(No Model.)

6 Sheets—Sheet 1.

C. S. LEDDELL.

VELOCIPEDE.

No. 459,586. Patented Sept. 15, 1891.

Fig. 3.

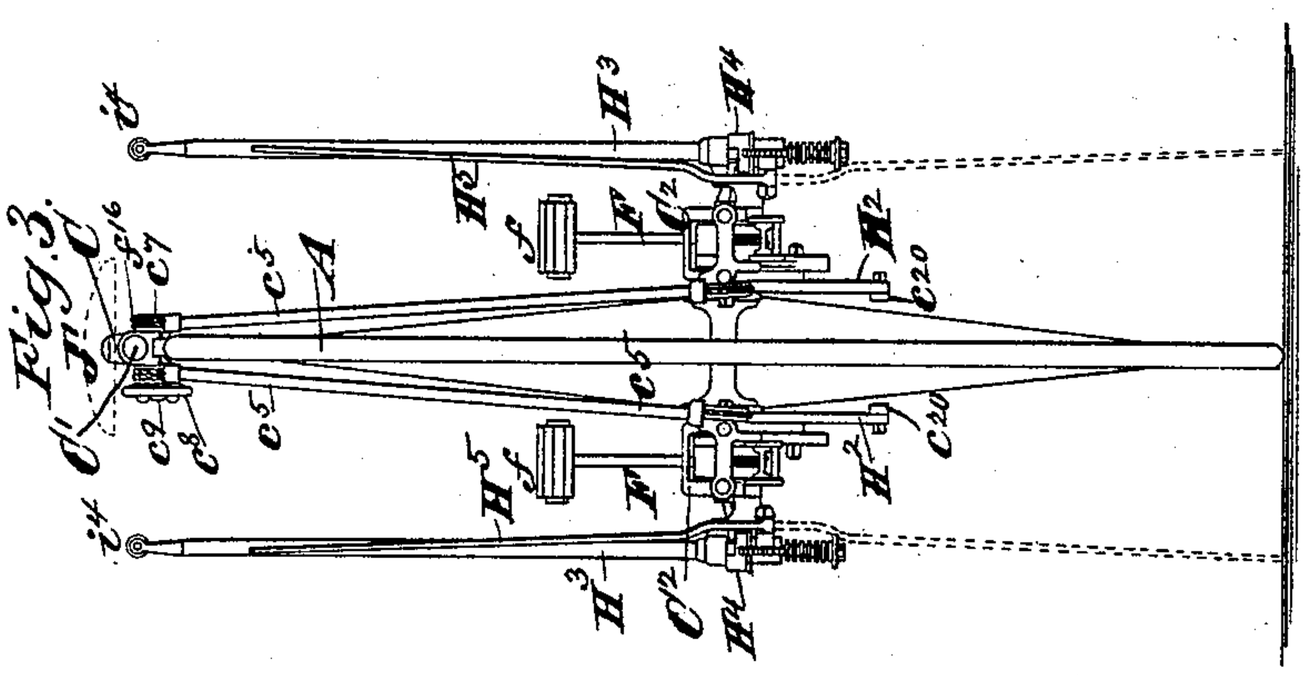


Fig. 2.

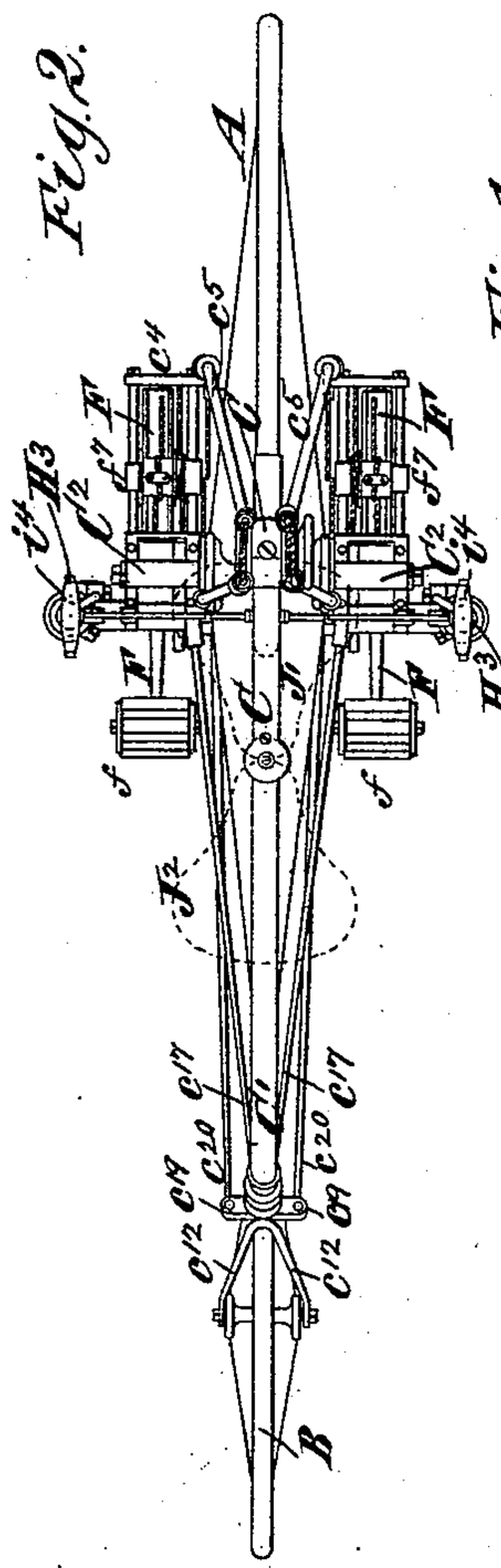
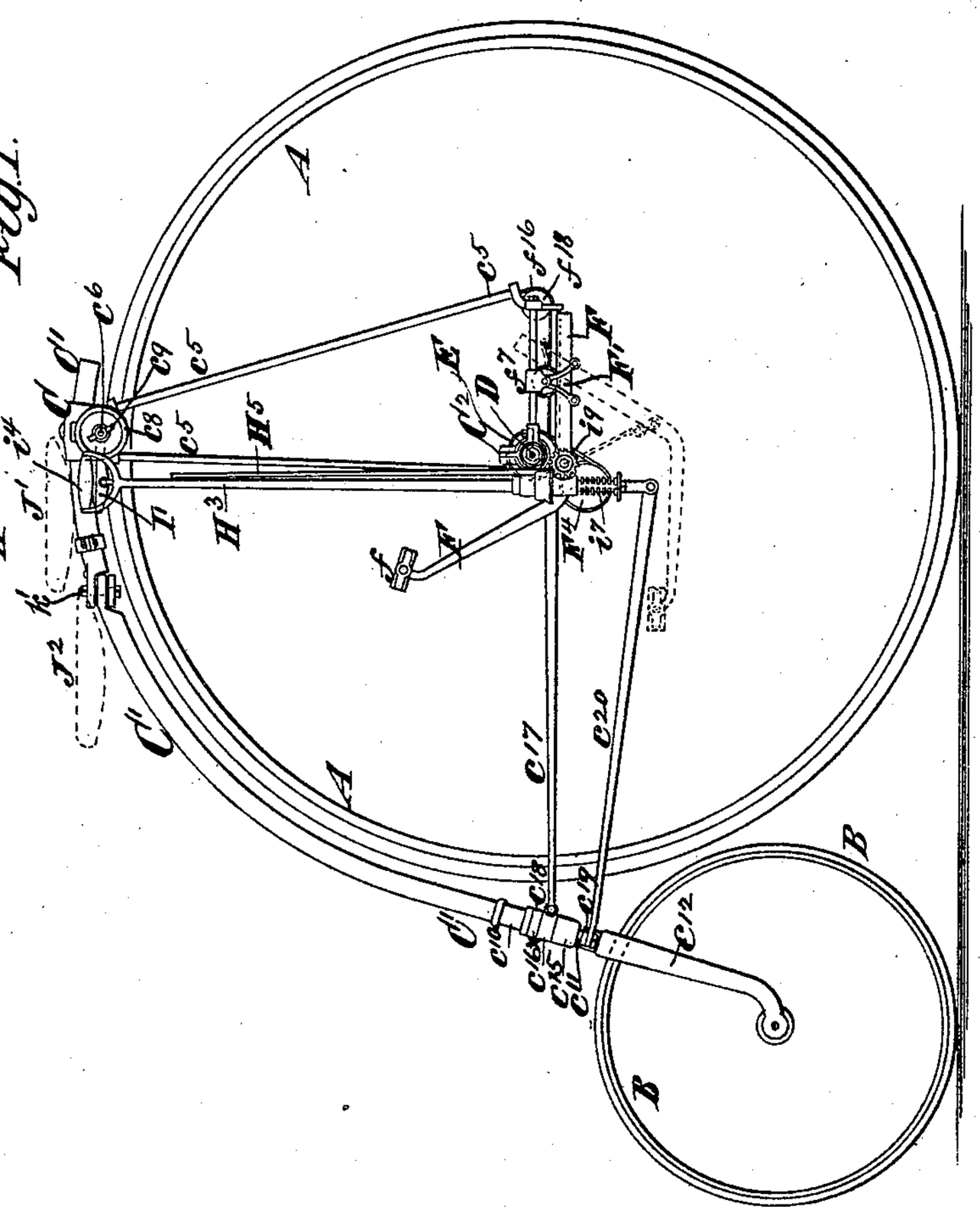


Fig. 1.



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O. L. Sundgren

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Brown & Hall

(No Model.) 6 Sheets—Sheet 2.

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VELOCIPEDE.

No. 459,586. Patented Sept. 15, 1891.

Fig. 6.

