No. 609,253. Patented Aug. 16, 1898.

B. C. VANDUZEN.

TRACTION ENGINE.

(Application filed Sept. 13, 1894.)

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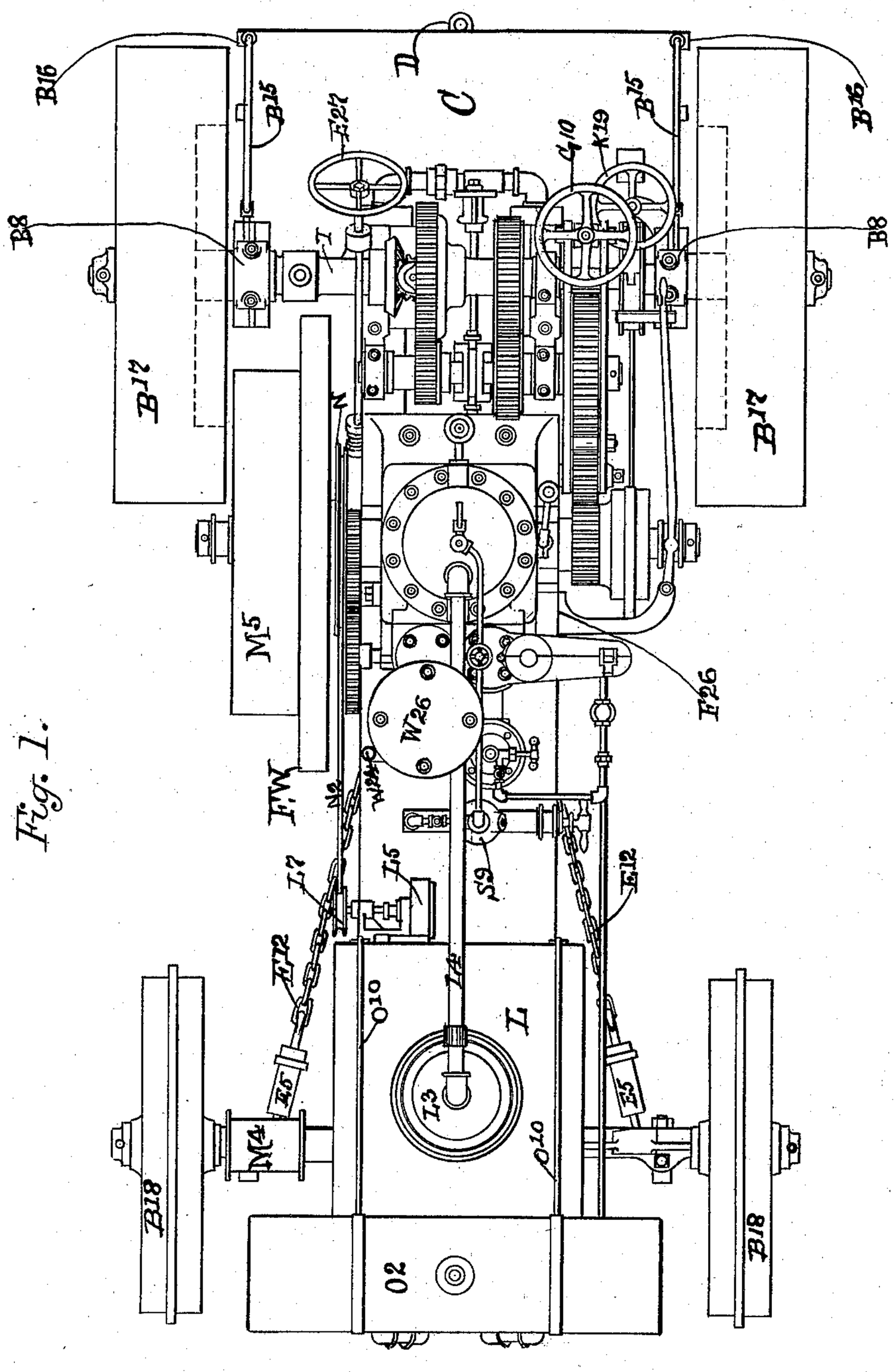

Fig. 1.

Attest.
K. Smith
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Inventor.
Benjamin C. Vanduzen

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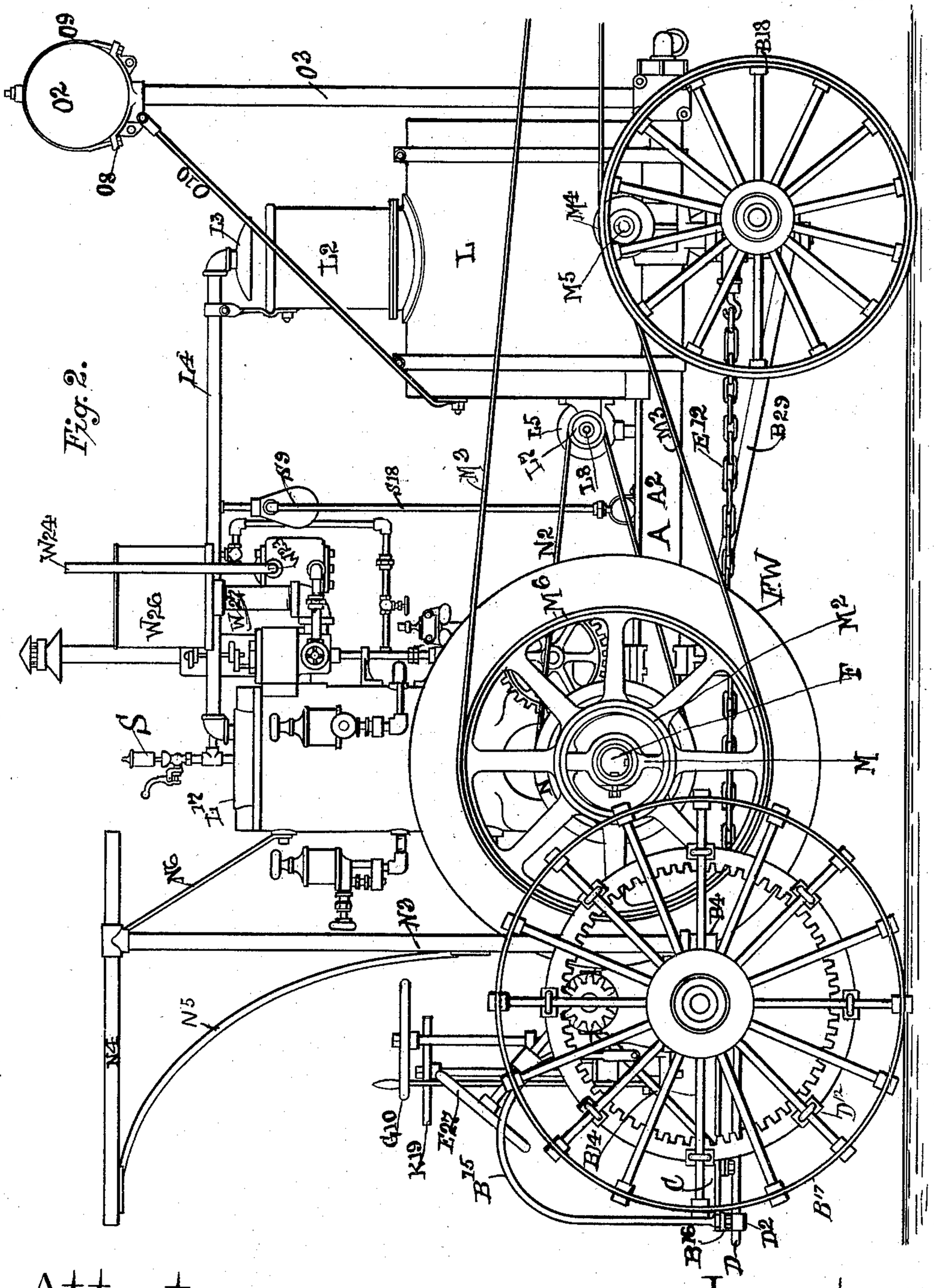
(No Model.) 19 Sheets—Sheet 2.



Attest.
T. Smith
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(Application filed Sept. 13, 1894.)

(No Model.)

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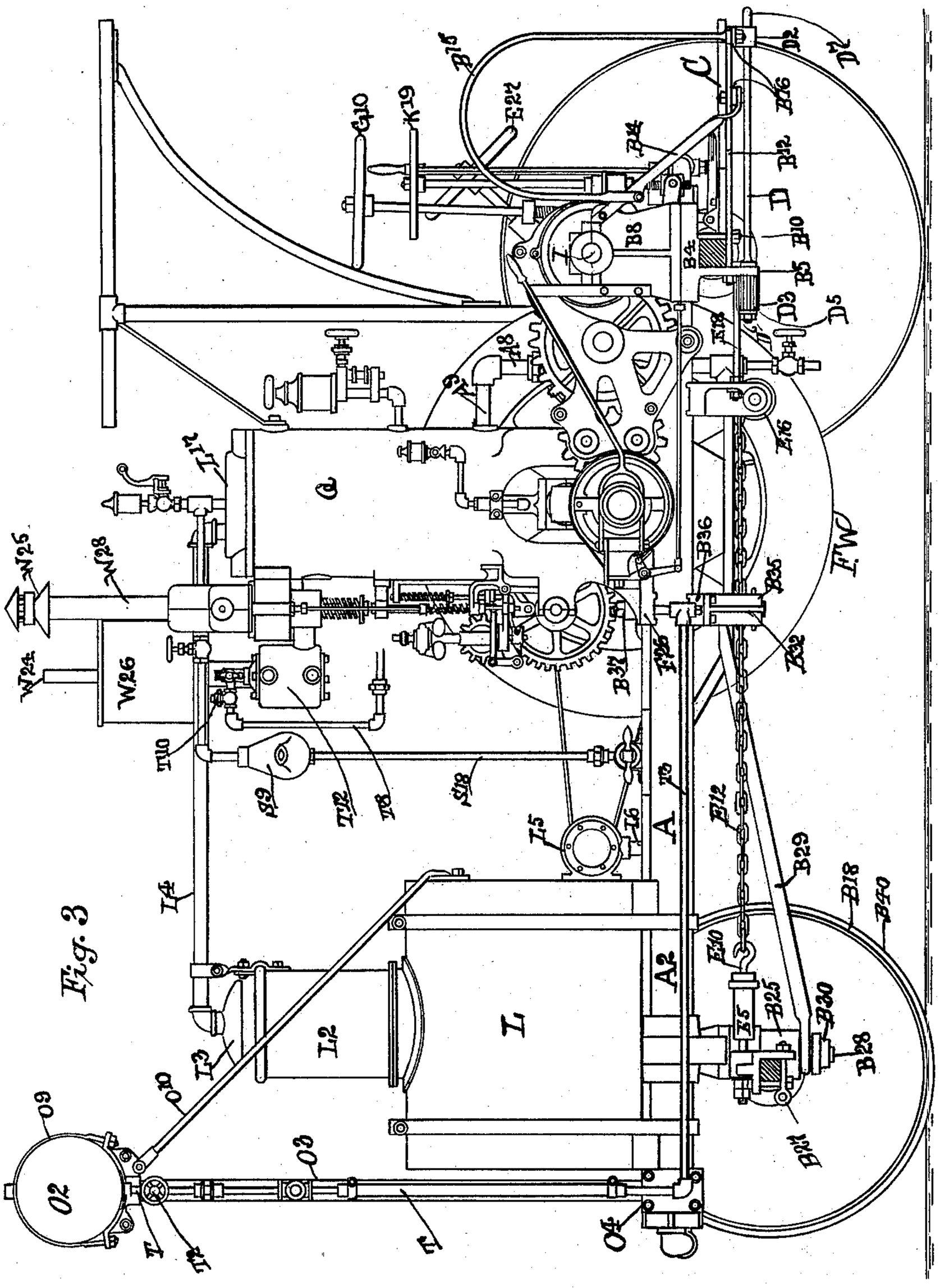

Fig. 3

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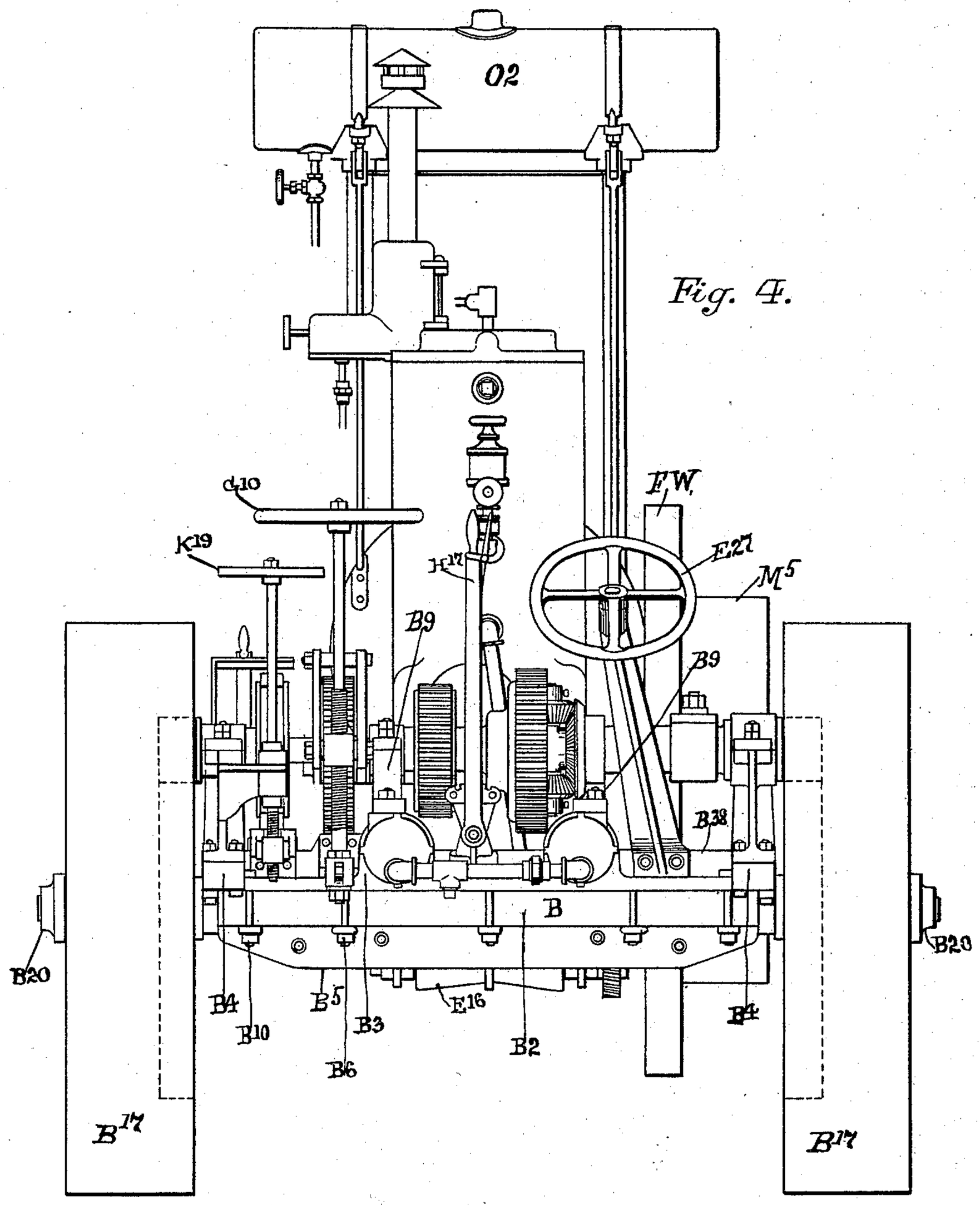

Fig. 4.

