparatus and bed are used, and one which is adapted to stand much more advantageously the working of the arms and cutters. By having

present the described features allowing lateral or transverse adjustment, the width of the heading can be regulated as desired.

I can if desired bring the two cutting mechanisms so close together that their cuts shall be tangential or nearly so, and little or no rib is left between them. If the two sets of cutters are arranged to alternate in their rotation as above described, they can be brought still closer together and an opening formed across the entire heading more or less complete.

By coupling together by chains or otherwise, the shafting and engines of the two sides of the machine the engines are caused to help one another, even when both sets of cutters are at work.

Coal and other materials are in such condition, naturally, that there is much variation in hardness within an area of small dimension, especially where foreign materials, such as sulphur and slate are more or less present; and a cutter in making a revolution will pass through resistances varying considerably. When the engines are joined in the way described the one whose cutters are meeting the least amount of resistance will assist the other having the greater work. The rib which is left between the two kerfs is small and can be readily removed by ordinary tools, and thereafter there will be a tunnel with continuous top and bottom adapted to serve as an entry or passage-way.

In Figs. 5, 6, and 7 there is shown a modified machine, though the general principles of operation and features of construction are preserved. In this case the connecting devices H H which join the side sections A A′, of the bed or main frame are rigidly secured thereto, and are preferably placed horizontally and may be utilized to support other parts of the machine. In this case there are two sets of cutters, two cutter carriers, two trains of cutter actuating gearing, and two sets of feed devices. But the power shaft is arranged transversely of the machine and thus but a single engine is necessary it having two cylinders, &c., and two pistons connected to the single power shaft. The engine is here brought down lower, and arranged horizontally, and the engine frame work can be utilized as part of the cross connection between the two side parts A A′ of the bed.

On each side of the machine there is a cutter actuating gearing comprising the wheel D on the cutter carrier shaft C, a pinion D′ on counter shaft E, wheel D^2 also on the counter shaft, and pinion D^3 and wheel D^4 on a short intermediate shaft E′. D^5 is a double bevel wheel on the crank shaft and is adapted to slide thereon, it having a lever J for moving it. When wheel D^5 is in engagement with wheel D^4 the engine and power shaft will rotate the cutters. The feed nut *d* is rotated by the shaft K having a beveled wheel *k*, and a pinion L, which engages with a wheel L′ on a short shaft *l* below the carrier shaft C and having a wheel M which engages the toothed part of the nut. By means of lever J, the wheel D^5 can be moved out of engagement with wheel D^4 to a neutral position, or into engagement with the aforesaid bevel wheel *k*. When in engagement with the latter, the nut at *d* is caused to revolve.

The manner of using the feed mechanism will be readily understood. When the cutters are to be advanced relatively to the bed the latter is fastened firmly in place by the jack screws A^4, or any other suitable devices adapted to engage with the walls of the tunnel, and it is held stationary until the cut is completed. At N, N, there are hinged jacks or braces near the central longitudinal line of the machine which when engaging with the bottom of the tunnel resist any reaction or back thrust and assist in holding the machine to its work. After the cutters have been advanced the desired distance, and either after or before the cores have been taken out and removed, the bed or main frame can be advanced up to the cutters, or as far as may be desired, as follows: The jack screws A^4 together with any other fastening devices are released, so that the bed is free. Suitable means for fastening the cutter carriers are then applied, such for instance, as those shown in my aforesaid Patent No. 414,893. Then the bevel wheels D^5 are moved into engagement with wheels K and the nuts are unlocked, whereupon, the engine being in motion, the nuts will be rotated in such way as to cause the bed to advance, it moving forward on the wheels A^3. After it has reached the desired point it is again fastened in place and the parts are ready for another cut. The frame is virtually carried upon adjustable pivot-like supports at the front end, and has, (in the wheels and the parts incident thereto) at the rear end, means for vertical adjustment around the axes of the said pivotal supports; and in respect to these parts there may be more or less variation, so long as the essential matters of construction and operation are preserved.

I do not claim herein, any of the subject-matters set forth in the claims of my application, Serial No. 398,690, filed July 7, 1891, wherein a machine is shown similar to that in Figs. 5 and 6 herein. I prefer to claim herein all novel matters common to both machines, claiming in said other case the novel features illustrated in Figs. 5 and 6.

What I claim is—

1. In a tunneling or mining machine the combination with a bed frame of two independent sets of cutters, an engine on said bed, and means for connecting the said cutters independently of each other with the said engine and disconnecting them therefrom, substantially as set forth.

2. In a tunneling or mining machine the combination of two independent sets of cutters, the bed or main frame, the two independent cutter carriers mounted upon said

bed, the two independent trains of gearing for advancing the said cutter carriers and means substantially as set forth for rotating said cutters, substantially as described.