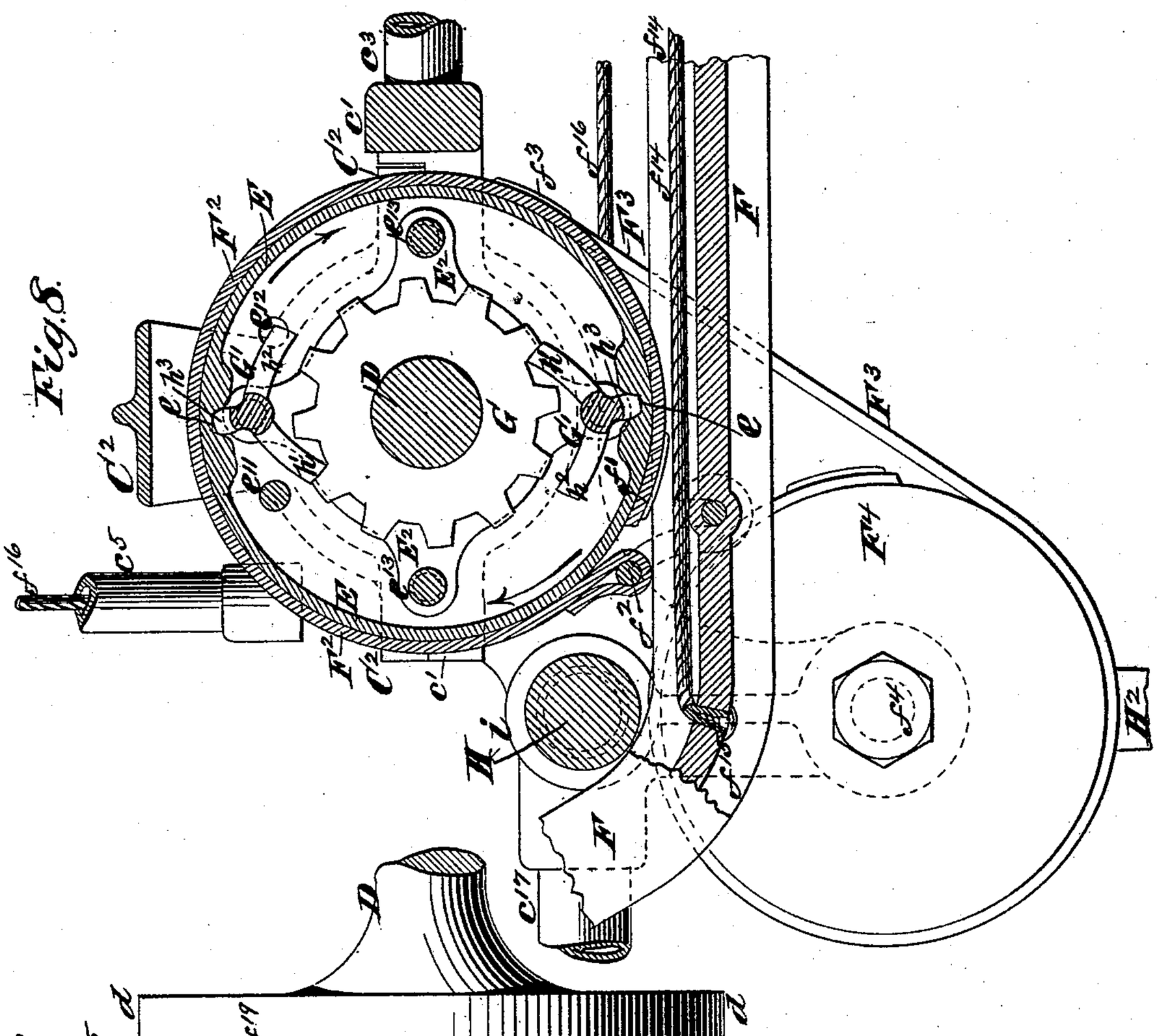

Fig. 7.

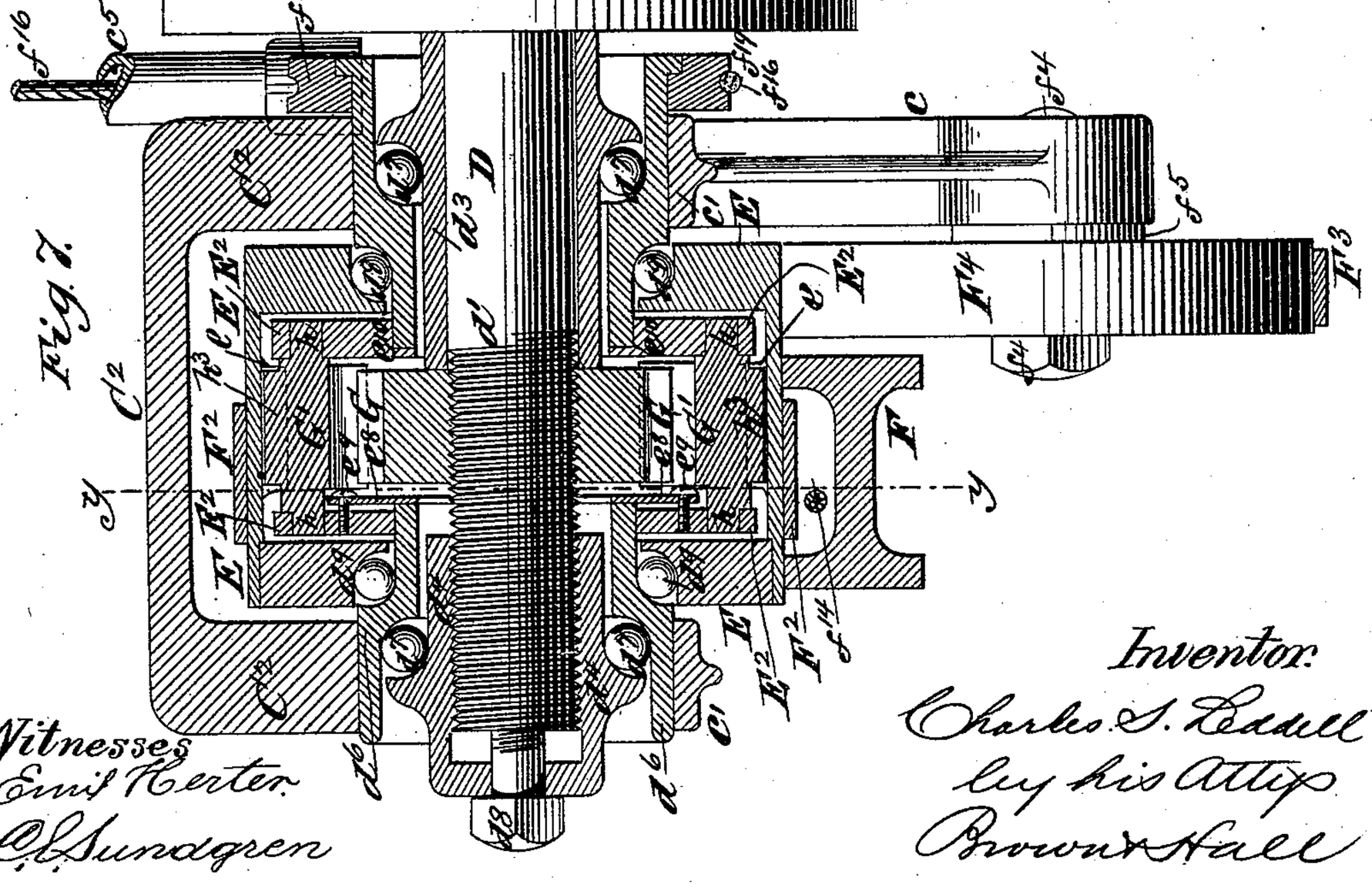

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Fig. 9.

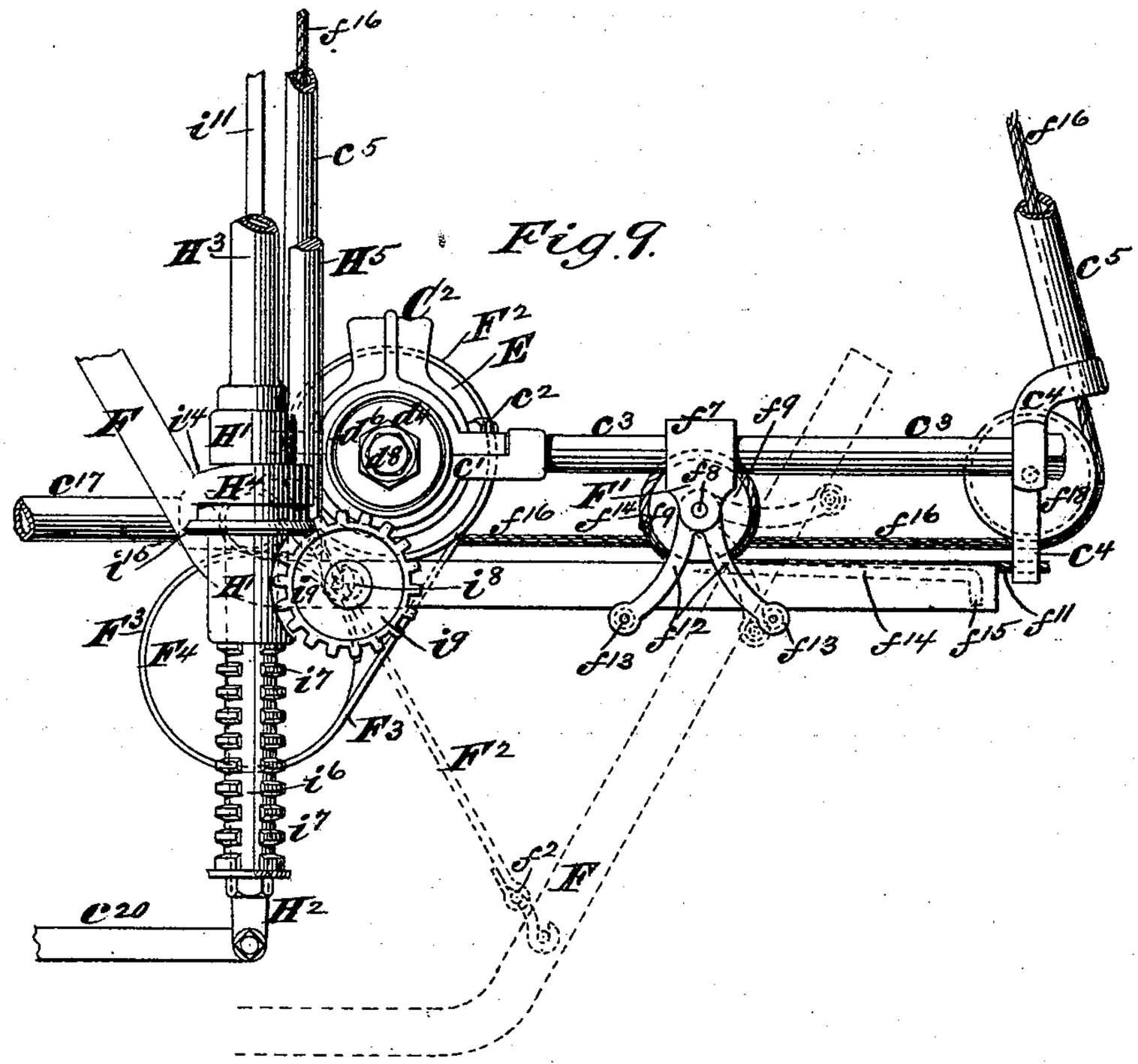

Fig. 10.