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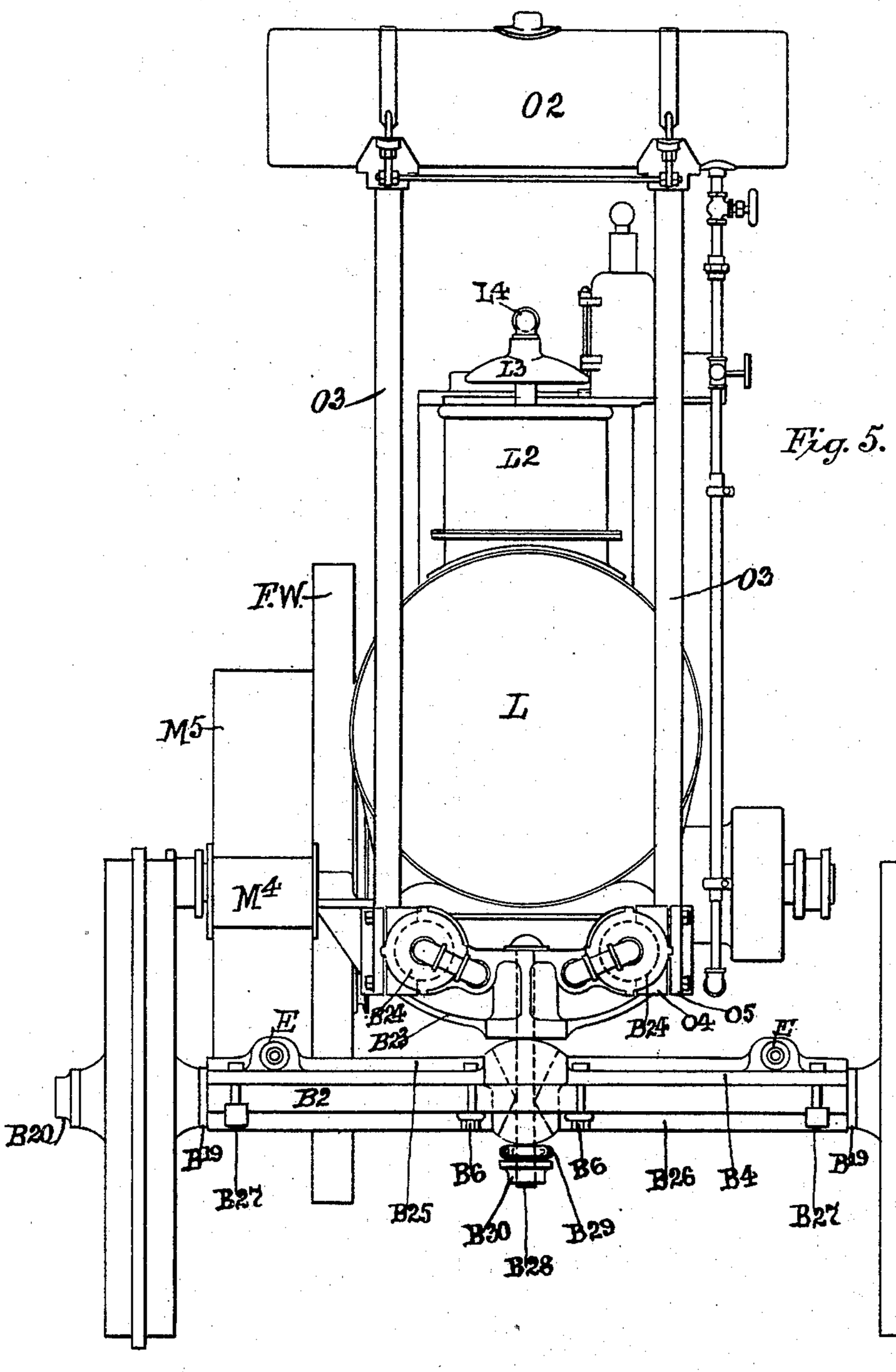

Fig. 5.

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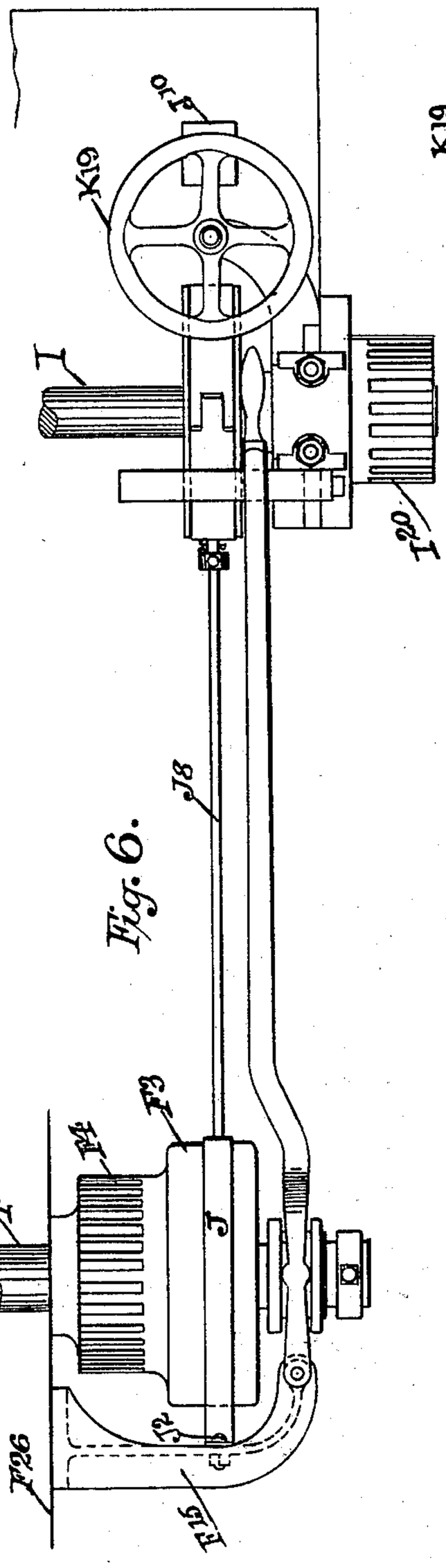

Fig. 6.

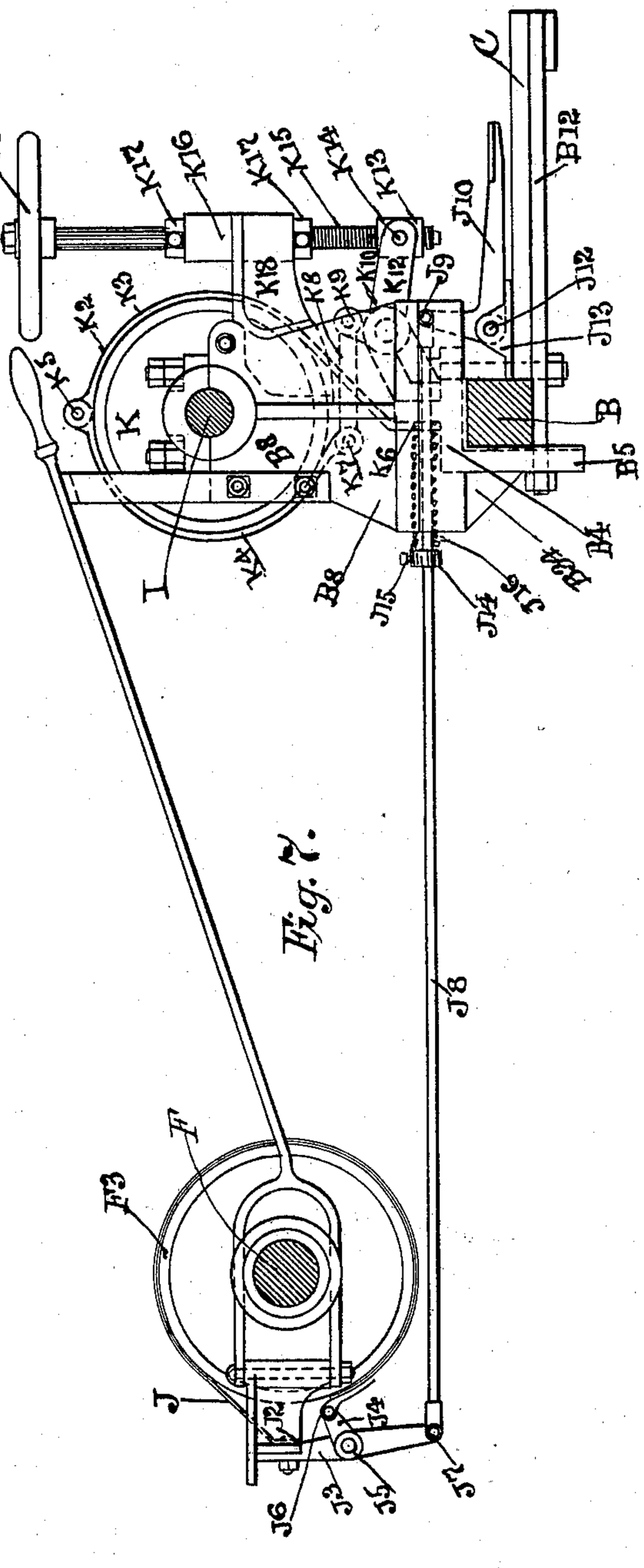

Fig. 7.

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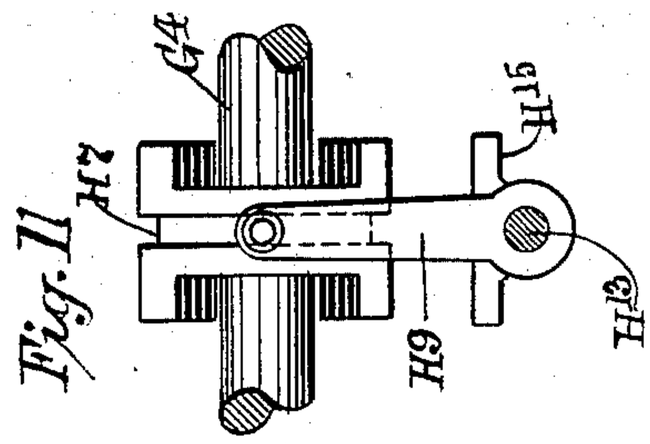
Fig. 11.



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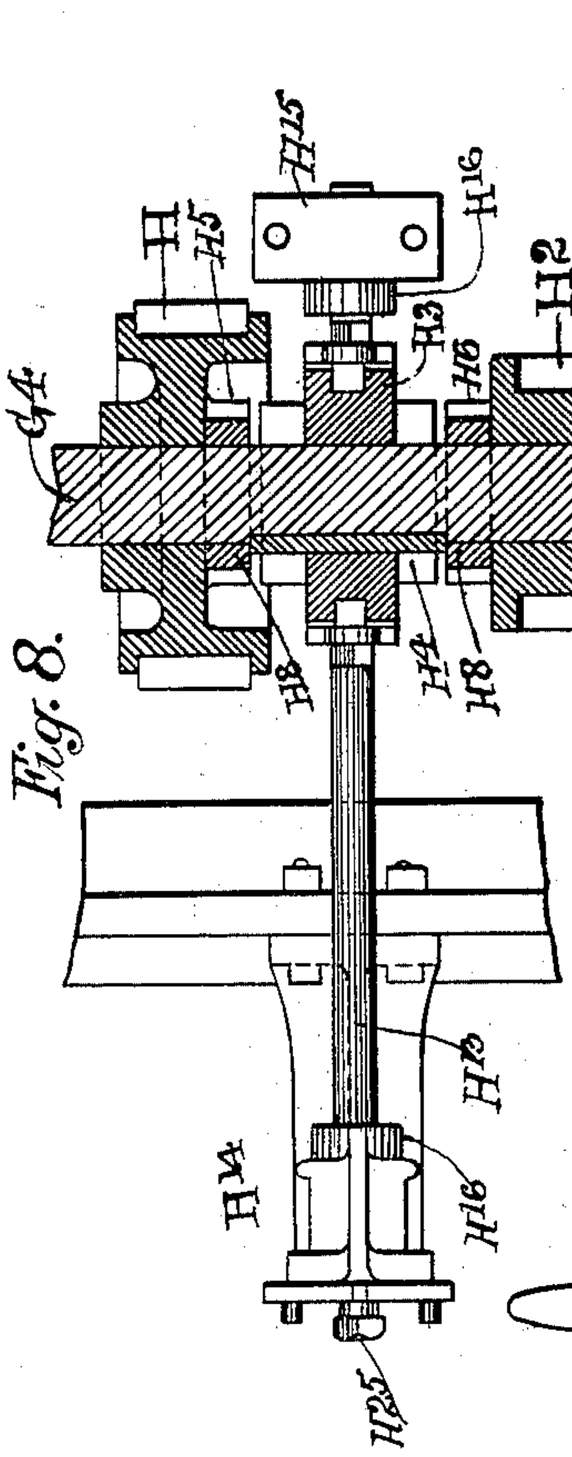
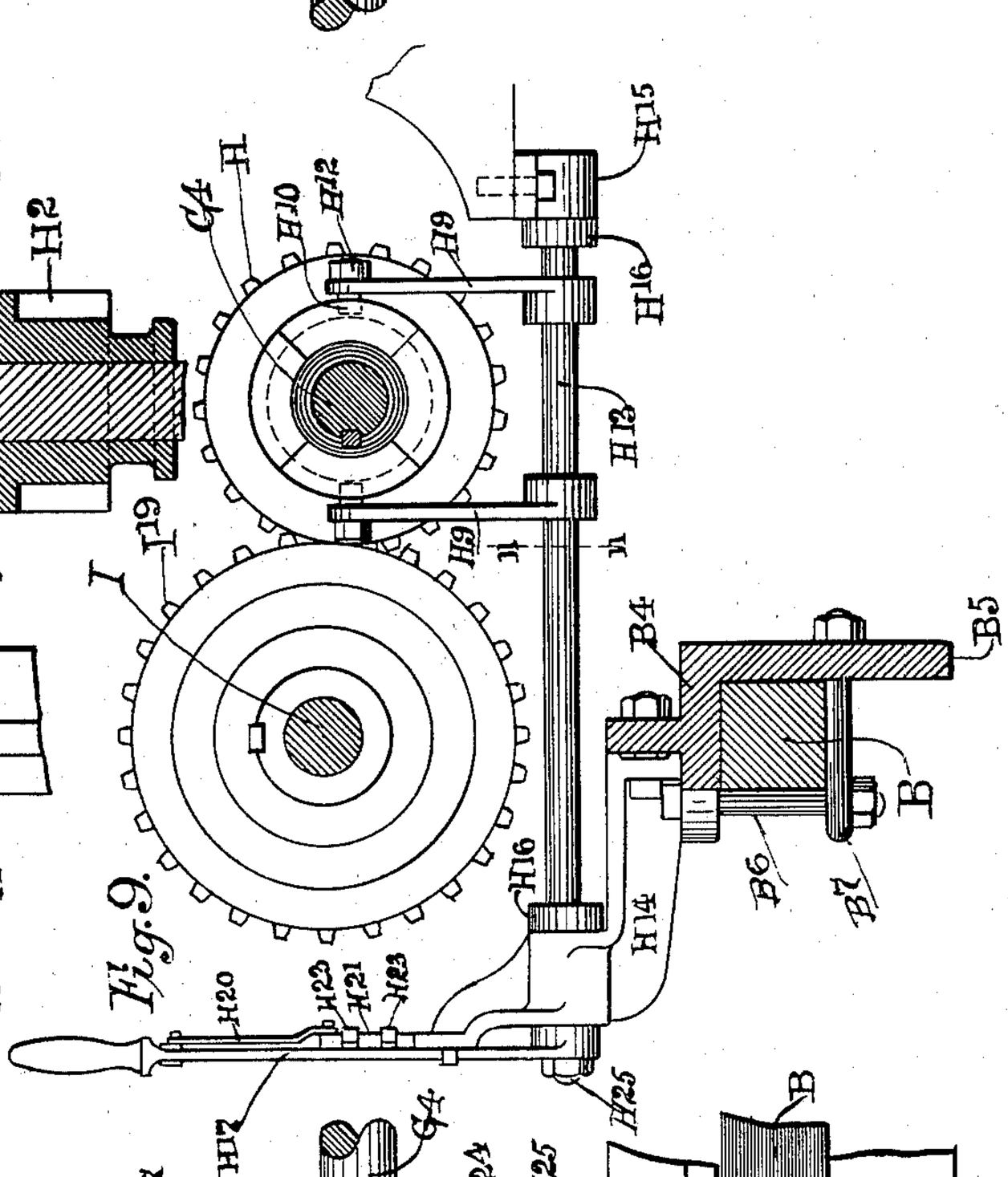


Fig. 9.



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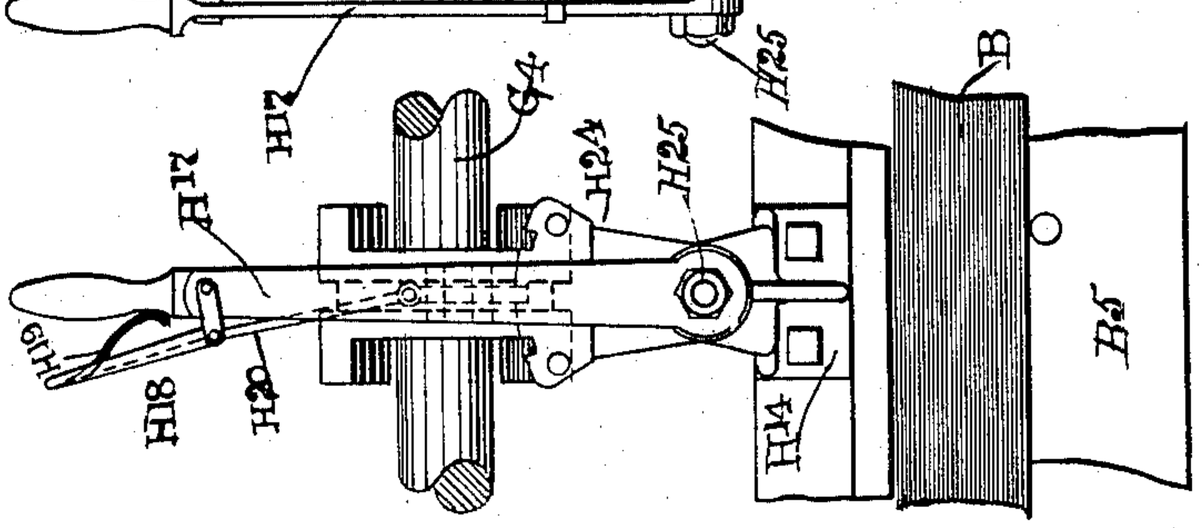

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Fig. 14.