3. In a tunneling or mining machine the combination of the two independent sets of cutters, the bed or main frame, two independent cutter carriers mounted upon the said bed, two independent trains of gearing for rotating the said two cutter carriers, and means substantially as set forth for moving the cutter carriers relatively to the bed, as described.

4. In a tunneling or mining machine the combination of two independent sets of cutters, two advancing and receding carriers for said sets of cutters, respectively, a bed frame comprising two parts each of which supports one of the aforesaid carriers, a train of cutter actuating gear on each of said parts of the bed, a train of cutter advancing gear on each part of said bed, and an engine on each part of said bed adapted to be independent of that on the other part, substantially as set forth.

5. In a tunneling or mining machine the combination of the two independent sets of cutters, the two independent cutter carriers, the two independent sets of cutter-actuating gears, and the bed or main frame formed in two parts, each part having secured to it one of the said cutter carriers and trains of gearing, and adjustable connecting bars or braces for joining the two parts of the said bed or main frame, substantially as set forth.

6. In a tunneling machine, the combination of a main frame or bed, an engine or driving mechanism, cutter-rotating gearing, two sets of independently rotating tunnel-forming cutters, and cutter carriers which are adjustable laterally toward and from each other whereby the width of the cut can be modified, substantially as set forth.

7. In a tunneling or mining machine the combination of the two adjacent sets of independent cutters which form two horizontal cylindrical kerfs, the cutter carriers, and the main frame having the two parts or sections respectively supporting the said cutter carriers, said sections of the bed, and said cutter carriers being adapted to pass into the said kerfs, means substantially as described for connecting together the two parts of the bed or frame which support the cutter carriers, two independently acting cutter actuating mechanisms on said frame sections, respectively, and two independently acting cutter-advancing mechanisms on said frame-sections, respectively, substantially as set forth.

8. In a tunneling or mining machine, the combination of the two sets of cutters, the separate cutter carriers, and the bed frame which supports the said carriers and cutters formed of two parts adapted to be adjustably connected together, substantially as set forth, whereby one can be moved longitudinally forward or back, relatively to the other, as described.

9. In a tunneling or mining machine, the combination of the two sets of cutters, the separate cutter carriers, and the bed frame which supports both the said sets of cutters and said cutter carriers formed in two parts adapted to be adjustably connected together, at their upper parts as described.

10. In a tunneling or mining machine, the combination of the two sets of cutters, the separate cutter carriers, and the bed frame which supports the said cutters and cutter carriers, and formed in two parts adapted to be adjustably connected together at the bottom substantially as set forth, whereby the bottom parts thereof can be placed farther apart or closer together, as described.

11. In a tunneling or mining machine the combination with the two independent sets of cutters, the two carriers for said sets of cutters, the two sets of gearing for rotating said carriers, the two sets of gearing for advancing said carriers, the independent engines for driving the said sets of cutters, and the frame or bed connected to both the said cutter carriers and having two parts adjustable in relation to each other, substantially as set forth.

12. In a tunneling or mining machine, the combination with the bed or main frame, of two cutter carriers thereon adapted to advance and recede relatively to the bed and mounted in substantially the same horizontal plane, two sets of cutters supported by the said carriers and arranged to form two horizontal cylindrical kerfs, adjacent to each other, of such dimensions as to adapt them to receive the entire machine, and two independently acting cutter-rotating mechanisms as described.

13. In a tunneling machine, the combination of two tunnel-forming cutters, two cutter-carriers, two sets of cutter-rotating devices, two engines or motors, a bed or frame which supports all of the aforesaid parts and is divisible centrally and longitudinally into two main parts, each part supporting a cutter, a cutter-rotating mechanism and an engine, and two sets of cutter-advancing devices, one on each of said parts of the main frame, whereby the cutters are moved forward, while the bed is stationary, substantially as set forth.

14. In a tunneling or mining machine, the combination of the bed or main frame two independent sets of cutters adapted to advance relatively to the main frame, the engine, and the two trains of gearing for rotating the two sets of cutters respectively, and two adjustable connecting mechanisms for throwing one or both of the said trains of cutter actuating gearing out of connection with the engine, substantially as set forth.

15. In a tunneling machine, the combination of two tunnel-forming cutters, two cutter-carriers, two sets of cutter-rotating devices, two engines or motors, a bed or frame which supports all of the aforesaid parts and is longitudinally separable from top to bottom in

two parts, and detachable bracing or tie-rods adapted to be secured to the tops and the bottoms of the said separable parts of the frame, each of said parts carrying one of said cutters its rotating mechanism, and an engine or motor, substantially as set forth.