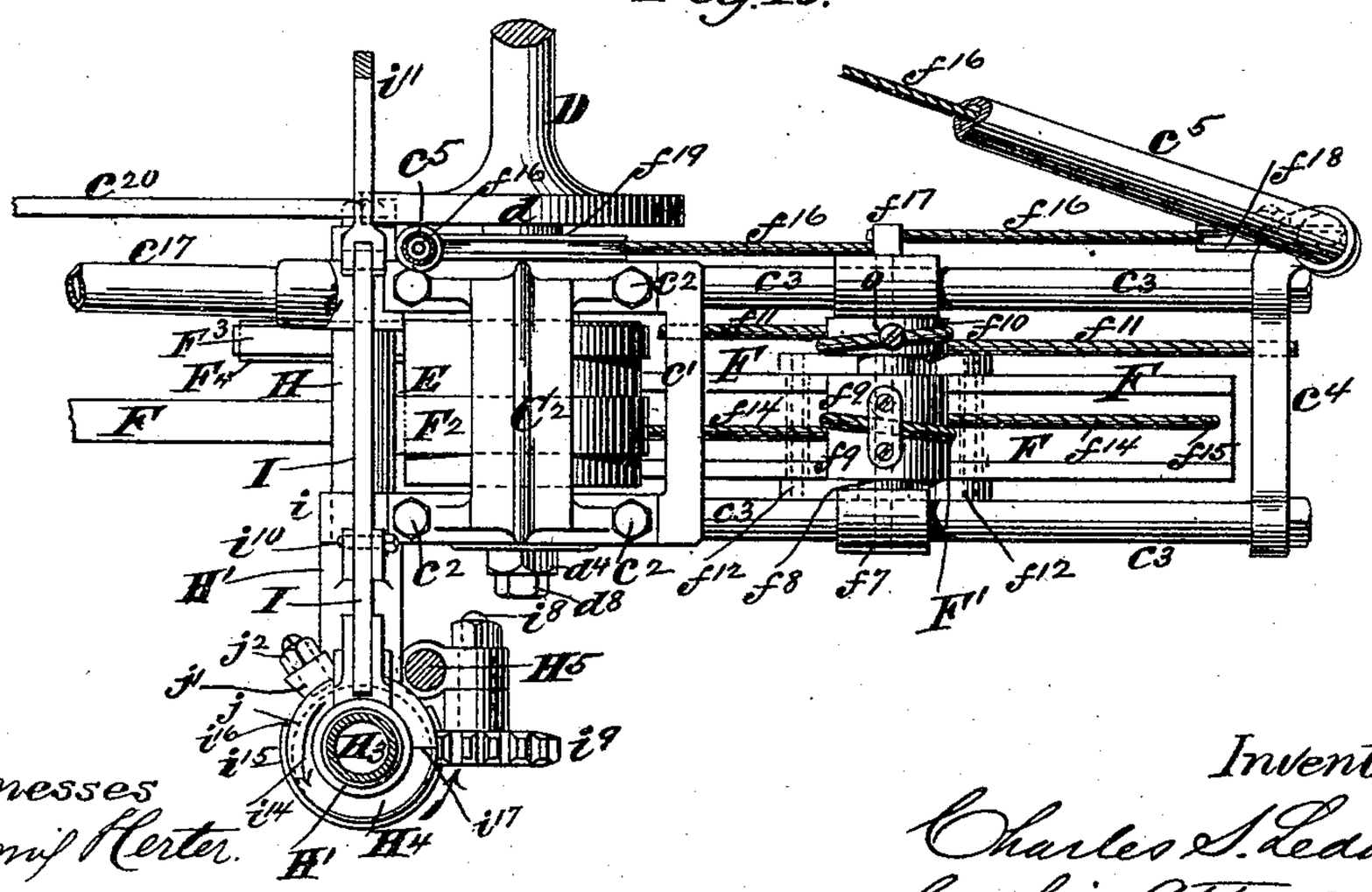

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Fig. 15.

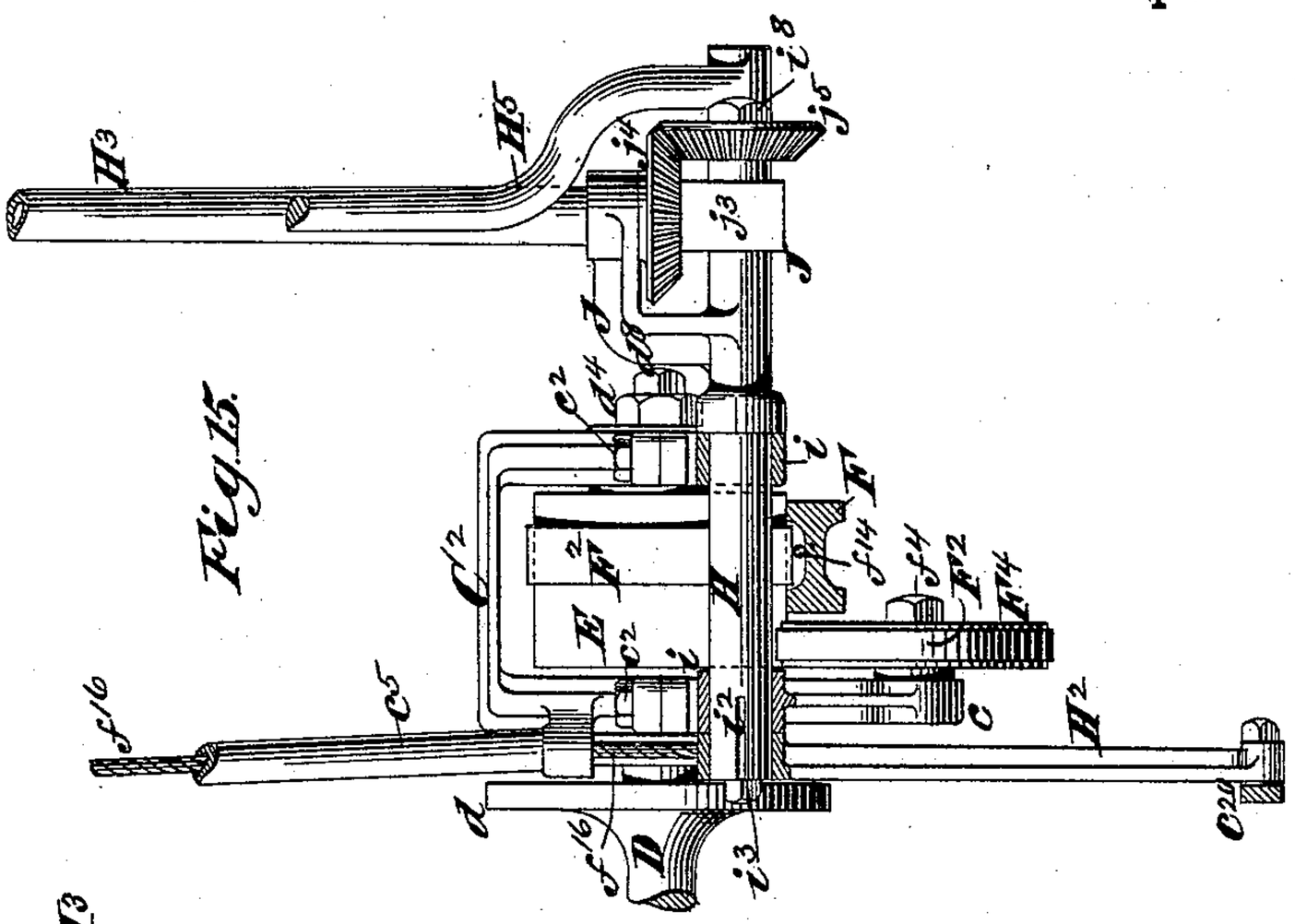

Fig. 14.

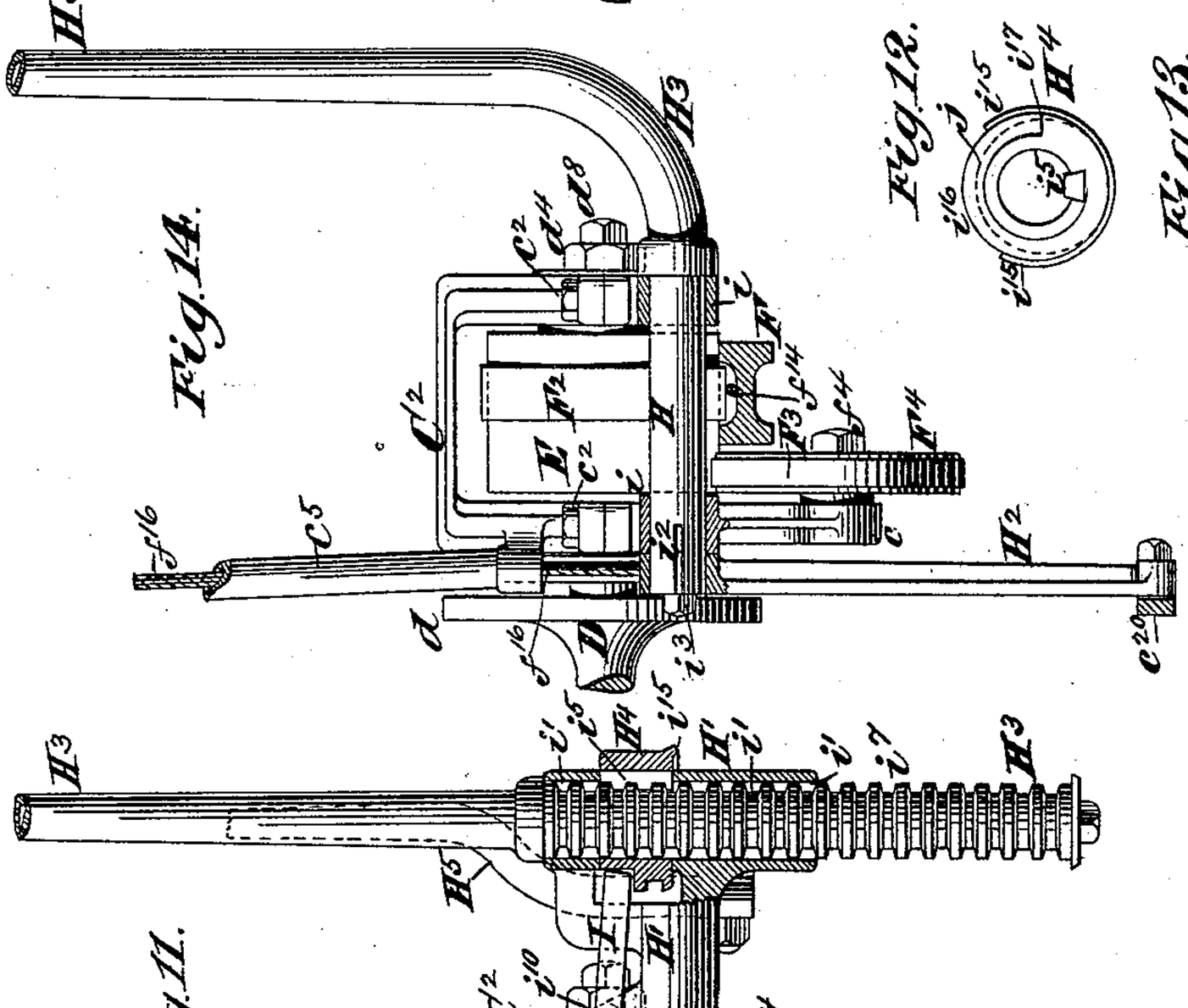

Fig. 12.