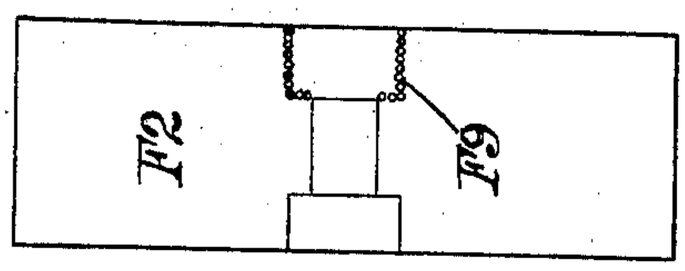
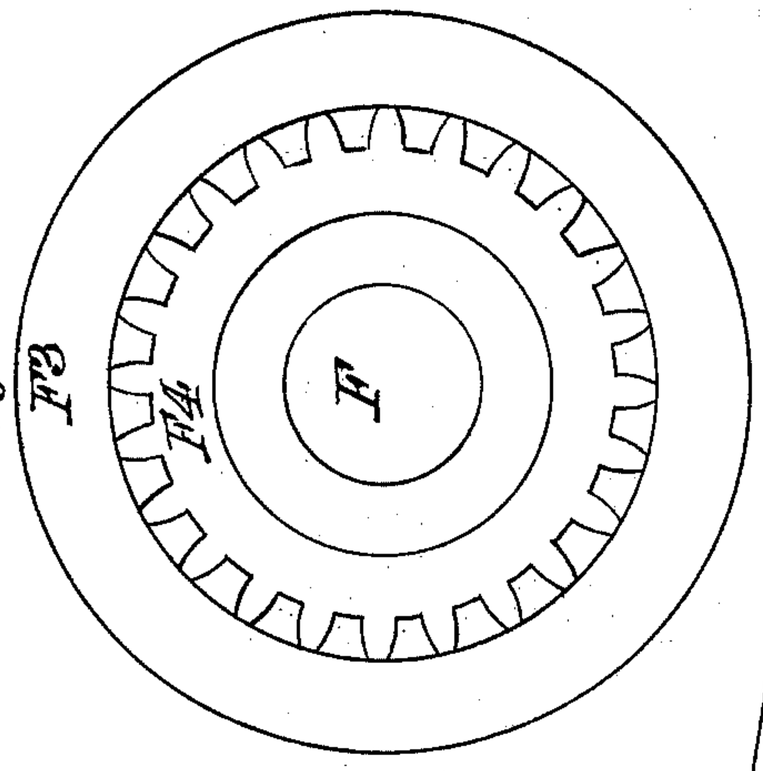


Fig. 13.



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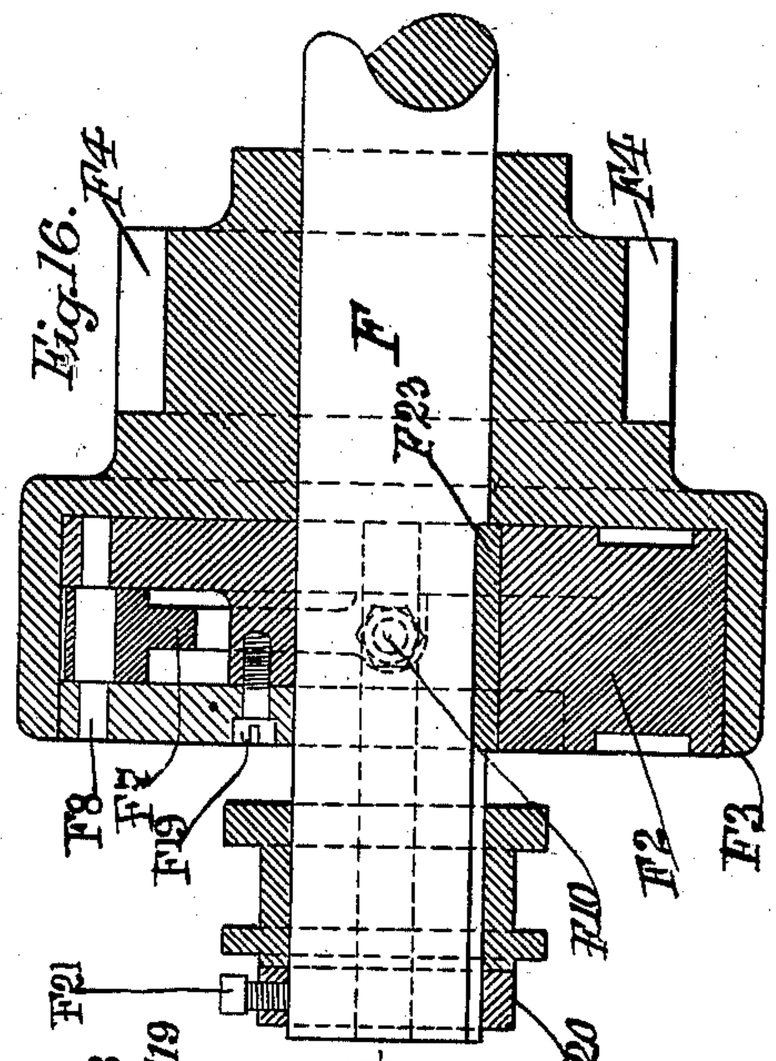
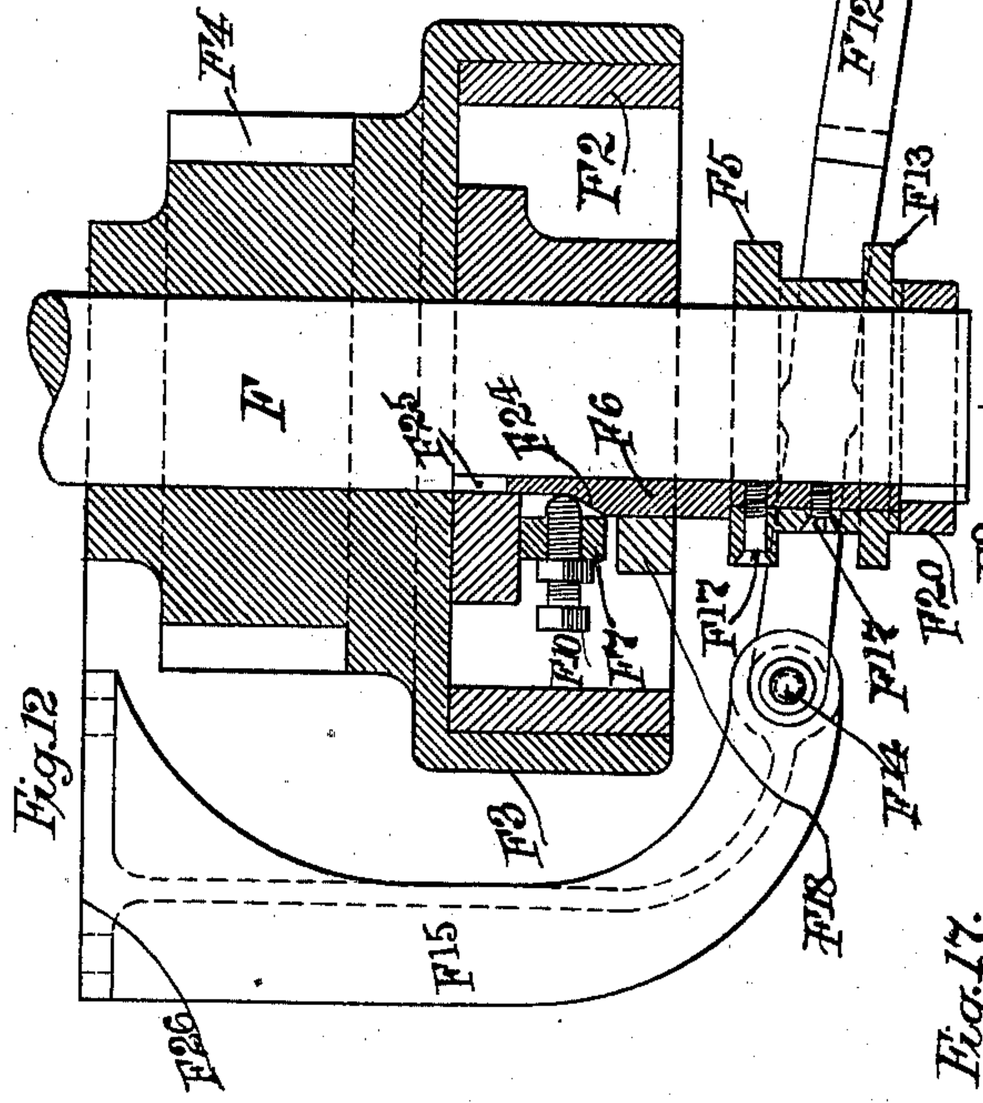


Fig. 12



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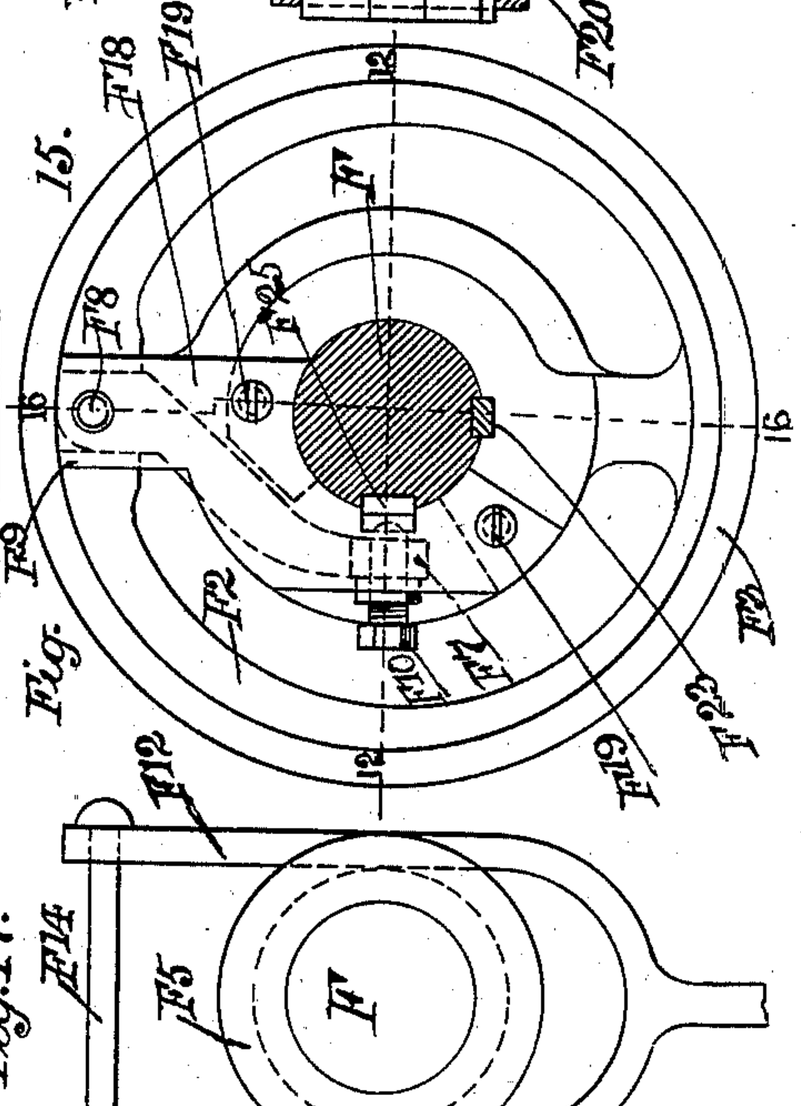

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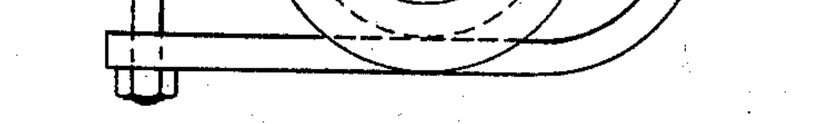