16. The combination of the cutters, the threaded feed shaft, the rotatable nut, the two sliding, intermeshing, continuously rotating, gear wheels connected to the power shaft for driving the nut, and means for sliding them together, into and out of the operative position substantially as set forth.

17. The combination of the cutter, the threaded feed shaft, the rotatable nut, the intermeshing wheels for rotating said nut, a plate for securing said wheels in permanent relation to each other, and a threaded rod engaging with said plate for shifting said wheels, substantially as set forth.

18. The combination of the cutters, the threaded feed-shaft, the rotatable nut, the two sliding, intermeshing, continuously-rotating gear wheels for driving the nut, means for locking the nut against rotation, the threaded shaft for sliding the said wheels, and the sliding power-transmitting chain-wheel detachably connected to the said gear-wheels, substantially as set forth.

19. The combination of two independent cutters, two trains of cutter-driving gearing, two engines connected respectively to said trains of gearing, the chain for transmitting power from one train of gearing to the other, and means for disconnecting the chain from either or both of said trains of gearing, substantially as set forth.

20. The combination of the main frame or bed, the two cutting mechanisms respectively supported upon the side parts of the said frame or bed, the two independent sets of cutter-actuating devices respectively arranged at the sides of the bed, the transversely arranged power-shaft, and means for connecting either or both the sets of cutter actuating devices with the power shaft, substantially as set forth.

21. In a machine for forming two adjacent or intersecting tunnels of a height greater than that of the machine, the combination of a main frame extending from the center of one, to the center of the other of said tunnels, means for holding said frame stationary, two tunnel forming cutters in front of the main frame and rotating in planes transverse to the axes of the tunnels, and advancing when at work relatively to the frame, the engine on said frame, mechanism driven by the engine for advancing the cutters, and mechanism for rotating them, the said parts being arranged substantially as described, whereby the cutters while advancing from the frame are mutually relieved from reactionary and side thrust, as set forth.

22. In a machine for forming two adjacent or intersecting tunnels, the combination of the main frame, the clamping devices for securing the frame stationarily in place, the two sets of cutters, detachably connected to the engine the two cutter carriers advancing longitudinally relatively to the main frame, the gearing for rotating the said cutters, the gearing for advancing them, and the power shaft and the engine both secured to the main frame, and situated between the said cutter carriers, substantially as set forth.

23. In a tunneling or mining machine, the combination of the two independent cutters, the cutter carrying longitudinally advancing shafts permanently parallel to each other, the gear for rotating said shafts, the two independent trains of gear for advancing said shafts, and a power-shaft intermittingly connected to either or both of said trains of gear, substantially as set forth.

24. In a tunneling or mining machine, the combination of two screw shafts, two sets of cutters carried thereby, independent bearings for said screw shafts, a main frame holding said bearings rigidly in relation to each other, and two independent sets of gearing supported on said frame for driving said cutters, substantially as set forth.

25. In a tunneling or mining machine, the combination of the two cutters, the frame behind the cutters, the two parallel cutter carriers on said frame, the engine, and the power-shaft situated between the cutter carriers and detachably connected to either or both the cutter carriers, substantially as set forth.

26. In a tunneling or mining machine, the combination of two independent sets of cutters, a bed frame supporting the said cutters permanently in the same relations to each other, an engine on said bed, two independent trains of gear for advancing the bed, and means substantially as set forth for connecting the engine therewith.

27. In a tunneling or mining machine, the combination of the two cutters, the main frame, the two cutter carriers, the two intermediate shafts respectively between said power shaft and the cutter carriers, and both driven by said power-shaft, and two clutches for disconnecting the cutter carriers from the power shaft independently, substantially as set forth.

28. The combination of two independent cutters, the two cutter carriers, the main frame, the transverse power-shaft and the longitudinal intermediate shafts both driven by the power shaft, substantially as set forth.

29. In a tunneling or mining machine, the combination of the bed or main frame, the engine mounted thereon, the two cutters or sets of cutters, and the two clutches, whereby the engine can be connected with both of the cutters or either one separately, substantially as set forth.

30. The combination with the two independent cutting mechanisms and the two independent trains of cutter actuating gearing, of the power shaft the engine, and two clutches respectively interposed between the said

power shaft and the trains of actuating gearing, substantially as set forth.

31. In a tunneling or mining machine, the combination of the two independent cutter mechanisms, the main frame or bed having the side parts respectively supporting the said cutting mechanisms and the connecting devices rigidly secured to the said side parts, the two trains of gearing for driving the said cutting mechanisms, respectively, and the power shaft intermittingly connected to either or both of the said trains of cutter actuating gearing, substantially as set forth.

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

REGINALD STANLEY.

Witnesses:
F. RAYMOND BURTON,
ERNEST HARKER.