Fig. 13.

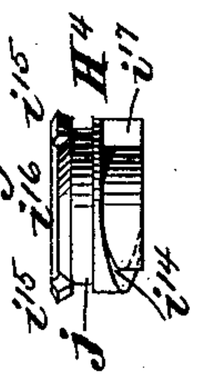

Fig. 11.

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VELOCIPEDE.

No. 459,586. Patented Sept. 15, 1891.

Fig. 19.

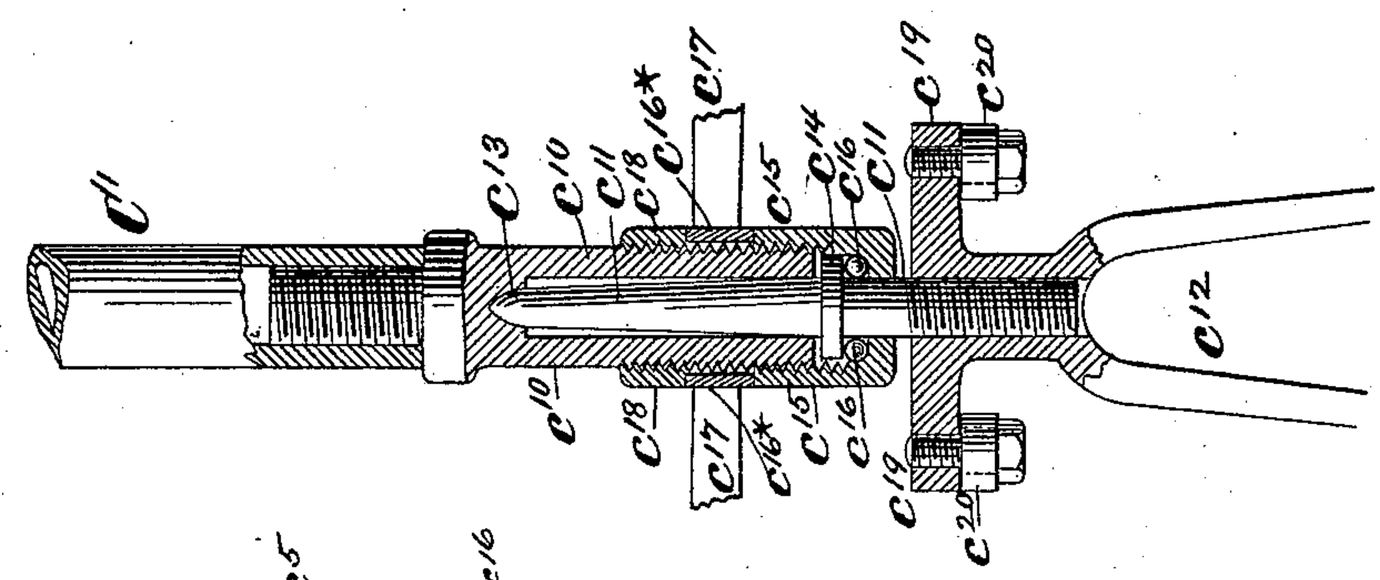


Fig. 17.

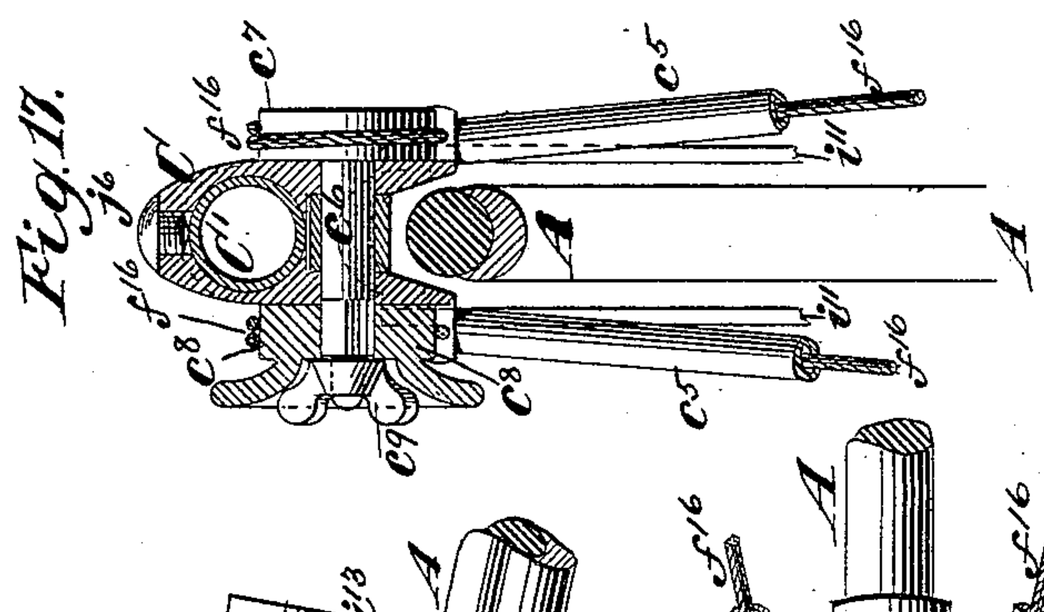


Fig. 16.

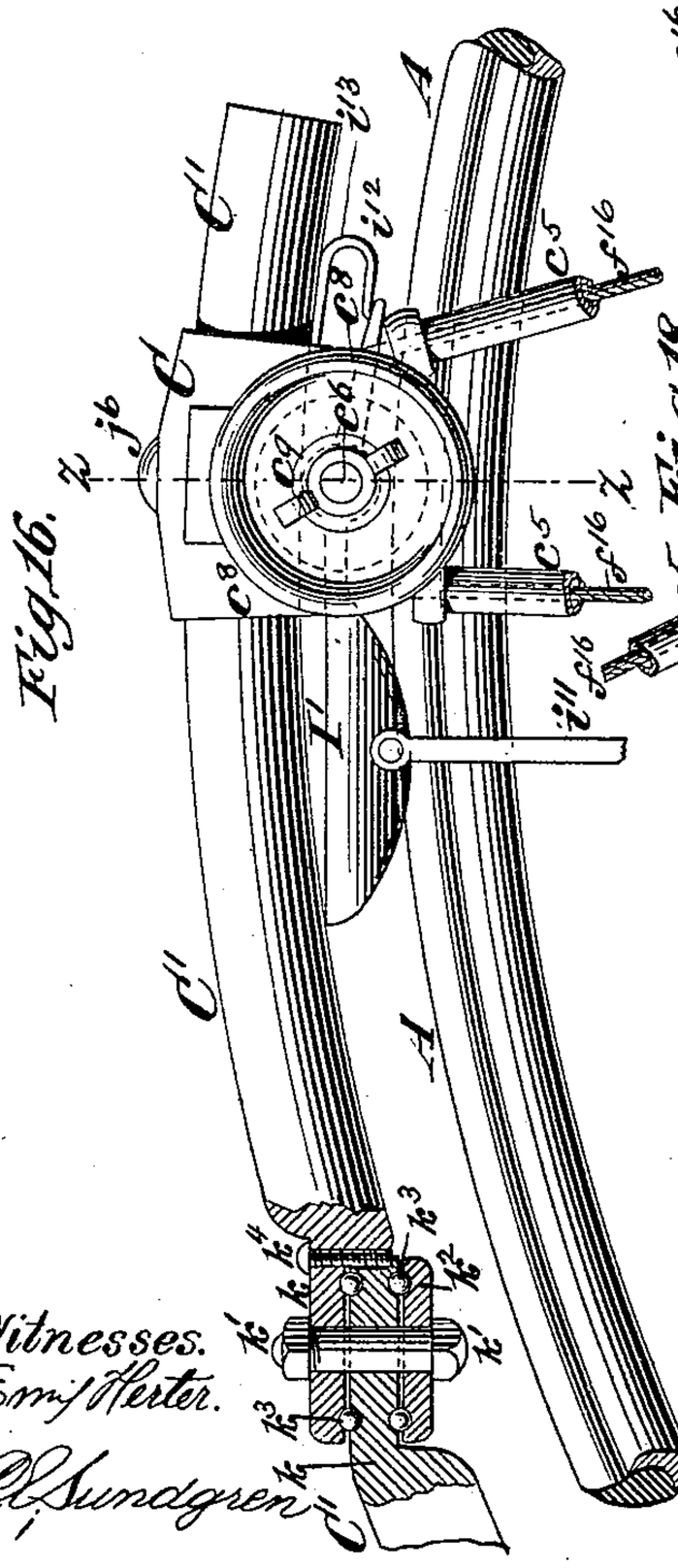
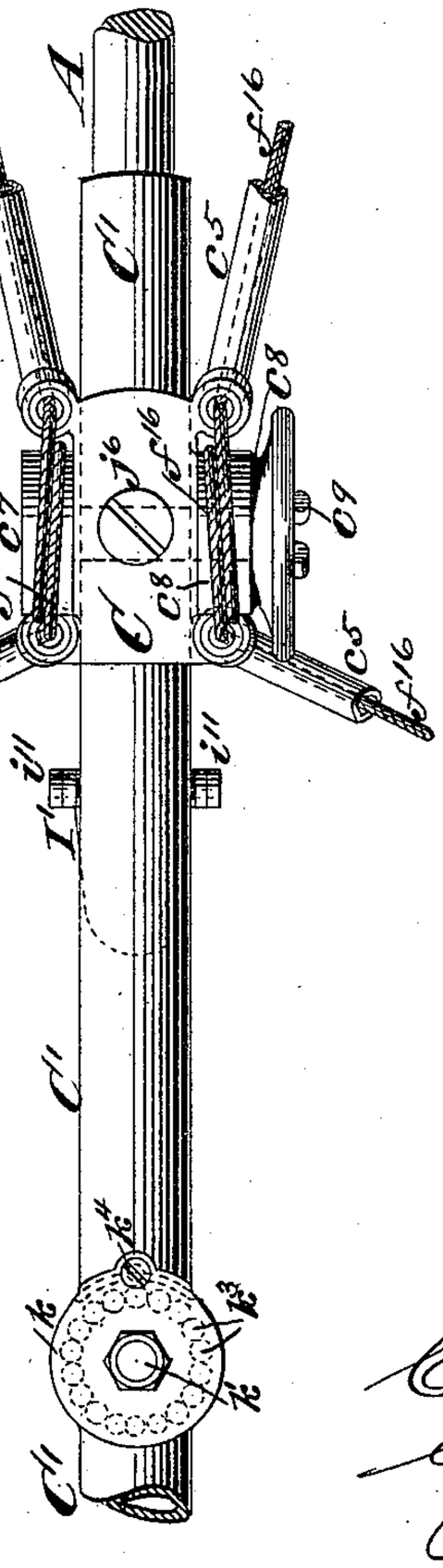
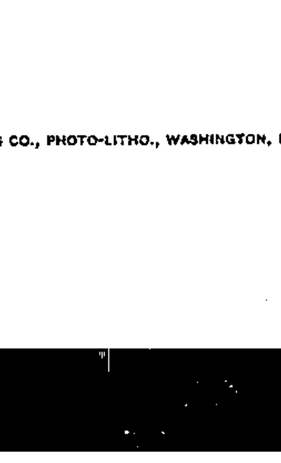