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Fig. 18

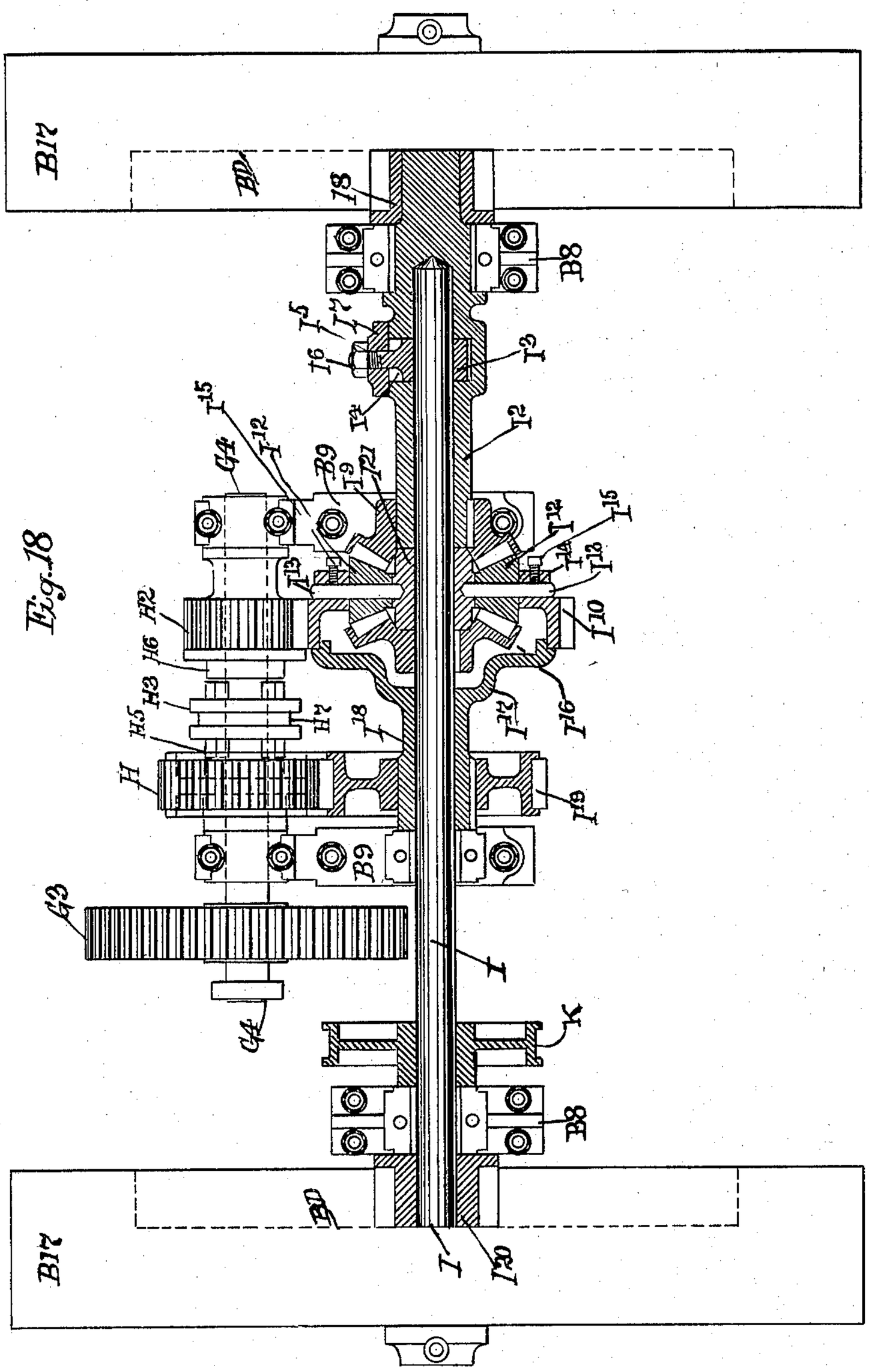

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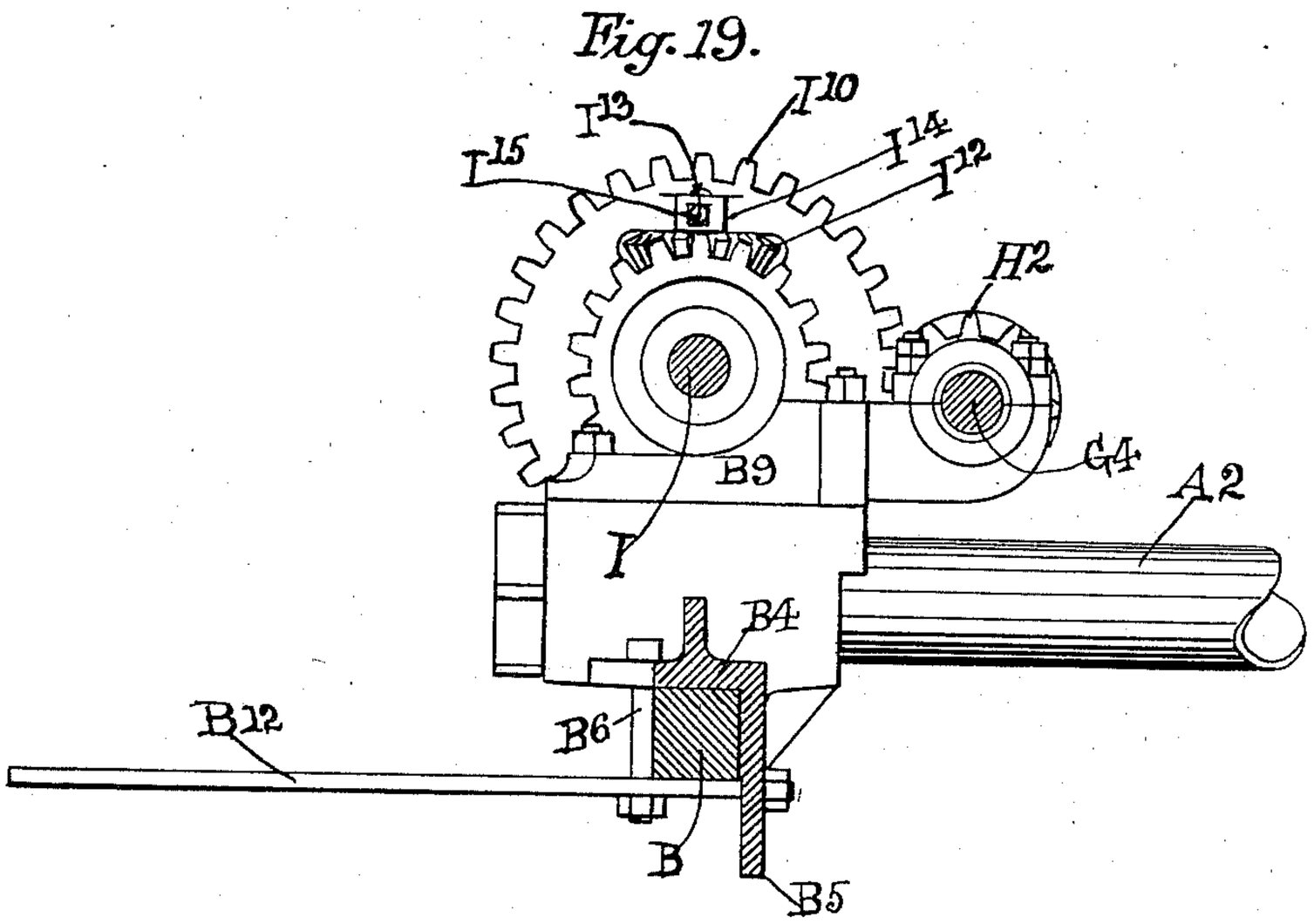
Fig. 19.



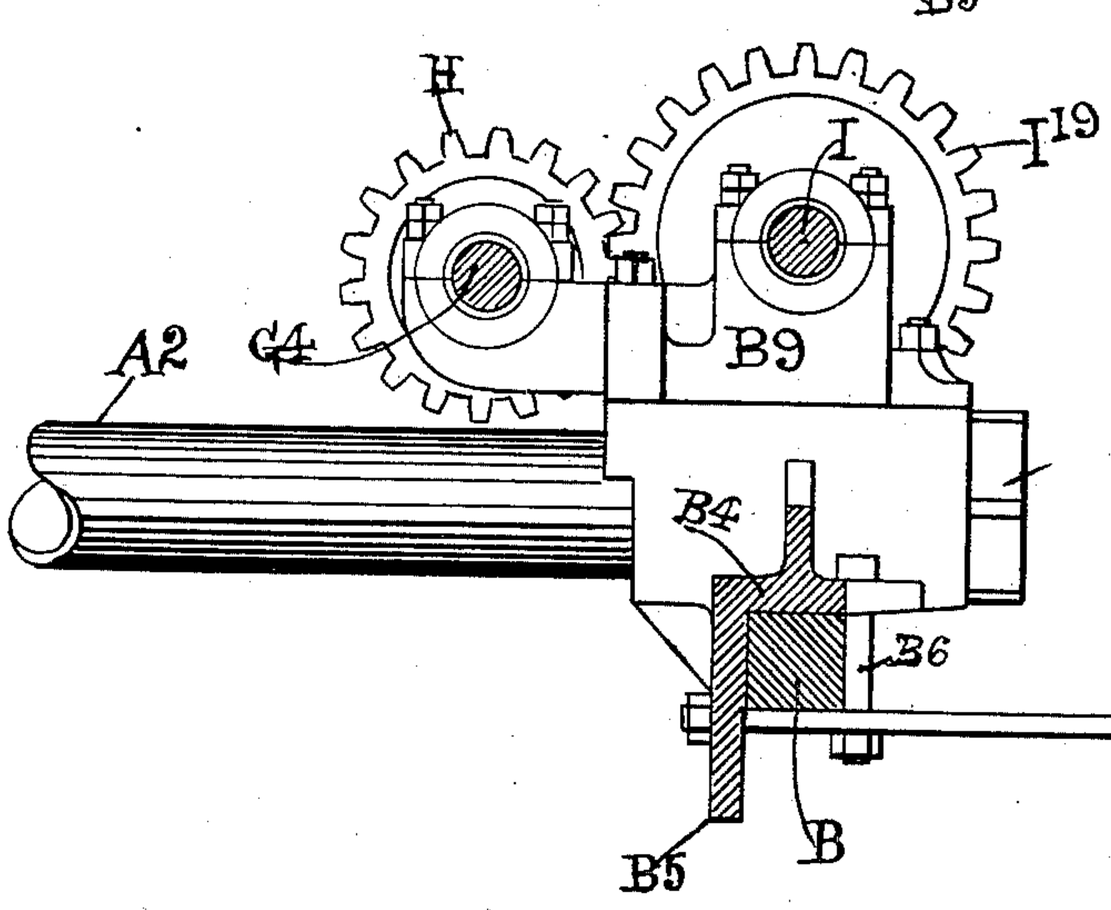


Fig. 20.

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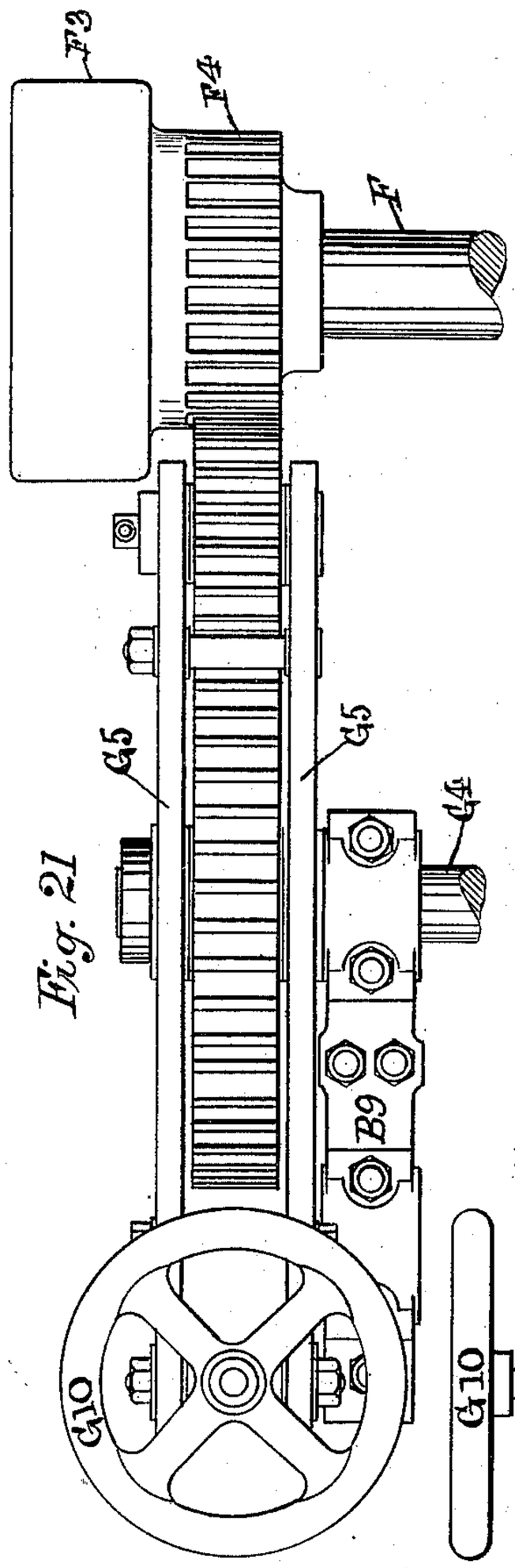

Fig. 21

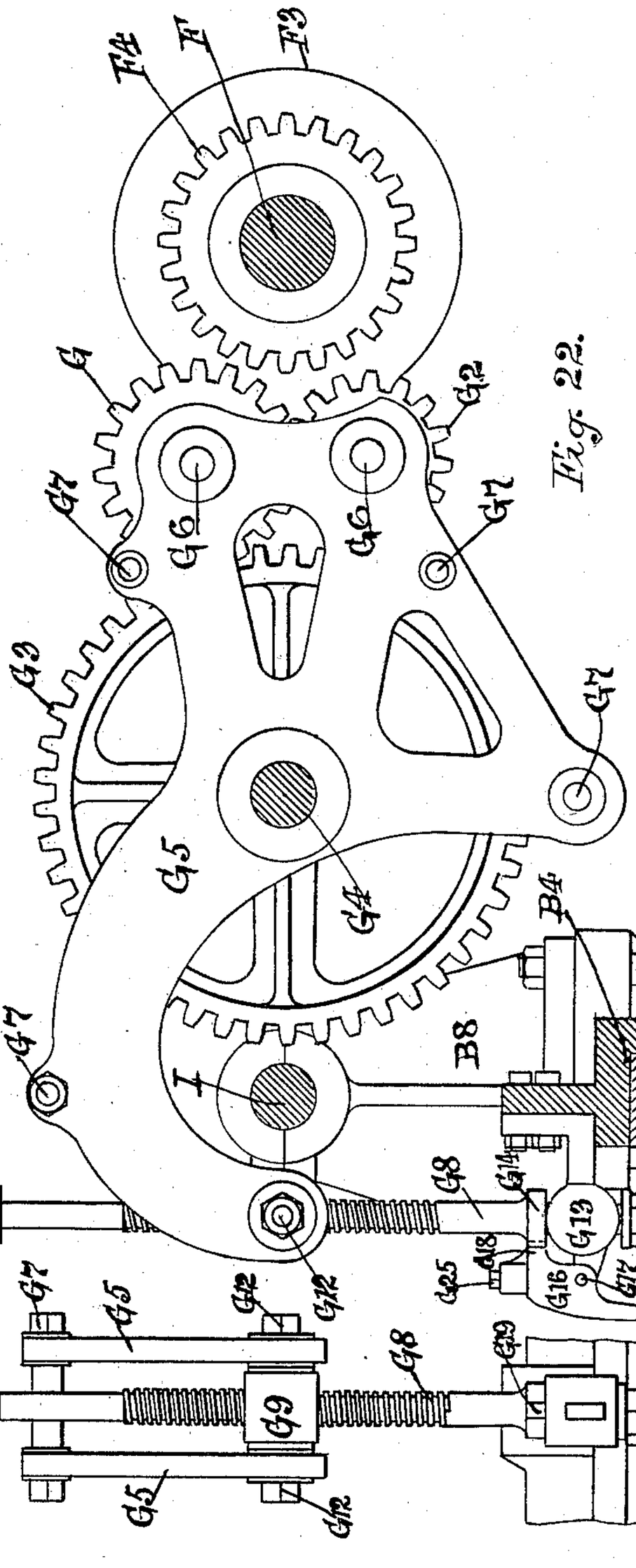

Fig. 22.

Fig. 23.

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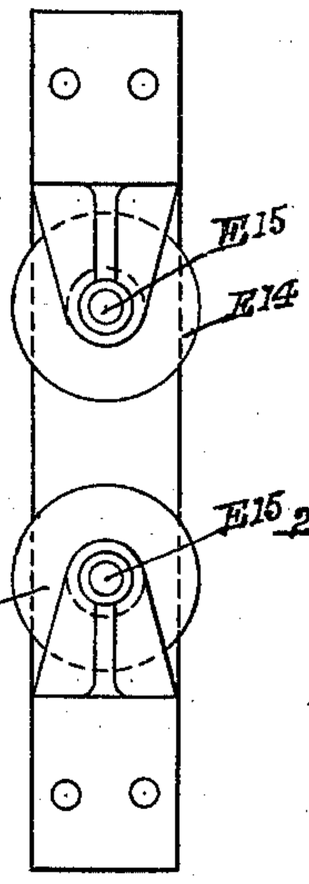
Fig. 26



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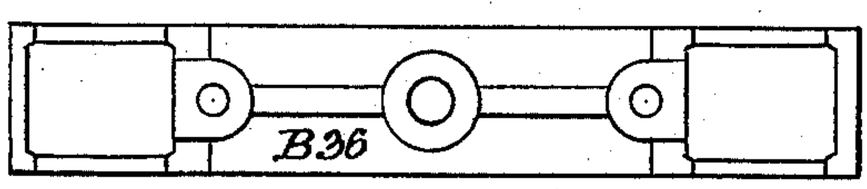

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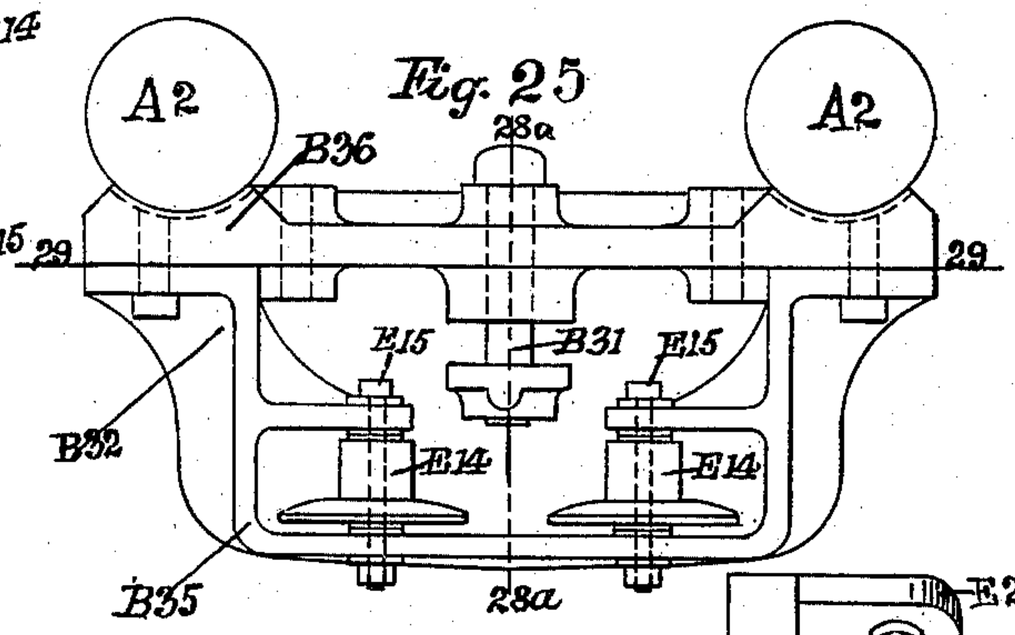
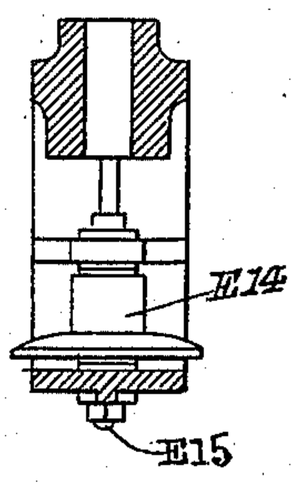


Fig. 25a.