Fig. 18.





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Inventor:
Charles S. Leddell
by his Attys
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UNITED STATES PATENT OFFICE.

CHARLES S. LEDDELL, OF MORRISTOWN, NEW JERSEY.

VELOCIPEDE.

SPECIFICATION forming part of Letters Patent No. 459,586, dated September 15, 1891.

Application filed September 28, 1886. Serial No. 214,746. (No model.)

To all whom it may concern:

Be it known that I, CHARLES S. LEDDELL, of Morristown, in the county of Morris and State of New Jersey, have invented a new and useful Improvement in Pedomotive Vehicles, of which the following is a specification.

My invention is more particularly applicable to bicycles, although certain features thereof may be embodied in other pedomotive vehicles.

The invention as a whole consists in the novel features of construction and combinations of parts which are hereinafter described, and pointed out in the claims.

In the accompanying drawings, Figure 1 is a side elevation of a bicycle embodying my invention. Fig. 2 is a plan thereof. Fig. 3 is a rear elevation, supposing the small steering-wheel to be in advance. Fig. 4 is an axial section of a clutch embodying my invention, including a portion of a lower frame and one end portion of the shaft or axle. Fig. 5 is a transverse section upon the plane of the dotted line *x x*, Fig. 4. Fig. 6 represents a side view of the three pawls and a drag-frame with which they are connected and which are used in the form of clutch shown in Figs. 4 and 5. Fig. 7 is an axial section similar to Fig. 4 of a clutch of modified form, also embodying the essential feature of my invention. Fig. 8 is a transverse section on the plane of the dotted lines *y y*, Fig. 7. Figs. 4 to 8, inclusive, are drawn full size. Fig. 9 is a side view of portions of the driving and steering mechanism upon a scale considerably larger than Figs. 1, 2, and 3. Fig. 10 is a plan of the parts shown in Fig. 9. Fig. 11 is a front view and partial section of the parts shown in Figs. 9 and 10, supposing the small steering-wheel to be in advance. Figs. 12 and 13 are a plan and side view of a cam which is employed for operating the brake and for locking the pivoted leg in its operative or inoperative position. Fig. 14 is a view similar to Fig. 11, showing a modification of my invention, wherein the handle-arm serves the purpose of steering only, and whereby simplicity is secured over the construction shown in Fig. 11. Fig. 15 is a view similar to Figs. 11 and 14, showing a construction in which the handle-arm at the side of the machine operates both to steer and to swing the pivoted leg, but is not employed to apply the brake. Fig. 16 is a side view and partial section of the upper portion of the machine. Fig. 17 is a sectional view upon the plane indicated by the dotted line *z z*, Fig. 16. Fig. 18 is a plan of the parts shown in Figs. 16 and 17, and Fig. 19 is a sectional elevation of the lower end portion of the backbone and a portion of the forked steering-shaft. Figs. 9 to 19, inclusive, are all upon substantially the same scale, which is considerably larger than the scale in Figs. 1 to 3.

Similar letters of reference designate corresponding parts in all the figures.

A B designate, respectively, the large driving-wheel and the smaller steering-wheel.

C designates a sleeve or socket which forms the upper frame portion and from which extends that part of the frame which is supported directly by the steering-wheel shaft, and which, as here shown, consists of a tubular backbone C′, curved to conform to the circle of the wheel.

C^2 designates yokes or lower frame portions which are employed, one on each side of the driving-wheel A, and which will be hereinafter more fully described.

D designates the shaft or axle, one end portion of which is shown in Fig. 4, and *d* designates one of the flanges from which the spokes of the wheel A (not here represented) extend.

There is applied to the shaft or axle D on each side of the wheel A a clutch, which I will soon describe in detail, and which comprises a clutch-drum E, to which a reciprocating rotary motion is imparted by means of a treadle-lever, as I shall soon describe. The arrangement of connections whereby the treadle-lever is connected with the clutch-drum in order to produce a direct movement of said drum and whereby the drum is returned after each movement of the treadle-lever is best shown in Figs. 4 and 5, and the construction of clutch, which forms part of my invention, is also best shown in Figs. 4, 5, and 6. Each treadle-lever F is supported by a fulcrum-bearing F′, which I shall hereinafter describe in detail. At the upper end of the treadle-lever F is a treadle *f*, on which the foot may operate. The exterior of the

clutch-drum E is preferably cylindric and straight from side to side. Around the clutch-drum E pass two connections F^2 F^3, which are arranged side by side. The connection F^2 is secured to the periphery of the drum at the point f' and makes about one complete turn around the drum and by a shackle f^2 is secured to the treadle-lever F, as best shown in Fig. 5. The connection F^3 is secured to the drum E at the point f^3 and passes down and around a supplemental drum F^4, which may be pivoted by a bolt f^4 to a depending portion c of the yoke or lower frame c^2, as shown in Fig. 4. Within the drum F^4, I have represented a coiled or convolute spring F^5, which may be secured at one end to a hub f^5, projecting from the frame portion c, and may be secured at the opposite end to a pin f^6 in the spring-drum F^4. This spring constantly tends to turn the drum F^4 in the direction indicated by the arrow in Fig. 5, and thereby to produce the return movement of the drum E in the direction indicated by the arrow in Fig. 5, while the action of the treadle-lever F turns both the drum E and the drum F^4 in a reverse direction to that indicated by the arrows. When the treadle-lever is pressed downward by the foot toward the position represented by dotted lines in Figs. 1 and 9, the pull upon the connection F^2 turns the drum E in a reverse direction to that indicated by the arrows in Fig. 5, and through the connection F^3 the spring-drum F^4 is turned also, and the spring therein is coiled up or put under tension. As soon as the treadle-lever F is relieved of pressure the spring F^5 acts to turn the drums F^4 and E in the direction indicated by the arrows, and thereby through the connection F^2 raises the lever F to its initial position. The shaft or axle has upon it a screw-thread d', whereby is secured to it a toothed wheel G, which, as here represented, has spur-shaped teeth, and this wheel is additionally secured in place by a nut d^2, applied to a reversed screw-thread upon the shaft D. Upon the shaft or axle are secured two sleeves d^3 d^4, and outside these sleeves are non-rotary bushings d^5 d^6, which are secured fast in the yokes or lower frame portions C^2, and which have or may have roller or anti-friction bearings d^7 interposed between their inner surfaces and the sleeves or portions d^3 d^4. The yokes C^2 may have caps c', secured to their lower portions by bolts c^2, and the yokes, with their caps, form cylindric bearings, in which the bushings d^5 d^6 may be secured against rotation by the bolts c^2. The sleeve d^3 may be secured tightly upon the shaft or axle D by driving or otherwise, and the sleeve or head d^4 may be screwed thereon and may be additionally secured by means of a bolt d^8, inserted into the end of the shaft or axle D, as shown in Fig. 4. It will be of course understood that the exterior surfaces of the sleeves d^3 d^4 and the interior surfaces of the bushings d^5 d^6 will be properly constructed with concave channels or seats to receive the anti-friction rollers d^7. The outer end portion of the sleeve or head d^4 may be of polygonal shape, as shown in Fig. 9, so that a wrench may be applied to it for tightening it upon the shaft D, and when so tightened the pressure which is exerted upon the bushing d^6 will be transmitted through the yoke C^2 to the opposite bushing d^5 and the latter will be moved inward, so as to take up any wear between it and the sleeve d^3. As here represented, the clutch-drum E, which is free to turn upon the exterior of the bushings d^5 d^6, has anti-friction-rollers or a roller-bearing d^9 between each side and the bushings d^5 d^6, and if the bolts c^2, which secure the bushing d^6 firmly in the yoke C^2, be loosened by turning or setting up the sleeve or head d^4 the adjustment of said sleeve or head will press the bushing d^6 inward in the yoke C^2, and will take up any lost motion which there may be between the clutch-drum E and the bushings d^5 d^6, as well as between the bushing d^5 and the sleeve d^3.

The connection between the clutch-drum E and the ratchet or toothed wheel G consists of one or more pawls, which are caused to act upon the wheel to turn it when the clutch-drum is moved in one direction and which are idle during the return movement of the drum. In Fig. 5 I have shown three pawls G′ as employed for this purpose, and these pawls have journal portions h fitting bearings in the clutch-drum and have arms h' h^2 projecting in reverse directions. The pawls having the double arms h' h^2 are intended for operating upon the wheel G in one or other direction to drive the machine with either the small steering-wheel B or the main driving-wheel in advance; but if the small steering-wheel B were always to be used in advance the pawls need have but the single arm h'. It will be readily understood that when the arms h' of the pawls G′ are engaged with the teeth of the wheel G, as shown in Fig. 5, and the treadle F is pressed down to turn the drum E in a reverse direction to that indicated by the arrows in Fig. 5, the pawls will transmit the direct rotary motion of the drum to the wheel G and the wheel and shaft D will be turned in the direction indicated by the arrow upon the wheel G in Fig. 5.