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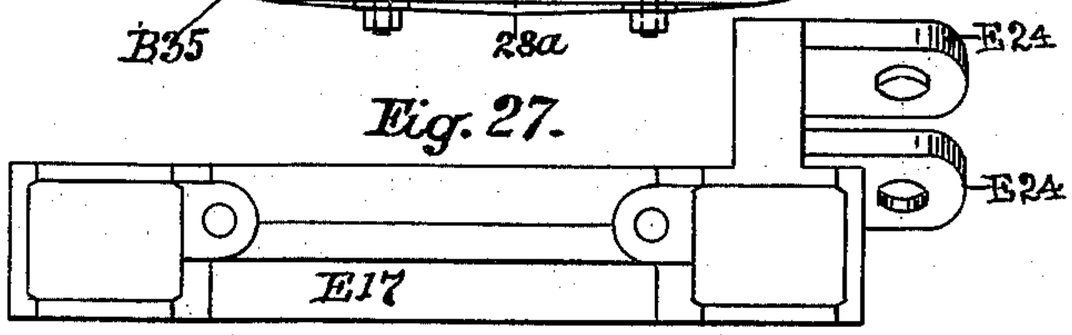

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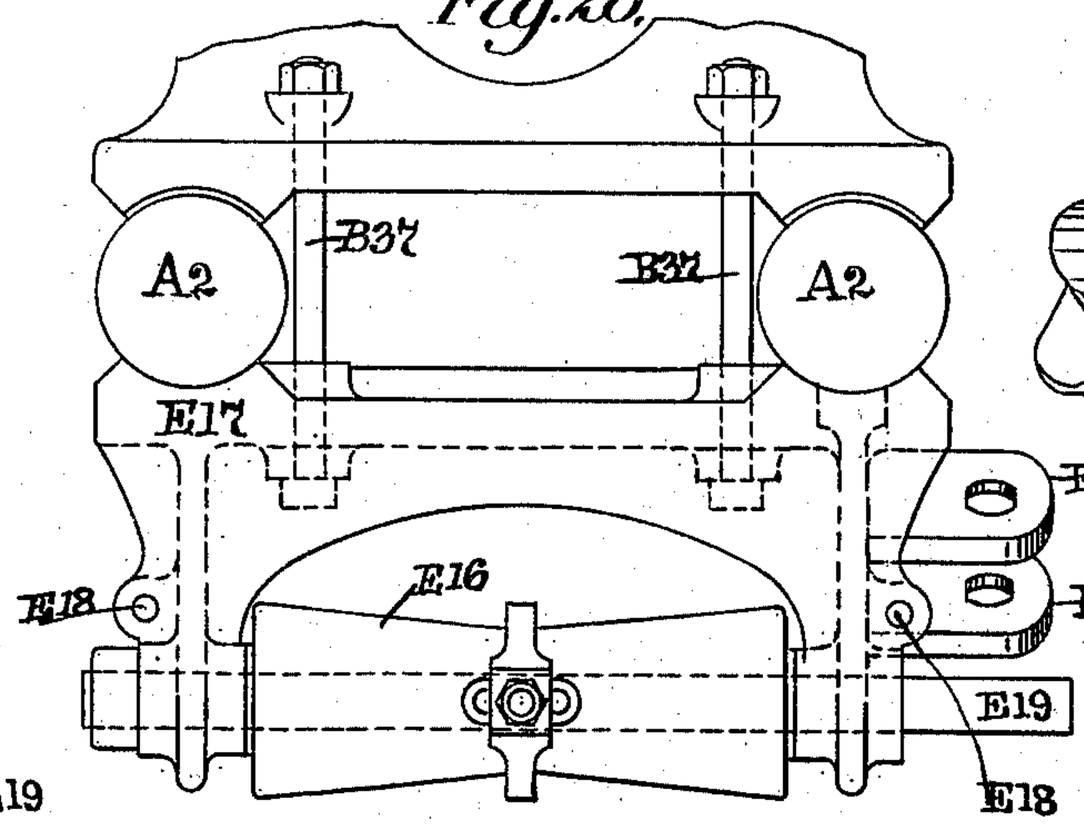
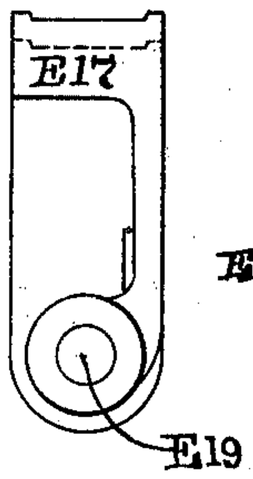


Fig. 29



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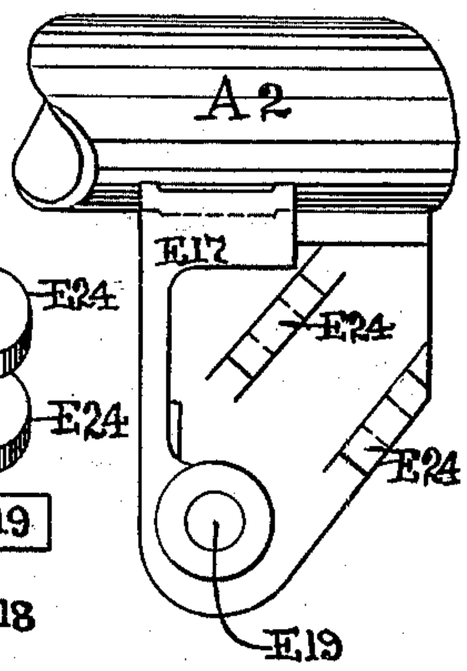

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J. E. Fitzpatrick

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Benjamin C. Vanduzen

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Fig. 33.

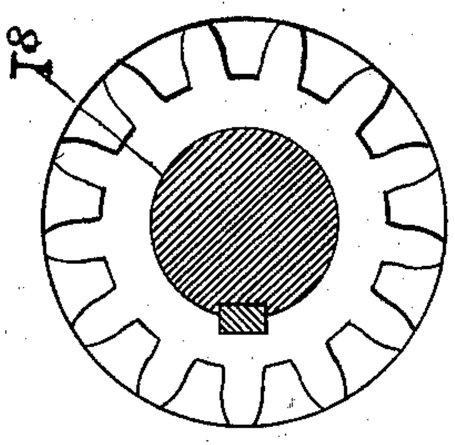

Fig. 34.

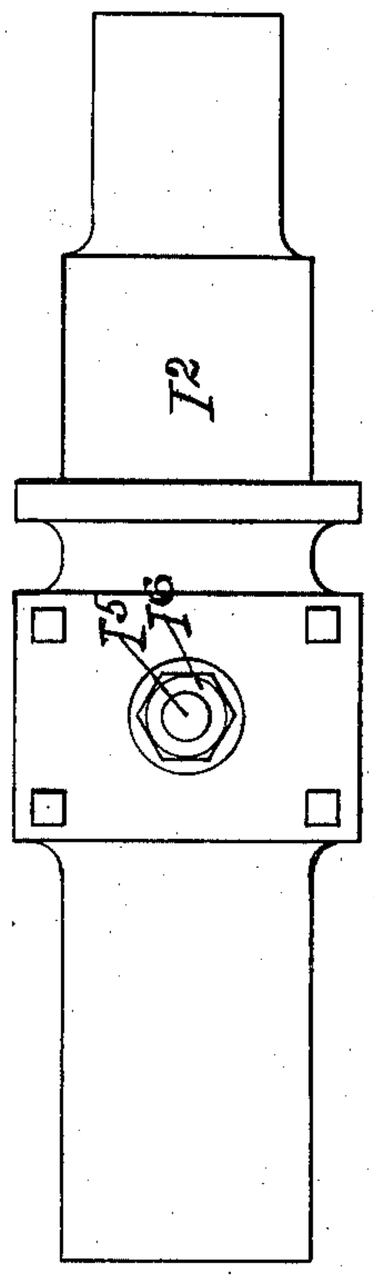

Fig. 31

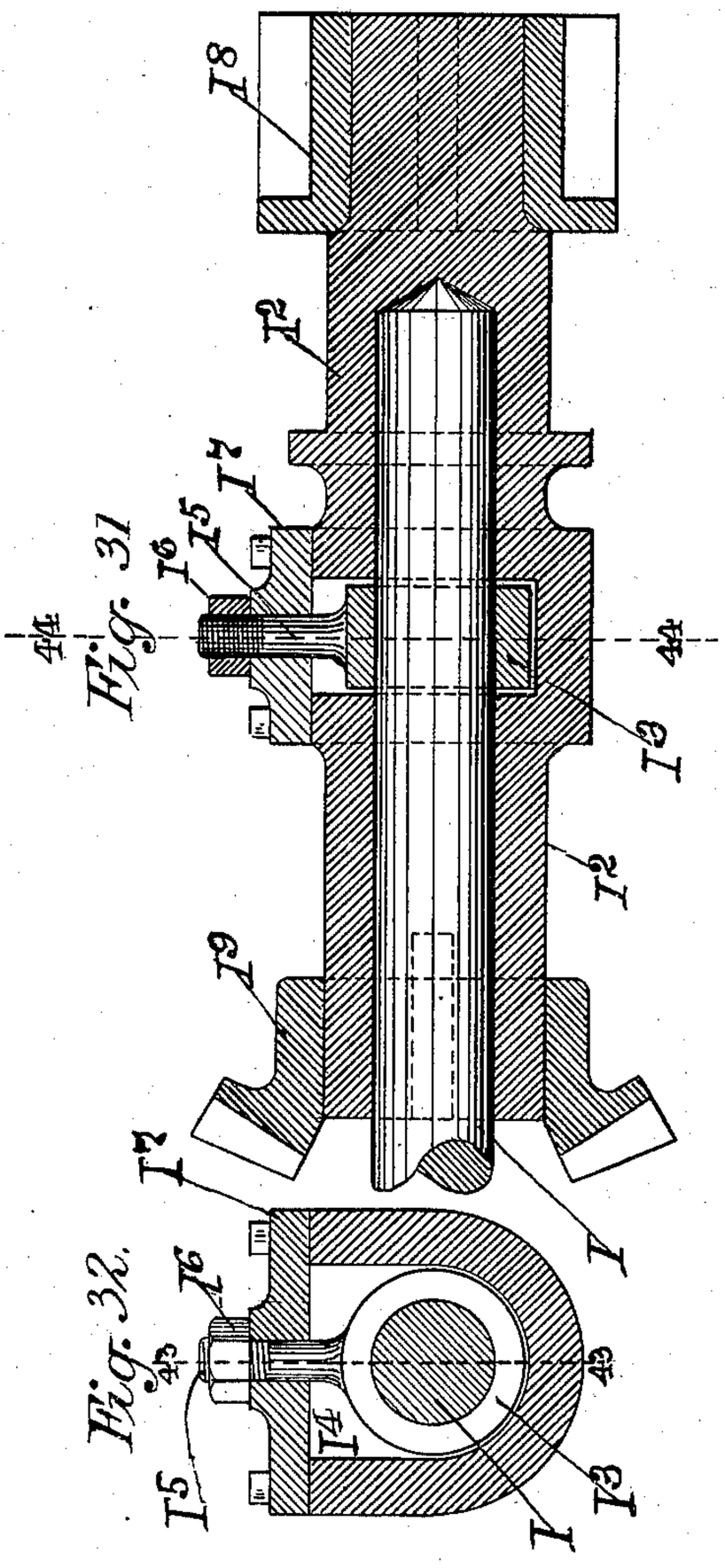

Fig. 32.

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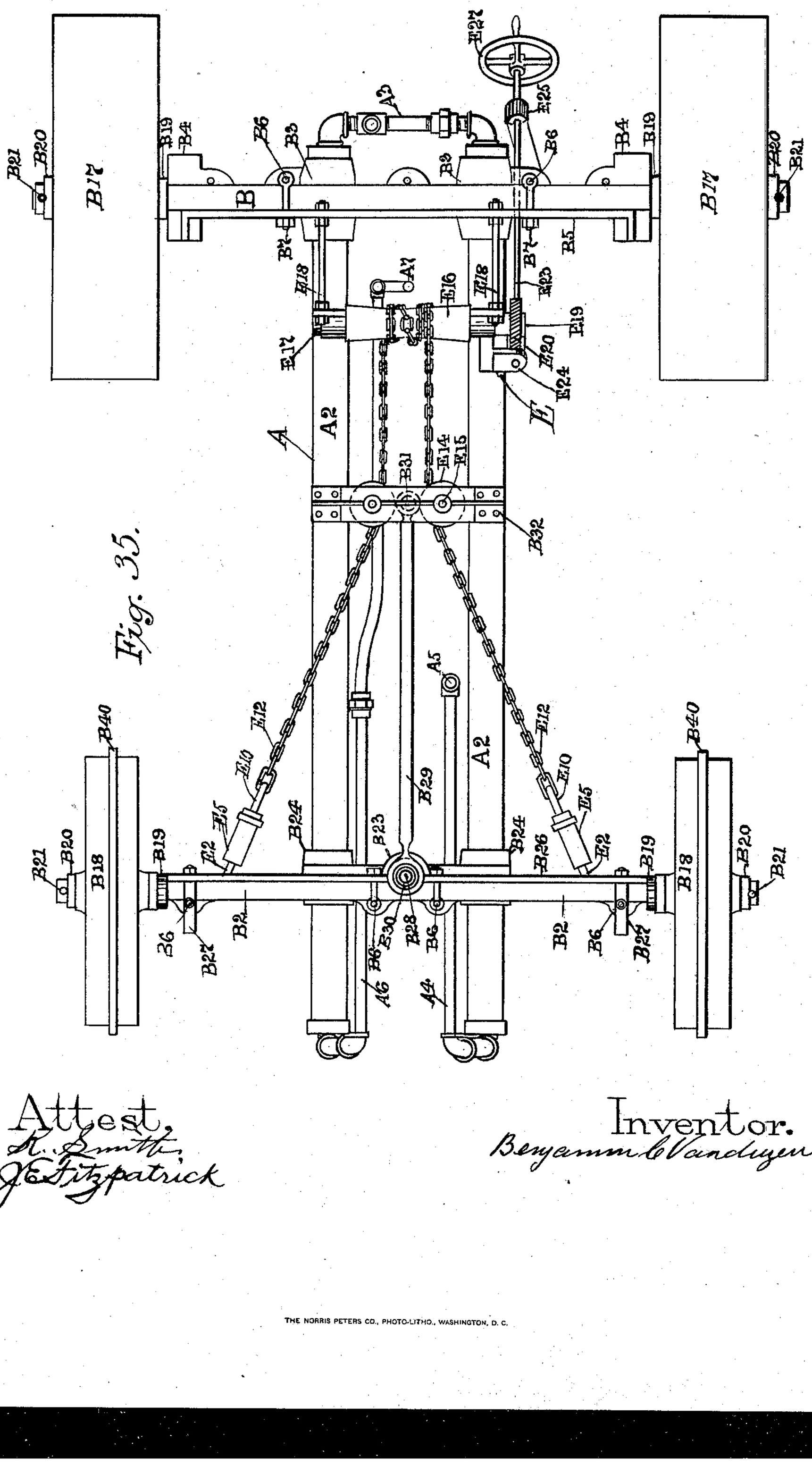

Fig. 35.

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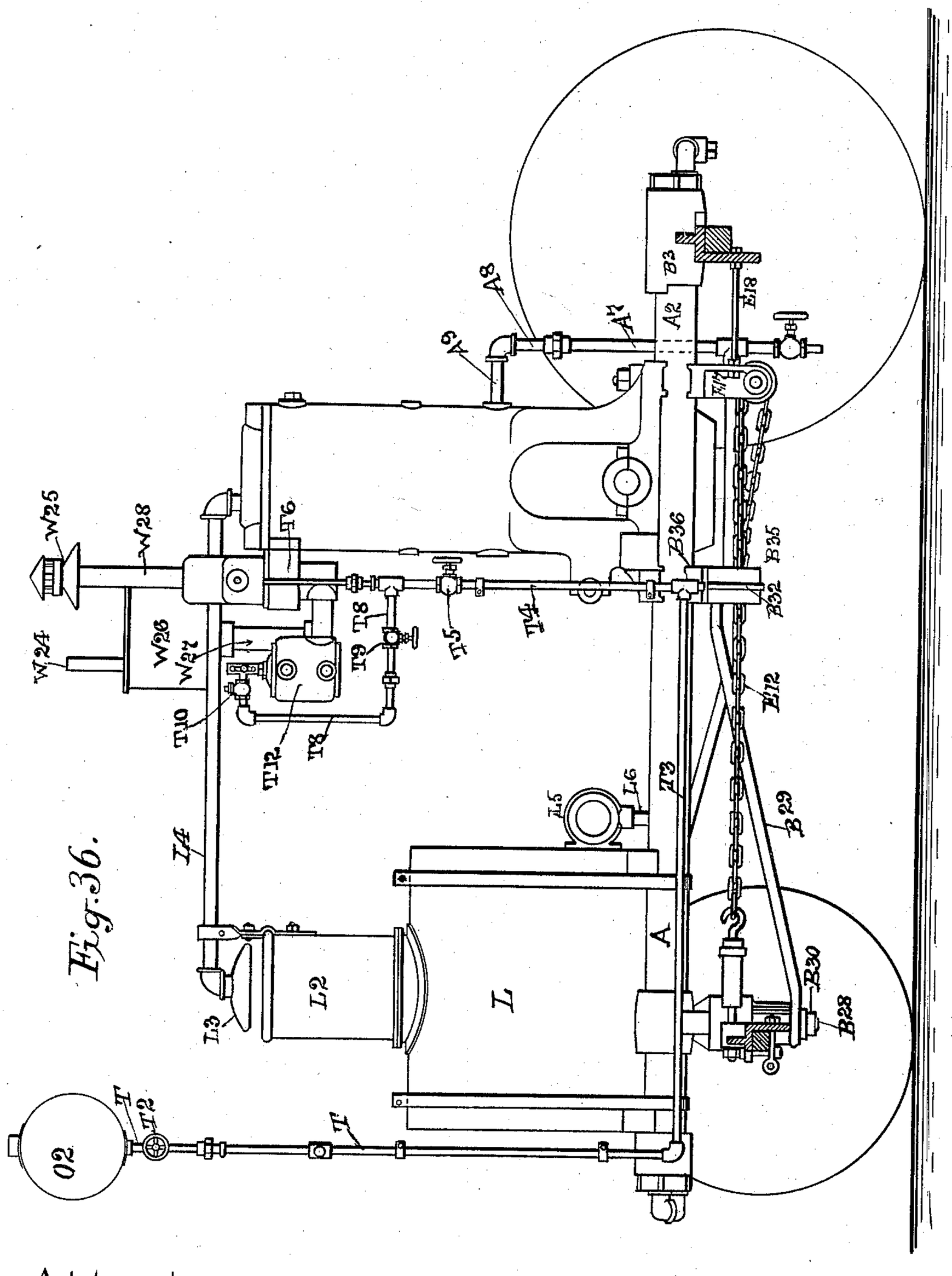

Fig. 36.