According to the usual construction of pawl-and-ratchet clutches the pawls G′ would be acted upon by springs to hold them in engagement with the wheel G, and during the return movement of the clutch-drum E and pawls G′ in the direction indicated by the arrow upon the clutch-drum in Fig. 5 the arms of the pawls would drag over the teeth of the wheel G and produce a disagreeable clicking sound. To avoid this objection I employ, in connection with the pawls G′, a drag which tends to retard the pawls at the commencement of the return movement of the drum and to lift their arms h' entirely out of contact with the wheel G.

The construction and operation of one form

of drag which I may employ is best illustrated in Figs. 4 and 6. E′ designates a ring-shaped frame, which is shown in transverse section in Fig. 4 and in face view in Fig. 6, and which has a bearing upon the inner end and circumference of the bushing d^6. This drag-frame E′ has in its periphery notches or recesses e, which receive drag-arms h^3, projecting inward from the pivots or journals h of the pawls G′. I have also represented in Fig. 4 an annular spring or spring-ring e', which is received within an annular cavity e^2 in the end of the drum E and which bears against the ends of the journals h of the pawls. This pressure produced by the spring may be varied by means of screws e^3, whereby it is secured to the clutch-drum, as shown in the lower portion of Fig. 4. The pawl-journals h project considerably beyond the bottom of the annular recess e^2, and if the screws e^3 be tightened the ring e' will be bent or deflected between the pawls, and will thereby be caused to bear more strongly against the pawls to press them toward the left hand of Fig. 4. Such pressure on the pawls endwise acts through the drag-arms h^3 of the pawls to press the drag frame or ring E′ more forcibly against the bushing d^6, and acts thereby to increase the frictional resistance which tends to resist the turning of the drag ring or frame E′ upon the bushing d^6. After each direct movement of the clutch-drum and at the commencement of its return movement the drag ring or frame E′ does not at once commence its return movement with the clutch-drum because of the friction which resists its turning upon the bushing d^6, and the retarding movement which this ring or frame E′ exerts upon the pawls G′ through their drag-arms h^3, lifts the arms h' of the pawls clear of the teeth of the wheel G, and the pawls then complete their return movement with the drum E without touching the wheel G. In the same manner when the drum E commences its direct movement the drag frame or ring E′ acts to retard the pawls, and by the movement of the drum E, the arms h' of the pawls are thrown into engagement with the teeth of the wheel G, so as to impart motion thereto. It is obvious that if the amount of retardation which the frame or ring E′ exerts upon the pawls G′ were not limited the arms h' of the pawls would not only be lifted out of the wheel G at the commencement of the return movement of the drum E, but the arms h^2 of the pawls would be brought into engagement with the wheel G. To prevent this I employ, in connection with the clutch-drum E and the drag-frame E′, a pin or screw e^4, which is shown in Fig. 4 as inserted into the end of the clutch-drum E and as projecting into the path of the ring or frame E′. The drag frame or ring E′ has a projecting arm e^5, upon one side or the other of which the screw e^4 comes, according to whether the clutch is to be operative in one direction or the other, and the pin and arm constitute a stop. In the position of parts shown the screw or pin e^4 is upon the right-hand side of the arm e^5 in Fig. 6, as is shown by the dotted circle in said figure. When the clutch-drum E is moved in the direction of the arrow thereon in Fig. 5, the ring or frame E′ drags behind until the pin e^4 strikes the right-hand side of the arm e^5, whereupon the ring or frame E′ is carried forward positively with the clutch-drum E and the pawls are held in their intermediate positions during such return movement. If the machine were to be operated with the large wheel A in advance, the frame or ring E′ would be shifted so that its arm e^5 would come upon the right hand of the pin e^4 in Fig. 6. As clearly shown in Figs. 4 and 6, the opposite sides of the arm e^5 are rabbeted at e^6, and there is a hole or perforation e^7 formed directly through the arm. If it be desired to leave the machine for any time and to prevent any meddlesome person from using it, the screw e^4 may, after the pawls have been moved into their intermediate position, be set inward, so that it will engage one or other of the holes e^7, and the pawls will thereby be locked out of action.

I will now describe the modification of my invention, which is illustrated in Figs. 7 and 8. All parts of this construction are substantially the same as before described, save that in this case the pawls G′, instead of being pivoted or journaled directly in the clutch-drum, are pivoted or journaled in the frame composed of two side portions or rings E^2, journaled upon the bushings d^5 d^6, and the drag-arms h^3 of the pawls project outward and engage notches or recesses e in the drum E. A drag is produced upon the frame E^2 in any suitable manner—as, for example, by means of a spring-ring e^8, which is secured by screws e^9 to the inner side of one of the frames E^2, as shown in Fig. 7, and bears against the end of the bushing d^6. The other frame E^2 is rabbeted at e^{10}, so as to fit against the end of the bushing d^5, and it will be obvious that when the screws e^9 are tightened up the spring e^8 will press more forcibly against the end of the bushing d^6 and will force the frames E^2 and the pawls which they carry toward the right hand of Fig. 7 and cause the rabbeted surface e^{10} to press forcibly against the end of the bushing d^5, thereby increasing the frictional resistance, which is opposed to the turning of the frames E^2, carrying the pawls. As represented in Fig. 8, the pawls are just about commencing their direct action, and when the return movement of the drum E in the direction of the arrow thereon commences the frames E^2 in which the pawls are journaled will drag behind, and the drum, acting upon the drag-arms h^3 of the pawls, will lift the pawl-arms h' out of engagement with the teeth of the wheel G and until the arm h' of one of said pawls strikes a stop-pin e^{11}, after which the clutch-drum E and the frames E^2, with the pawls, will turn together.

To adapt the clutch for a reverse operation, I provide a second hole or perforation e^{12} in the clutch-drum E, into which the pin e^{11} may be inserted. I have in Fig. 8 shown the clutch as provided with two pawls, and the frames E^2, which carry the pawls, may be connected at other points by rods or struts e^{13}.

For imparting motion to the clutch-drum E from the treadle-lever F, I may employ an arrangement of bands or flexible connections similar to that shown in my Letters Patent No. 320,073, or may gear the treadle-lever with the clutch-drum by means of a rack and gear-teeth, as shown in my Letters Patent, No. 342,915, dated June 1, 1886. I may, however, employ the arrangement of fulcrum-bearing F′ for the lever F and connections shown in Figs. 9 and 10, to which I shall now refer. This fulcrum-bearing comprises a carriage f^7, which slides upon guides c^3, forming a part of the fixed frame, said guides being connected at their inner ends with the caps c' of the yoke C^2 and at their outer ends by a cross-piece c^4. The carriage f^7 has bearings for a shaft or pin f^8, on which turns a drum f^9. f^{10} is a drum or wheel which is rigidly connected or formed with the wheel or drum f^9, so as to turn therewith, and which is connected with the frame portion, so that when the carriage f^7 is slid along the guides c^3 the drums f^9 f^{10} will turn. As here shown, the connection is flexible, and consists of a cord or band f^{11}, secured at a to the drum f^{10}, and also secured at opposite ends to the cap c' and the cross-piece or portion c^4. The treadle-lever F works between the drum f^9 and a hanger or bearing f^{12}, which is forked or bifurcated, as shown in Fig. 9, and provided at the lower end with rollers f^{13}, on which the lever moves. This hanger f^{12} may swing freely upon the shaft or pin f^8, so as to assume the position shown by dotted lines in Fig. 9. The treadle-lever F is connected with the drum f^9 by means of a flexible connection f^{14}, which encircles the drum f^9 and is secured thereto, as shown in Fig. 10, and which has its opposite ends secured at f^{15} to the treadle-lever. The top or upper surface of the treadle-lever may be channeled, as shown best in Figs. 4 and 7, in order to afford room for the connection F^2 and the connection f^{14} between said treadle-lever and the clutch-drum E. Inasmuch as the drum or wheel f^{10} is by the connection f^{11} made to turn when the carriage f^7 is slid along, the drum f^9, turning therwith, takes up the connection f^{14} on one side and pays it out on the other side, thereby moving the fulcrum-support F′ positively along the lever. It will be obvious that if the carriage f^7 is moved away from the clutch-drum the length of the lever-arm between the carriage and clutch-drum will be increased and the power transmitted by the lever will be decreased, while at the same time speed will be increased. If, on the contrary, the carriage f^7 be moved toward the clutch-drum E, the length of the arm between said carriage and clutch-drum will be lessened and power will be gained at the expense of speed.

In order to shift the sliding carriage f^7, I prefer to employ connections extending upward to the top of the machine, where they can readily be operated by the rider while in his seat. The upper frame portion C, I have here represented as connected with the lower frame portion by tubular braces or inclined stays c^5, and the sliding carriage f^7 at each side of the machine is controlled by a wire cable or other flexible connection f^{16}, which is secured thereto at f^{17}, and which passes around guide-rollers f^{18} f^{19}, and thence upward through the tubes c^5. The guide-roller f^{19} may be arranged to turn upon the projecting end portion of the bushing d^5, as shown in Figs. 4 and 7.

I have represented as journaled in the upper frame portion C a short shaft or pin c^6, which has at the opposite ends two windlasses or drums or wheels c^7 c^8, and which has applied to it a nut c^9, whereby the frame portion C may be clamped tightly between the drums or wheels c^7 c^8 and so held against turning. The drum or wheel c^8 is, as shown in Fig. 17, fitted to a squared portion of the shaft c^6, and may be constructed so as to form a circular handle, whereby it and the shaft c^6, with the drum c^7 at the opposite end thereof, may be turned. The flexible connections f^{16}, which are carried through the tubes c^5 and which are practically endless, encircle the drums c^7 c^8 as many times as desired, and may be at one point secured to the drums, so that any turning of the drums by the hand applied to the drum c^8 will draw up the connection f^{16} on one side of the drums and pay it out on the opposite side thereof, thereby moving the sliding carriage f^7 in one or other direction, as desired. By then tightening the nut c^9 the carriage f^7 will be held in the desired position and against accidental shifting.