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T. Smith

J. E. Fitzpatrick

Inventor.

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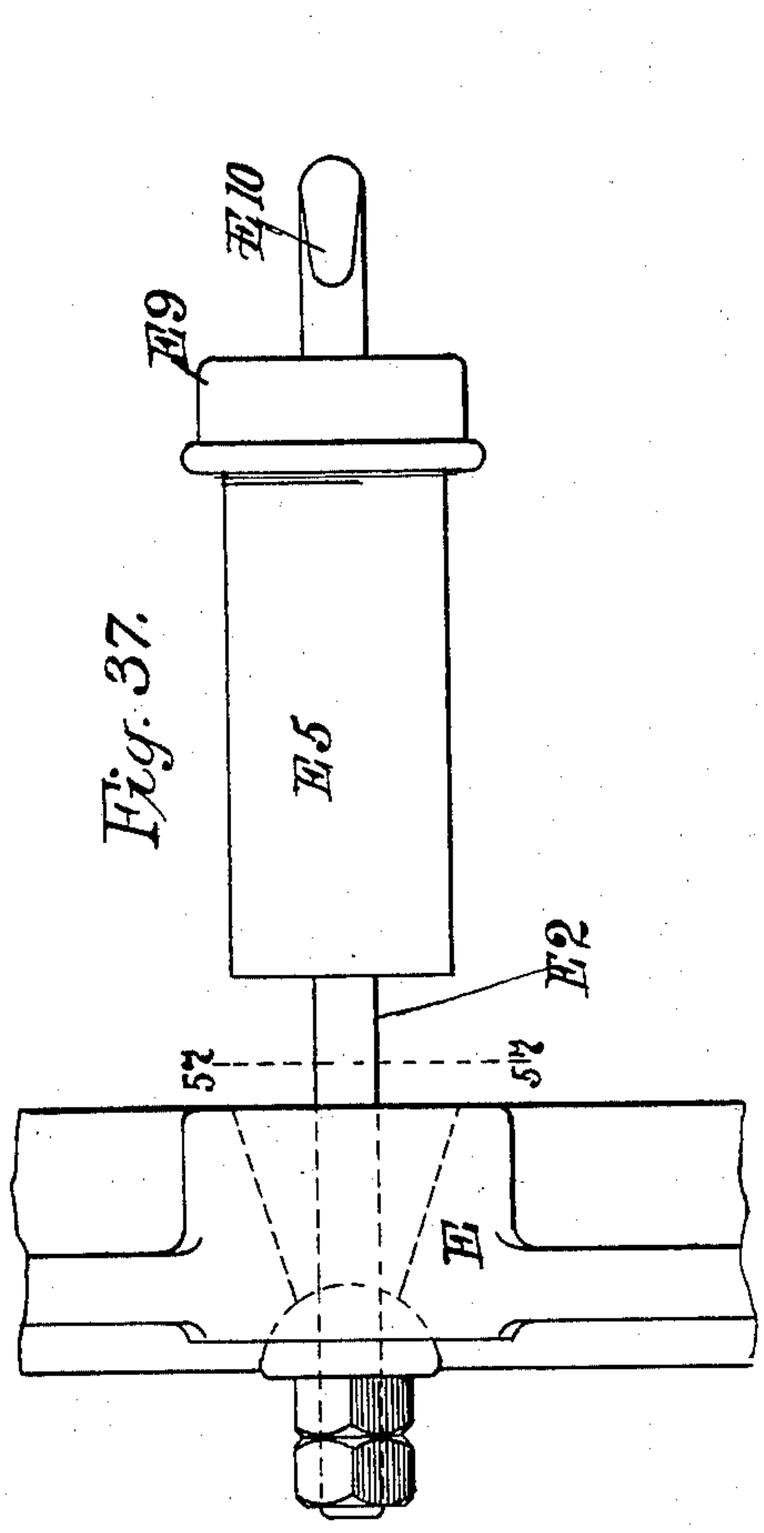
Fig. 37.



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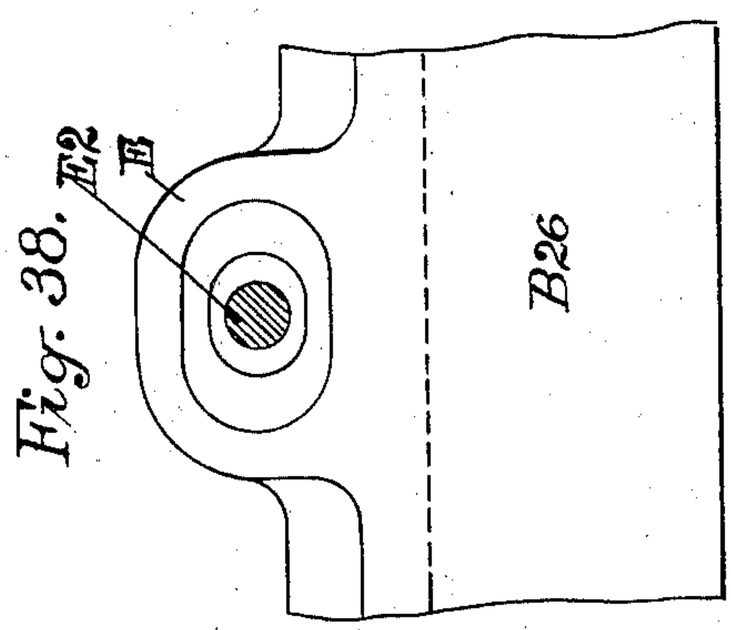

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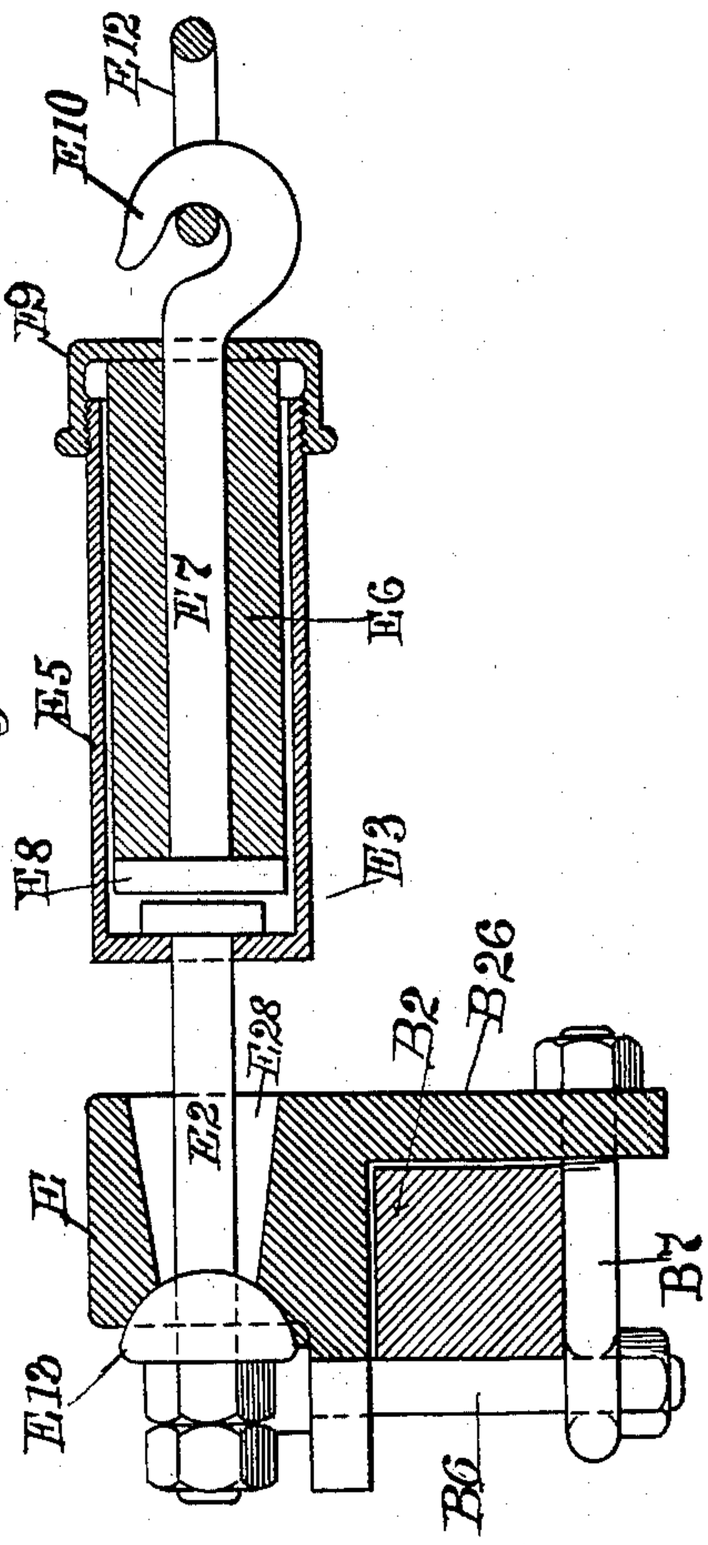

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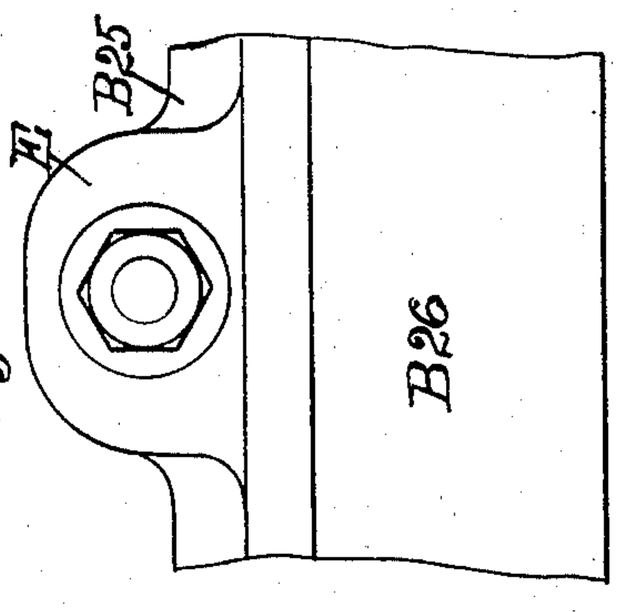

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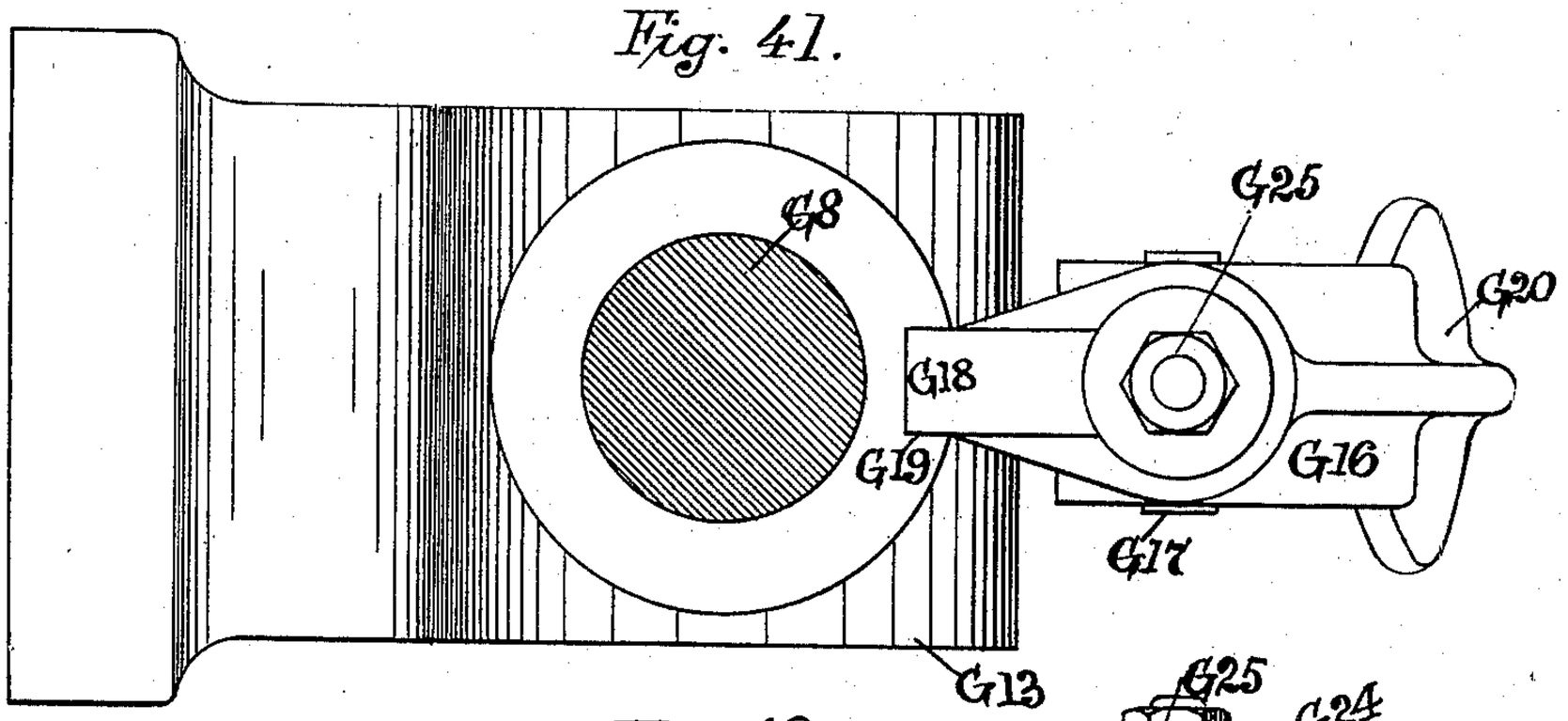
Fig. 41.



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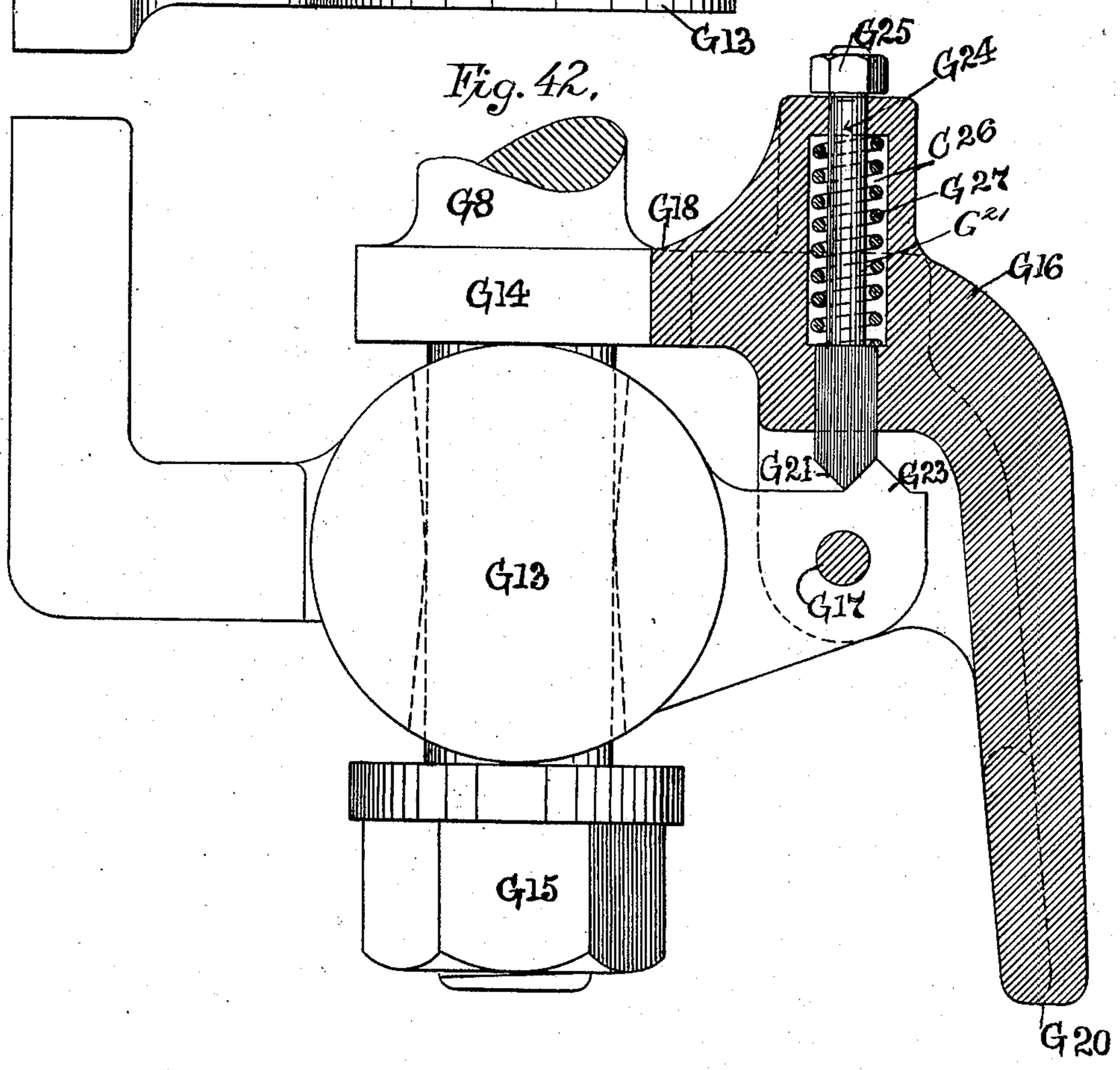

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(No Model.)

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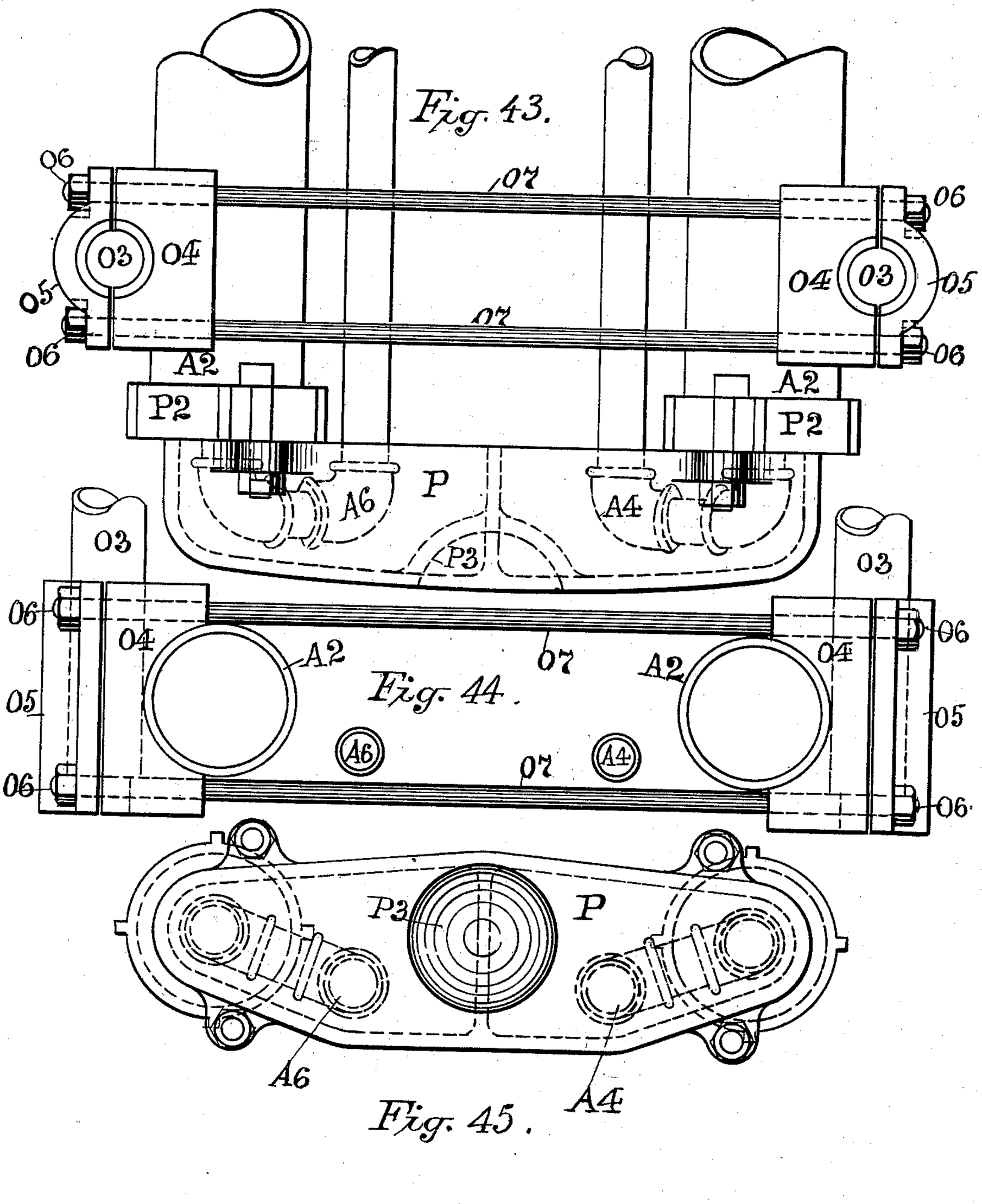

Fig. 43.

Fig. 44.

Fig. 45.

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H. Smith
J. E. Fitzpatrick

Inventor.
Benjamin C. Vanduzen

No. 609,253. Patented Aug. 16, 1898.

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(Application filed Sept. 13, 1894.)

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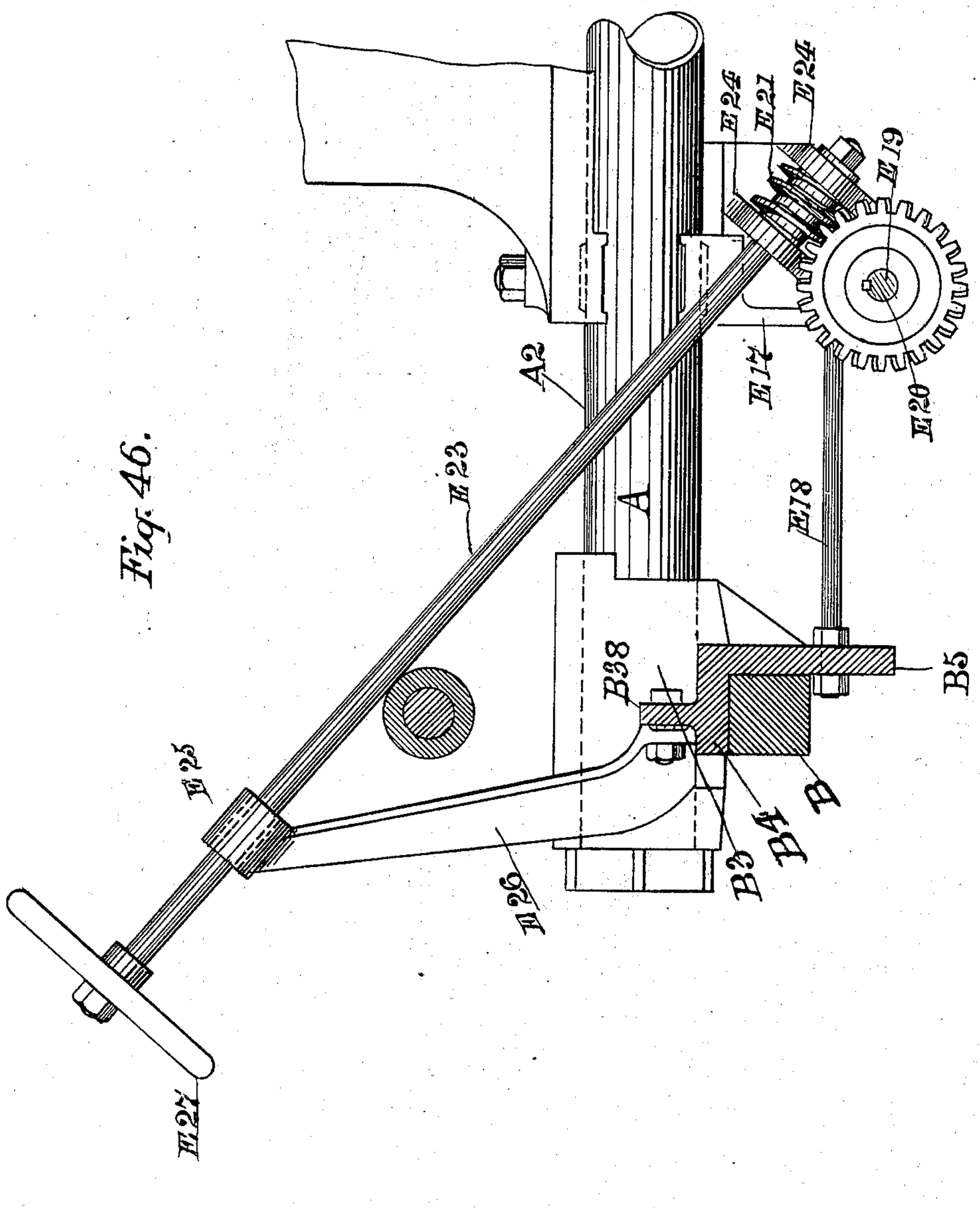
Fig. 46.



Attest,
K. Smith
J. E. Fitzpatrick

Inventor:
Benjamin C. Vanduzen

UNITED STATES PATENT OFFICE.

BENJAMIN C. VANDUZEN, OF WINTON PLACE, OHIO, ASSIGNOR TO THE VANDUZEN GAS AND GASOLINE ENGINE COMPANY, OF CINCINNATI, OHIO.

TRACTION-ENGINE.

SPECIFICATION forming part of Letters Patent No. 609,253, dated August 16, 1898.

Application filed September 13, 1894. Serial No. 522,898. (No model.)

To all whom it may concern:

Be it known that I, BENJAMIN C. VANDUZEN, a citizen of the United States, and a resident of the town of Winton Place, in the county of Hamilton and State of Ohio, have invented certain new and useful Improvements in Traction-Engines, of which the following is a specification.

Certain features of my invention have to do with new and valuable mechanism for burning the gases derived from gasolene, benzin, kerosene, or other coal oils, and thereby operating an engine.

Certain other features of my invention have to do with the construction of a new engine, and certain other features of my invention relate to mechanism whereby the said engine is a valuable traction-motor.

The several features of my invention and the various advantages resulting from their use, conjointly or otherwise, will be apparent from the following description and claims:

In the accompanying drawings, making a part of this application, and in which similar letters of reference indicate corresponding parts, Figure 1, Sheet 1, is a plan of a machine illustrating my invention. Fig. 2, Sheet 2, is an elevation of the exhaust side of said machine—that is to say, the side where the burned products of combustion are exhausted. Fig. 3, Sheet 3, is an elevation of the receiving side of the said machine—namely, that side which is opposite to the one shown in Fig. 2. Fig. 4, Sheet 4, is an elevation of the rear end of the machine. Fig. 5, Sheet 5, is an elevation of the front end of the machine. Fig. 6, Sheet 6, is a plan view of the mechanism of the brake and mechanism for starting and stopping. Fig. 7, Sheet 6, is a side elevation of the same. Fig. 8, Sheet 7, is a plan view showing details of the claw-clutch arrangement. Fig. 9, Sheet 7, is an elevation of the said clutch arrangement. Fig. 10, Sheet 7, is an elevation of the end of the clutch and showing the reverse-lever. Fig. 11, Sheet 7, represents an elevation of that side of the central portion of the clutch which faces toward the left in Fig. 9 and taken in the plane of the dotted line 11 11 of Fig. 9. The figures of Sheet 8 show details of the friction-clutch, to wit: Fig. 12 is a sectional plan. Fig. 13 is an elevation showing gear-wheel. Fig. 14 is a plan of the expander. Fig. 15 is an elevation of the friction-shell, expander, and lever, all combined. Fig. 16 is a sectional plan. Fig. 17 is an elevation of the forked connection for shifting and expanding the expander. Fig. 18 of Sheet 9 is a plan of the driving-gear and showing the differential clutch-gears in section and device for locking the shaft connections of driving-wheels. The figures of Sheet 10 show brackets for carrying the clutch-shaft, to wit: Fig. 19 is an elevation of the single bracket. Fig. 20 is an elevation of the double bracket. The figures of Sheet 11 show reversing-gear, to wit: Fig. 21 is a plan of the same. Fig. 22 is a side elevation thereof. Fig. 23 is an end elevation thereof. The figures of Sheet 12 respectively represent combination of engine, clamp, steering-drum, and bracket and the combination of the engine, clamp, steering-drum, idlers, and bracket, to wit: Fig. 24 is a plan of the idler, brackets, and clamps. Fig. 25 is an elevation of the same. Fig. 25^a is a vertical transverse section in the plane of the dotted line 28^a of Fig. 25. Fig. 26 is a plan view below the line 29 29 of Fig. 25. Fig. 27 is a plan of the steering-drum brackets. Fig. 28 is a side elevation of the steering-drum brackets, in combination with securing-clamp, reaches, and steering-drum, looking from rear of engine. Fig. 29 is an end elevation of the steering-drum bracket on the receiving side of the engine. Fig. 30 is an end elevation of the steering-drum bracket on the exhaust side of the engine. The figures of Sheet 13 represent views of the differential sleeve arranged with a frictional lock and lock-box, to wit: Fig. 31 represents a longitudinal horizontal section thereof. Fig. 32 represents a cross-section of the lock-box and lock, taken in the plane of the dotted line 44 44 of Fig. 31. Fig. 33 is an end view of the pinion-gear shown in section at the left hand of Fig. 31. Fig. 34 is a plan view of this differential sleeve. Fig. 35, Sheet 14, is a plan view showing the steering-gear, drum, and water-piping. This plan is taken from beneath the machine, looking upward.

Fig. 36, Sheet 15, represents a side elevation of the machine with certain parts of the mechanism removed in order to show the water-pipes and the gasolene-pipe connections connecting the carbureter and lighter-valve, the water-tank, overflow-tank, and engine also being shown, together with the steering-chain and connections of the gear. The figures of Sheet 16 illustrate the spring for the steering-chain and cup and connections to the axle-casing, viz: Fig. 37 is a plan view of the same. Fig. 38 is a view of the parts shown in Fig. 37 to the left of the dotted line 57 of Fig. 37, the spectator standing to the right of the plane of said dotted line and looking toward the left. Fig. 39 is a vertical section of the mechanism shown in Fig. 37. Fig. 40 is a view of that end of the said mechanism which is at the left end in Figs. 37 and 39. The figures of Sheet 17 illustrate the device for locking the screw for operating the reversing-gear. Of these, Fig. 41 is a plan view of the said mechanism. Fig. 42 is a side view showing the lever and lock-box in section, the rest in elevation. Sheet 18 shows views in detail of the buffer-block or fender for preventing any obstructions on the road from coming into contact with the working gear of the engine and water-pipes of the engine and also enables the engine to push out of its way any movable obstruction, also showing the brackets for sustaining the gasolene-tank and its location. Fig. 43 is a plan view showing the buffer-block for protecting the water-pipes and for other purposes. Fig. 44 is an elevation of the brackets for carrying the gasolene-tank. Fig. 45 is a front elevation of the buffer-block and of the water-pipes. Sheet 19, Fig. 46, is an elevation of the worm-wheel operating the steering-drum.