The construction and manner of combining the steering-wheel shaft with the backbone or frame is best shown in Fig. 19. The backbone C′ may consist of a tube, in the lower end portion of which is inserted an end piece c^{10}, and the steering-wheel shaft c^{11}, which is constructed with a fork c^{12}, is fitted to a suitable bearing in the end piece c^{10}, and the upper end of said shaft, by fitting in a bearing portion c^{13}, is afforded a thrust-bearing, whereby the weight upon the backbone is supported. The steering-wheel shaft c^{11} has a collar c^{14}, and is secured in its bearing by means of a cap-nut c^{15}, anti-friction rollers c^{16} being interposed, if desired, between said cap and the collar c^{14}. The end piece c^{10} of the backbone or frame is also surrounded by a collar c^{16*}, from which braces c^{17} extend to the caps c', which are applied to the forks or lower bearing portions C^2. The collar c^{16*} is held in place between the cap c^{15} and the screw-threaded collar or nut c^{18}, applied as shown in Fig. 19.

The forked steering-shaft c^{11} is shown as

provided with arms c^{19}, extending laterally in opposite directions and with which are connected rods c^{20}, whereby the steering-shaft is turned to effect the steering of the machine, as I shall now proceed to describe. The caps c' of the yokes or lower frame portions C^2 are constructed with bearings i, and at each side of the machine is a rock-shaft H, here represented as arranged horizontally and which is fitted to said bearings i. The rock-shaft is here shown as having at its end a bracket H′, constructed with a cylindric socket or slideway i', extending transversely to the axis of the rock-shaft, for a purpose hereinafter described. At the inner end of each rock-shaft H is a downwardly-extending arm H^2, from the lower end of which a rod c^{20} extends to and is connected with one of the laterally-extending arms c^{19} of the steering-wheel shaft c^{11}. It is obvious that the steering might be accomplished by a single rock-shaft H on one side of the machine and a rod c^{20}, extending from the arm H^2 of that rock-shaft and connected with a single lateral arm c^{19} of the steering-wheel shaft. I prefer, however, to employ a rock-shaft and duplicate connections on opposite sides of the machine. In order to secure the arm H^2 upon the rock-shaft H in such manner that it may be readily set in position and then held securely, I slit or slot the shaft H at i^2, and at two or more points in its circumference I fit into the end thereof a conical screw or plug i^3, (best shown in Fig. 11,) and by which the slotted portion of the shaft may be expanded tightly into the eye of the arm H^2.

In the simplest form of that feature of my invention which relates to steering, the rock-shaft H has a handle-arm H^3 formed integral with it and extending upward from its outer end, as shown in Fig. 14. The handle-arm H^3 may be provided at the top with a spade-handle i^4, as is shown in Fig. 1, and it will be understood that by swinging the handle-arm H^3 in a plane parallel with the plane of the wheel A a pull or a push will be exerted through the rod c^{20} and the steering-wheel will be canted, if desired, for steering.

In the example of my invention, which is shown in the general views and also in Figs. 9, 10, and 11, the handle-arm H^3, in addition to steering, is operated to apply the brake and to swing upward or downward a supporting-leg, hereinafter described, and it is to these figures that I shall now particularly refer. The cylindric socket or bar i', which is formed in the bracket H′, is divided or cut away between its ends in order to receive a cam H^4, through which the handle-arm H^3 extends and to which said handle-arm is locked by a spline i^5 in the cam engaging a groove i^6 in the lower portion of the handle-arm. The lower portion of said arm is cylindric and is formed with circumferential grooves, so as to form a rack i^7, the function of which is best illustrated in Fig. 9. The handle-arm H^3 may be raised or lowered, as necessary, in the socket i', and no matter what its vertical position it may be readily turned to rotate the cam H^4.

H^5 designates a supporting-leg the head of which is pivoted at i^8 to the bracket H′ at the outer end of the rock-shaft, and concentric with said pivot is a gear-sector i^9, which may form the head of the pivot on which the leg H^5 is secured so as to turn therewith, and this gear sector or wheel i^9 is in permanent engagement with the rack i^7 upon the handle-arm H^3. Whenever it is desired to leave the machine standing, all that is necessary is to raise the handle-arm H^3 in the socket i', and the gear-sector i^9 will thereby be turned and the leg H^5 will be swung from the position shown in Figs. 9 and 10 and in full lines in Fig. 3 downward to the position shown by dotted lines in Fig. 3, so as to make the machine self-supporting.

I designates a lever, which is pivoted at i^{10} to the bracket H′ at each side of the machine, and which is in proximity to the cam H^4. The inner end of the lever I is connected by a rod i^{11} with the brake I′, which is at the top of the machine, as best shown in Figs. 16 and 17. This brake may be pivoted by the bolt c^6, which extends transversely through the upper frame portion C, and it may have a tail-piece i^{12} extending rearward from the pivot, as shown in Fig. 16, and between which and the backbone a spring i^{13} is applied in order to lift the brake from the wheel A. The cam H^4 has an inclined upper surface i^{14}, and it will be readily understood that when the handle-arm H^3 is turned in the socket i' the inclined surface i^{14} of the cam will act upon the lever I to draw down the brake I′ and apply it to the periphery of the wheel. The inclined surface i^{14} of the cam H^4 is best shown in Fig. 13, which, however, represents the cam in an inverted position. At the bottom of the cam is an annular tooth or rib i^{15}, which is continuous throughout the circumference, save for a gap i^{16}, and which engages the gear-sector i^9 at the head of the pivoted leg H^5. During the normal operation of the handle-arm H^3 for steering or for applying the brake the annular tooth or rib i^{15} engages the gear-sector i^9 and holds the leg H^5 in an inverted position, as shown in full lines in the drawings. If the handle-arm H^3 and the cam H^4 be turned so as to bring the gap i^{16} in the rib i^{15} opposite the sector, the sector is thereby freed from the lock, and by raising the handle-arm H^3 the pivoted leg H^5 will be swung downward into the position shown by dotted lines in Fig. 3. The cam H^4 is also constructed with an eccentric surface j, which is represented by a dotted line in Figs. 10 and 12, and opposite which is arranged in the bracket H′ a bolt or pin j'. This pin may be made in the form of a set-screw threaded into the bracket H′ and provided with a lock-nut j^2, whereby it may be held against accidental turning. It will be observed that the leg H^5 is not radial to the pivot i^8, but is tangential to a circle concentric with said pivot. Con-

sequently when swung down its lower end strikes more directly upon the ground and has less tendency to scrape over the surface than would be the case if it were radial to the pivot i^8.

To swing the leg H^5, the handle-arm H^3 and cam H^4 are first turned to free the locking-rib i^{15} of the cam from the sector i^9, and the arm H^3 is then raised or lowered. In case the leg be swung downward on uneven ground the end of the locking-rib i^{15} might strike against a tooth of the sector i^9 and not enter a tooth-space. The cam would then have no locking action on the sector, but by turning the handle arm and cam in the reverse direction to that indicated by the arrow on the cam in Fig. 10 the eccentric surface j of the arm will bind on the screw j' and the handle-arm will be crowded over against the opposite side of the socket or bearing i', so as to oppose a considerable friction to its upward and downward movement, and consequently the leg H^5 will be locked by friction against swinging.

If it be desired to change the height of the handle-arm H^3, it may be turned in the proper direction, as indicated by the arrow in Fig. 10, and until the groove i^6 coincides with the sector i^9, and the handle-arm may then be raised or lowered without affecting the leg H^5, and may then by turning be brought into a new engagement with the sector. The abrupt shoulder i^{17} at the end of the cam-surface i^{14}, by striking against the brake-lever I when the cam is turned in the direction indicated by the arrows, Fig. 10, forms a stop to arrest the turning of the handle-arm H^3 when the groove i^6 is opposite the sector i^9. If the machine be in use, a single turning movement of the handle-arm H^3 in the reverse direction to that indicated by the arrows in Fig. 10 will first release the sector i^9 from the locking-rib i^{15}, and by continuing the turning and at the same time raising the handle-arm the leg will be swung down, the brake will be applied by the action of the cam-surface i^{14} on the lever I, and the leg will be locked by the binding of the surface j on the screw j'.

In the modification of my invention shown in Fig. 15 the handle-arm H^3 performs only the function of steering and of operating the leg H^5. In that figure the rock-shaft H is represented as having secured to its outer end a frame or bracket J, which comprises a step-bearing j^3 for the lower end of the handle-arm and to which the leg H^5 is pivoted at i^8. j^4 j^5 designate bevel-wheels by which the handle-arm H^3 is connected with the leg H^5, and by turning the handle-arm the leg may be swung downward or upward, as desired, while by swinging the handle-arm back and forth in a plane parallel with the wheel A the machine may be steered.

As best shown in Figs. 16, 17, and 18, the upper frame portion C is of very simple construction, consisting only of the block or socket-piece, which is bored to receive the backbone C′ and which may be secured in position on the backbone by a screw j^6. By this construction all necessity of making the backbone of a fixed length is avoided, because the upper frame portion C has simply to be brought to a proper position on the backbone and there secured.

In Fig. 1 I have represented by dotted lines J′ the position of the seat upon the backbone when the machine is to be run with the small wheel B in advance, and by the dotted lines J^2 I have represented the position which the seat may occupy when the machine is to be run with the main driving-wheel A in advance. In case the machine is to be run with the main driving-wheel A in advance the backbone should be formed in two sections, as best represented in Fig. 16, but also in Fig. 1, and connected by a swivel-joint having an axis vertical or radial to the shaft D.

As shown in Figs. 16 and 18, the sections of the backbone have at their adjacent ends disk-like portions k, connected by a vertical bolt or pivot k' and a plate or washer k^2, and between these parts, which are concentrically pivoted, may be arranged anti-friction rollers or balls k^3, so as to form a roller or anti-friction bearing.

When the machine is to be employed with the small steering-wheel B in advance, it is necessary to lock the two sections of the backbone rigidly in line, and to do this I may employ a pin or screw k^4, which is inserted, as represented in Fig. 16, so as to engage both the sections of the backbone and thereby prevent them from turning one relatively to the other upon the pin or pivot k'.

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

1. The combination, with a driving-wheel and a toothed wheel connected therewith, of a reciprocating rotary clutch-drum, one or more pawls having double arms for acting on the toothed wheel to turn it in either direction and which are actuated to turn said wheel by the direct movement of the drum in one or other direction, a rotary drag for retarding the movement of the pawls with the drum to lift the pawls clear of the toothed wheel, a spring actuating said drag, and a stop for limiting the retardation of the pawls and which is adjustable to adapt the clutch for operating in either direction desired, substantially as herein described.

2. The combination, with a driving-wheel, of an axle, a peripherically-toothed wheel mounted on said axle and connected with the driving-wheel, a reciprocating rotary clutch-drum surrounding said toothed wheel, one or more pawls journaled in the drum, drag-arms on said pawls, a rotary drag-frame receiving the drag-arms of the pawls and by which the pawls are caused to lift clear of the toothed wheel at the first of the return movement of the drum, and a spring for varying the

resistance offered by the drag-frame to the return movement of the drum, substantially as specified.

3. The combination, with the shaft or axle D and toothed wheel G thereon, of the reciprocating rotary clutch-drum E, one or more pawls G′, journaled therein and provided with drag-arms h^3, the rotary drag frame or ring E, and a spring e', acting upon journals of the pawls to increase the frictional resistance to the turning of the drag-frame upon its support, substantially as herein described.

4. The combination, with the shaft or axle and a toothed wheel fast thereon, of the reciprocating rotary clutch-drum E, one or more pawls G′, journaled therein and each having a drag-arm h^3, the rotary drag-frame E′, receiving said arms, and a stop-pin e^4 on the drum for limiting the extent of retardation produced by the frame E′, substantially as herein described.

5. The combination, with a driving-wheel, of an axle, a peripherically-toothed wheel rigidly mounted on said axle, a reciprocating rotary clutch-drum E, surrounding said toothed wheel, one or more pawls G′, journaled in said drum, each provided with a drag-arm h^3, projecting radially from its center, and a rotary drag-frame E′, having recesses in its periphery receiving said arms, substantially as specified.

6. The combination, with a driving-wheel and a toothed wheel connected therewith, of a clutch-drum and lever and flexible connection for imparting direct movement to the clutch-drum, a spring-actuated drum and flexible connection for making the return movement of the clutch-drum, one or more pawls actuated by the clutch-drum in its direct movement to turn the toothed wheel, and a drag-frame for retarding the pawls in their return movement with the clutch-drum and for causing said pawls to lift from the toothed wheel during such return movement of the clutch-drum, substantially as herein described.

7. The combination, with the lower frame portion of a bicycle, of non-rotary bushings secured therein and a driving-clutch comprising a reciprocating rotary drum and supported by roller or ball bearings on said non-rotary bushings, substantially as herein described.

8. The combination, with the shaft D and the wheel G thereon, of the lower frame portion C^2, the non-rotary bushings d^5 d^6, secured therein, and a reciprocating rotary clutch-drum journaled on said non-rotary bushings at opposite sides of the wheel G, substantially as herein described.

9. The combination, with the shaft or axle D and the sleeves d^3 d^4 fast thereon, of a yoke C^2, forming a part of the frame, the non-rotary bushings d^5 d^6, fast in said yoke and supported by roller-bearings on the sleeves, and a reciprocating rotary clutch-drum supported by roller-bearings on said bushings d^5 d^6, substantially as herein described.

10. The combination, with a driving-wheel and a clutch for imparting rotary motion thereto and comprising a reciprocating rotary clutch-drum and a lever for operating it, of a horizontally-movable fulcrum-support for the lever, and guides on which the said fulcrum-support may be shifted toward and from the point of connection of said lever with the drum in order to vary the power and speed produced by the lever and clutch-drum, substantially as herein described.

11. The combination, with a driving-wheel and a clutch for imparting rotary motion thereto and comprising a reciprocating rotary clutch-drum and a lever for operating it, of a fulcrum-support for the lever, guides on which the fulcrum-support may be shifted along the lever, and a connection extending to the top of the machine for shifting said fulcrum-support, substantially as herein described.

12. The combination, with a driving-wheel and a clutch for driving the same, comprising a reciprocating rotary clutch-drum and a lever for operating it, of a fulcrum-support for the lever and guides on which said support may be shifted along the lever, a drum or wheel at the top of the machine, and a flexible connection attached to the said fulcrum-support and wound upon said drum or wheel at the top of the machine, substantially as herein described.

13. The combination, with a driving-wheel and a clutch for driving it, comprising a reciprocating rotary clutch-drum and a lever for operating it, of a fulcrum-support for the lever, consisting of a drum supported in a sliding carriage, a connection whereby the drum is caused to turn and move along the lever as the sliding carriage is moved, and a connection extending to the top of the machine for shifting the sliding carriage, substantially as herein described.

14. The combination, with the large driving-wheel and the smaller steering-wheel and its shaft, of a rock-shaft journaled in the main frame of the machine and having arms, one of which is connected with the steering-wheel shaft and the other of which is prolonged upward to form a handle, substantially as herein described.

15. The combination, with the rock-shafts at opposite sides of machine having arms through which motion is transmitted for steering and other arms which are prolonged upward and serve as steering-handles, of pivoted legs capable of being swung up parallel with said handle-arms or downward to support the machine and which are operated by said handle-arms, substantially as herein described.

16. The combination, with the steering-wheel shaft c^{11} and arms c^{19}, of the rock-shafts

H and arms H^2, the ends of the shafts being slotted or split and expanded into the arms H^2 by taper screws i^3, and rods c^{20}, connecting the arms H^2 and c^{19}, substantially as herein described.

17. The combintion, with a steering-wheel shaft provided with a collar and socketed bearing-piece to which the shaft is fitted, forming a thrust-bearing for the end of the shaft, of a cap-nut having a screw-threaded connection with the exterior of said socketed bearing-piece and inclosing said collar between one of its ends and the socketed bearing-piece, substantially as specified.

18. The combination, with the bearing-piece c^{10} and the steering-shaft c^{11}, journaled therein, having its end supported in a thrust-bearing and provided with a collar c^{14}, of the cap c^{15}, applied to the bearing-piece, and anti-friction rollers or balls interposed between said collar and cap, substantially as herein described.

19. The combination, with the backbone C′, of the end piece c^{10}, forming a direct continuation thereof, the steering-wheel shaft c^{11}, fitting the socket-bearing in the end piece and having the collar c^{14}, and the cap-nut c^{15}, adjustable upon said end piece and retaining the said shaft in its bearing, substantially as herein described.

20. The combination, with the steering-wheel shaft and a rock-shaft at the side of the machine, having an arm connected with the steering-wheel shaft for steering, of a brake and a handle-arm extending upward from the rock-shaft for operating it and arranged to turn on its own axis for applying the brake, substantially as herein described.

21. The combination, with a steering-wheel shaft and a rock-shaft at the side of the machine, having an arm connected with the steering-wheel shaft for steering, of a brake, a leg pivoted to swing upward and downward, and a handle-arm extending upward from the rock-shaft and movable independently of the rock-shaft to apply the brake and operate the said leg, substantially as herein described.

22. The combination, with a handle-arm extending upwardly, of a cam rotated by said handle-arm, a leg adapted to be swung upwardly and downwardly, and a tooth on said cam for locking the leg in any position into which it may be adjusted, substantially as specified.

23. The combination, with a handle-arm extending upwardly, of a cam rotated by said handle-arm, a brake, a connection between the brake and the cam, and a leg adapted to be swung upwardly and downwardly by the handle-arm, said cam being provided with an eccentric, substantially as and for the purposes herein described.

24. The combination, with a cam, of an upwardly-extending handle-arm having a connection with the cam so as to rotate the same, a brake, and a connection between the brake and the cam, substantially as specified.

25. The combination, with a cam, of an upwardly-extending handle-arm adapted to be moved longitudinally through the cam and having a connection with the cam so as to rotate the same, a brake, and a connection between the brake and the cam, substantially as specified.

26. The combination, with a cam provided with an internal projection, of a handle-arm provided near one end with a rack and with a longitudinally-extending groove, a toothed wheel normally engaging said rack, said handle-arm being capable of being rotated to bring said groove opposite said toothed wheel in order to disengage it from the toothed wheel, and the cam to raise and lower the handle-arm, substantially as specified.

27. The combination, with a steering-wheel shaft and a rock-shaft at the side of the machine and having an arm connected with the steering-wheel shaft for steering, of a brake and a rod and lever for applying it, a handle-arm applied to the rock-shaft for swinging it and which is turnable on its axis, and a cam on said handle-arm for acting on the brake-lever, substantially as herein described.

28. The combination, with a steering-wheel shaft and a rock-shaft at the side of the machine and having an arm connected with the steering-wheel shaft for steering, of a leg pivoted to swing upward and downward and having a gear-sector concentric with its pivot, and a handle-arm having a rack upon its lower portion connected with the rock-shaft for turning it and movable lengthwise to swing the leg by means of its rack engaging the gear-sector on the leg, substantially as herein described.

29. The combination, with the steering-wheel shaft c^{11} and the rock-shaft H, having an arm connected with the steering-wheel shaft for steering and having a bracket H′ at the outer end, of the handle-arm H^3, having a rack at the lower end and free to slide transversely to the rock-shaft, and a leg pivoted at the end and having a gear-sector concentric with its pivot and with which the rack on the handle-arm engages, substantially as herein described.

30. The combination, with a steering-wheel shaft c^{11}, a brake, and a rod and lever for operating it, and a rock-shaft having a bracket H′ at one end and an arm H^2 at the other end connected with the steering-wheel shaft, of the handle-arm H^3, having a rack at the lower end and sliding lengthwise in said bracket, a cam having a spline connection with the handle-arm for operating the brake-lever, and a pivoted leg having a gear-sector with which the rack on the handle-arm engages, substantially as herein described.

31. The combination, with a pivoted leg having a gear-sector concentric with the pivot, of a handle-arm H^3, having a rack at the lower end engaging the gear-sector, a bearing wherein the handle-arm may be moved lengthwise

and turned, and a cam having a spline connection with the handle-arm and serving to lock the leg in operative and inoperative position, substantially as herein described.

32. The combination, with the brake and a lever whereby it is applied and a pivoted leg having a gear-sector concentric with the pivot, of a handle-arm H^3, having a rack at the lower end engaging said gear-sector, a bearing wherein said handle-arm may move lengthwise and turn, and a cam having a spline connection with said handle-arm and serving both to apply the brake and lock the leg in operative or inoperative position, substantially as herein described.

33. The combination, with the backbone and the lower yokes or frames which are supported by the shaft or axle, of a sleeve or socket receiving the backbone through it and secured upon the exterior thereof, and braces or rods connecting the lower yokes or frames with the sleeve or socket upon the backbone, substantially as herein described.

34. The combination, with the main driving-wheel and the smaller steering-wheel, of a backbone comprising two sections connected together by a vertical pivot which provides for the use of the machine with the large wheel in advance, and a locking device whereby the two sections of the backbone may be held rigidly in line when the machine is to be used with the steering-wheel in advance, substantially as herein described.

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