The engine and its connections are supported upon a horizontal frame or platform. This platform may be of any suitable material. I have, however, invented a novel description of platform which serves the purpose not only of a support for the engine, but also performs the office of a conduit for the water used in connection with the engine, thereby, among other advantages, enabling the water to be cooled as desired. In carrying into effect this feature of my invention I construct the platform or frame A as follows: The side pieces A^2 A^2 are joined to the rear end piece A^3. (See Figs. 2, 3, and 35.) Each of these pieces is piping and the three as joined constitute a continuous conduit. The front end of the right-hand pipe A^2 is connected to a smaller pipe A^4, which connects at A^5 with the lower end or outlet L^6 (see Fig. 3) of a centrifugal pump hereinafter described. The front end of the left-hand pipe A^2 is connected to a smaller pipe A^6, which connects at A^7 to an upward extension A^8 piping A^9, which latter connects with the water-jacketing of the cylinder. (See Fig. 3.) The various sections or portions of the pipe constituting the frame are suitably united, as by elbows and pipe-couplings, in the usual manner.

The machine is supported upon a rear axle B and a forward axle B^2. One of the axles, as B, is rigidly connected to the frame A, preferably as follows: A sleeve B^3 is cast or otherwise formed around the piping A^2, a sleeve for each pipe A^2. These sleeves are rigidly fixed to a saddle or axle cap B^4, preferably by being cast in one with the latter. This saddle rests upon the axle B and is prevented from slipping off of the same by a front flange B^5 and by bolts B^6, connected at the lower ends to eyebolts B^7, the latter extending under the axle and bolted directly to the front flange. This saddle B^4 carries the differential shaft I and the journal-boxes B^8 in which the journals of the differential shaft revolve. (See Figs. 1, 3, and 23.) The sleeves B^3 (see Fig. 4) carry the journal boxes or bearings B^9, which support the journals of the counter-shaft for operating the clutch-gear, which latter in turn causes the machine to travel at a high or low rate of speed. To the saddle B^4 there is also connected a platform C. (See Fig. 3.) This platform usually consists of a wooden flooring supported upon three flat bars B^{12}, bolted to the flange B^5, and further secured in position by means of the bolt B^{10}, bolted to the saddle at points B^{13}. The rear end of the platform receives additional support by the oblique brace B^{14}, whose lower end is bolted to the platform-bar B^{12}, as shown, (see Fig. 3,) and whose upper end is bolted to the journal-box B^8. A like brace B^{14} is present at the other side of the platform and is similarly connected. (See Fig. 2.) The bars B^{12} are rearwardly connected together and braced in position by means of the transverse braces B^{16}, bolted thereto.

At each side of the platform a guard-rail B^{15} is present, whose lower end is connected to the rear end of the flat bar B^{12} and whose forward end is connected to the upper adjacent brace B^{14}. (See Figs. 1, 2, and 3.)

To the flange B^5 is also connected a draw-bar D. The rear or free end of the draw-bar is held in position by a bracket D^2, fastened to the rearward horizontal transverse brace or bar B^{16} aforementioned. (See Figs. 1, 2, and 3.) Means for permitting the draw-bar to elastically yield within desired limits are provided and preferably consist, as shown, of a piece of pipe D^3, located in front of the flange B^5 and inclosing a spring D^4, of rubber, resting against the front edge of the flange B^5. The draw-bar D passes through this rubber and at its front end is provided with an enlargement, in the present instance consisting of a washer D^5 and a nut D^6, the latter screwed onto the draw-bar and abutting against the front end of the spring. The rear end of the draw-bar is provided with an eye or any other suitable connection D^7 for enabling connection to be made therewith for traction purposes.

Each rear axle is supported upon wheels B^{17}, located on the respective end portions of the said axle. The width of the tread of these wheels will be according to the nature of the ground over which the vehicle works.

The front axle is provided, as shown, with one or two wheels B^{18} B^{18}. In case one wheel were used it would be centrally located. Two wheels are preferable, located, respectively, at the outer end portions of the said axle, substantially as shown in Fig. 35. The wheels are kept in place on their respective axles by any of the well-known means, in the present instance by the shoulders or collars B^{19} on the axle at the end of the hubs and collars B^{20} on the outer or front end of the hubs. The collars B^{20} are held in place by bolts B^{21}, passing through the adjacent extremity of the axle. (See Fig. 35.)

A cross head-block B^{23} (see Figs. 5 and 35) is suitably secured to the frame A—namely, to the pipes A^2. In the present illustrative instance means for connecting this cross head-block B^{23} to the pipes consists of the sleeve B^{24}, respectively shrunk onto their adjacent pieces of pipe A^2. These sleeves are rigidly connected to the cross head-block.

A saddle B^{25} rests upon the axle, and a rear flange B^{26} of this saddle rests against the rear side of the axle B^2. Bolts B^6 and eyebolts B^7, in connection with the flange B^{26}, embrace the axle (substantially as heretofore described in connection with the rear axle B) and hold the front saddle B^{25} securely to the axle B^2.

Bolts B^6 near the outer end of the axle B^2 instead of being united with eyebolts B^7 are respectively screwed into the eyepieces B^{27}. These eyepieces are a preferred means for connecting the rear fork of the tongue to a vehicle. This tongue is seldom necessary, but can be used in cases where the machinery is disabled or for other desired purposes.

The king-bolt B^{28} passes down through the head-block B^{23} and axle-saddle B^{25} substantially as shown. The head of the king-bolt prevents it from slipping down out of place. On the lower end of the king-bolt is located the front eye portion of the reach B^{29}, (see Fig. 35,) and on the king-bolt immediately below this eye portion of the reach is screwed a collared nut B^{30}, which latter retains the king-bolt and the front of the reach in position. The rear end of the reach is pivotally connected by the bolt B^{31} to the clamp-brackets B^{32}, secured to the right and left portions A^2 A^2 of the piping. (See Figs. 3, 5, 35, and 36.)

It will be observed that the clamp-bracket is preferably made in two pieces B^{35} B^{36}, the clamp fitting against the pipe A^2 and secured thereto by means of bolts B^{37} to the lower portion of the engine-bed, which latter rests upon the piping, substantially as shown, and forms the opposite jaw or complementary piece of the clamp just mentioned. (See Figs. 3, 25, 28, and 36.)

The means for readily and successfully turning the front axle B^2 on its king-bolt and thus controlling the direction in which the machine shall travel are as follows: To each of the lugs E (present on the saddle B^{25}) of the front axle is connected a bolt E^2. An enlargement or head E^3 at the rear end of the bolt E^2 lies within the end E^4 of the cylinder E^5. (See Figs. 3, 35, 37, 38, 39, and 40.) Within the cylinder is located a spring E^6, and draw-bolt E^7 passes through said spring and at its forward end is provided with a head E^8, which rests against the end of said spring E^6. The bolt passes through a cap E^9, screwed onto the rear end of the cylinder E^5. The rear end of the bolt E^7 is provided with an eye or hook E^{10} for engaging a connection, preferably a chain, as E^{12}. Traction upon the chain E^{12} compresses the spring E^6 between the draw-bolt head E^8 and the cap E^9 and furnishes a certain amount of an elastic yielding between the axle and the mechanism for drawing chain, thereby conducing toward the ease of operation and preventing undue strain and breakage of the parts.

For enabling the bolt E^2 to properly oscillate in response to a change of its axial direction as its end of the axle is moved toward the rear end of the machine or away therefrom a semicircular button or bearing-piece E^{13} is provided, whose curved peripheral surface bears partly against the corresponding curved bearings in the lug E, substantially as shown in Fig. 39. That opening E^{28} in the lug through which the bolt passes is also rearwardly enlarged for the same purpose.

Each chain E^{12} is carried backward against the idler-pulley E^{14}, pivoted on axles E^{15}. (See Fig. 3 and figures on Sheet 12 from 24 to 28, inclusive.) The chain is then carried backward and wound upon a drum E^{16}, journaled in a clamp-bracket E^{17}, secured to the piping A^2. This bracket is further braced by means of tie-rods E^{18} E^{18}, connected or braced to the flange B^5 of the rear saddle B^4. (See Figs. 3, 35, and 36.) These chains E^{12} are respectively wound in opposite directions upon the drum E^{16}. Mechanism for rotating this drum E^{16} is substantially as follows, (see Figs. 35 and 46:) On a projection E^{19} of the shaft is fixed a worm-wheel E^{20}, which meshes into a worm E^{21}, fixed upon a shaft E^{23}, whose lower end is journaled in the bearings E^{24} E^{24}, connected to the bracket E^{17}, and whose front end is journaled in the bearing E^{25}, supported by arm E^{26}, connected to the flange B^{38} of the saddle B^4. The shaft E^{23} is rotated by the hand-wheel E^{27}, located over the platform C, and consequently within the reach of the operator standing upon said platform.

I will now proceed to describe the friction-gear whereby the machine is started and stopped. (See more particularly Sheet 8, Figs. 12 to 17, inclusive.)

F indicates the crank-shaft of the engine. On this crank-shaft is an expander F^2, secured to the shaft by a key F^{23}. A friction-shell F^3 surrounds the expander and also the shaft F. This friction-shell is rigidly con-

nected to the driving-gear F^4, and both it and said gear rotate loosely on the crank-shaft F.

Means for operating the expander are substantially as follows: On the crank-shaft F is a shifter-sleeve F^5, which is secured to and operates the expander-key F^6 and the lever F^7 as follows: An inclined or beveled side of the expander-key reciprocates with the key under the point of the expander-lever, which point in the illustrative instance is an adjustable one, consisting of a set-screw F^{10}, screwed through the free end of the expander-lever F^7 and resting against the bevel of the expander-key F^6. By means of this set-screw F^{10} the throw of the lever may be increased or diminished. The expander-lever is pivoted at F^8 to the expander F^2. In the vicinity of the lever the expander is cut in two, forming a slit or opening F^9, extending from the periphery of the crank-shaft, and as the free end of the lever is moved out from the crank-shaft by means of the expander-key a portion of the end of the lever in the vicinity of the pivot strikes against the opposing free end of the expander on the opposite side of the slit therein, and an opposite portion of the lever strikes against the adjacent side of the slit and forces or springs the two portions of the expander at that point apart, thereby increasing its diameter and causing it to tightly engage the sheet F^3.

The degree of friction between the expander F^2 and its surrounding shell F^3 will depend upon the throw of the lever F^7, which throw, as was before seen, is determined by the adjustment of the set-screw F^{10}.

In conjunction with the pivotal connection F^8 is a plate F^{18}, secured to the hub of the expander by set-screws F^{19}, the function of the plate being to afford a better pivotal support and connection for the expander-lever and also facilitate the removal of the expander-lever. It will be understood that the expander-key slides in the groove F^{25} in the crank-shaft F.

Means for securing the expander-key to the shifter-sleeve F^5 consist of the set-screws F^{17}. A collar F^{20} on the end of the shaft, secured thereto in place by set-screw F^{21}, serves to retain the shifter-sleeve in position and from slipping off of the crank-shaft. The shifter-sleeve is operated by a forked lever F^{12}, pivotally connected to the bracket F^{15} by means of a pivot bolt or spindle F^{14}. The forks of the lever engage the shifter-sleeve between the abutments F^{13} on the sleeve. This lever is provided with a suitable handle, as F^{16}. The bracket F^{15} is pivoted to the side of the base of the engine at F^{26}. (See Figs. 12 and 3.) As the forked lever F^{12} is moved toward the expander the latter will engage the friction-shell and the driving-gear F^4. Consequently when the crank-shaft F is in motion and the expander has thus engaged the friction-shell F^3 the driving-gear F^4, connected to the friction-shell, having likewise been set in motion, will operate the entire machine, as hereinafter set forth.

When the shifter-lever F^{16} is moved away from the expander, the latter will be diminished in diameter and will no longer engage the shell F^3, and consequently the crank-shaft will no longer continue to operate the machine. One object of having such a mode and means of starting the machine is that no matter how rapidly the crank-shaft is rotated I am enabled to start the machine gradually and without risk of any breakage of the parts, the connection between the expander F^2 and the shell F^3 allowing of a certain amount of slippage until the machine has acquired the desired momentum and rate of speed. This mode of frictional connection between the crank-shaft and the driving-gear is also of great advantage in case the machine meets with an unexpected obstacle which suddenly stops its movements or suddenly retards its speed, in which event the operating parts of the machine are prevented from being broken by reason of the fact that the expander will slip within the clutch-shell F^3. It will be understood that the expander is lubricated at the point of its contact with the friction-shell.

I will now describe the reversing-gear for changing the direction in which the machine is to move. (See more particularly Sheets 11 and 17 for details of the same.)

Close to the driving-wheel F^4 aforementioned are the two pinions G and G^2, both of which pinions mesh with the spur-gear G^3, fixed concentrically on the clutch-gear shaft G^4, that carries the fast and slow speed gear. The frame for supporting the pinions G and G^2 is pivoted on the clutch-gear shaft G^4 and preferably consists of two parallel plates G^5 G^5, fastened together at proper points by connecting-bolts G^7, which hold the plates in position. The axles G^6 G^6 of the pinions G and G^2 are respectively journaled in the said plates.

The oscillatory movement of the plate G^5 is effected by the screws G^8 working through and engaging a nut G^9, whose extensions on either side are respectively connected to the plate G^5. Each extension passes through and beyond its adjacent plate G^5 and there receives a nut G^{12} for the better securing the nut G^9 in position. The free end of the screw G^8 is provided with a suitable crank or hand wheel G^{10}. This screw G^8 not only serves to oscillate the frame G^5 G^5, but also to hold it in place at the desired point. Owing to the rapid motion of the machine and the jarring consequent upon its movement over rough ground I have found that the screw G^8 will be rotated by the jarring of the machine. I have therefore provided a device for preventing such rotation except when intentionally performed by human agency, which device is substantially as follows: The screw G^8 extends down to the bracket G^{13}, and the lower end of the screw below the bracket is secured in position by a

nut G^{15}. Directly above the bracket G^{13} the screw is provided with the collar G^{14}, fixed thereto. On this collar is a notch G^{19} for the reception of the latch G^{18} of the locking-lever G^{16}, which lever is provided with a tail G^{20}. This lever G^{16} oscillates on a pivot G^{17}, secured in a portion of the bracket G^{13}, and the bracket is further provided with a pointed detent G^{23}, having a double incline.

Reciprocating through the upper portion of the lever G^{16} is a spring set-bolt G^{21}, whose lower end is pointed and likewise provided with a double incline, substantially as shown in Fig. 42. The upper end of this set-bolt is provided with the nut G^{25} or equivalent projection for preventing the bolt from slipping down through the lever G^{16} farther than necessary.

The set-bolt G^{21} has for the upper portion of it a diminished shank G^{24}, embraced by the spring G^{27}, contained in the chamber G^{26} of the lever G^{16}, the spring at the top abutting against the upper end of the said chamber and at its lower end pressing against the enlarged portion of the said bolt, thereby continually and elastically pressing said bolt down and out. The operation of this part of my device is substantially as follows: When it is desired to cause pinion G to engage the driving-gear F^4, the screw G^8 is rotated so as to raise the adjacent end of the frame G^5, thereby throwing the pinion G into engagement with the driving-gear F^4 and causing the machine to go in one direction. When it is desired to cause the machine to go in the opposite direction, the screw G^8 is rotated in the reverse direction, thereby lowering the adjacent end of the frame G^5 and bringing the pinion G^2 into engagement with the driving-gear F^4, thereby causing the machine to travel in the opposite direction. Rotating the screw so as to bring the frame G^5 to its middle point of oscillation (see Fig. 22) results in throwing both of the pinions G and G^2 out of engagement with the driving-gear F^4 and causing the machine to be at rest, as shown. After the frame G^5 has been set at the desired point by means of the screw G^8, in order that the screw G^8 may retain that position, the operator causes the latch G^{18} of the lever G^{16} to enter the notch G^{19} and the collar G^{14} of the screw. This he does by striking the upper part of the lever with the toe of his foot, and the set-bolt will then engage the left-hand incline of the point G^{23}, as shown in Fig. 61. The screw is now secured, locked, and prevented from rotating. When the operator desires to again rotate the screw, he strikes the tail G^{20} of the lever G^{16} with the toe of his boot, driving the tail toward the nut G^{15}, thereby throwing the latch G^{18} out of engagement with the notch G^{19} of the collar G^{14} and causing the left-hand incline of the said bolt G^{21} to engage the right-hand incline of the point G^{23} of the bracket. The locking-lever will now be held permanently out of engagement with the screw G^8, and the latter may be rotated at will. As often as desired the locking-lever can be again operated to engage the screw and lock it, as aforementioned.

It may be here remarked that the opening through the bracket G^{13}, occupied in part by the lower end of the screw, is enlarged from the center in both directions to allow for the lateral vibration of the frame, consisting of the plates G^5 G^5, bound together, as aforementioned.

I will now describe the clutch-gear shaft and the construction whereby I am enabled to impart to the machine a fast or slow speed at will. (For the details of this construction see Sheets 7 and 9.)

Upon the cluch-gear shaft G^4 is mounted the fast-speed gear H and the slow-speed gear H^2, both of which gears are mounted loosely on the said shaft. The fast gear carries a complementary clutch-piece H^5, and the slow-speed gear carries the complementary clutch-piece H^6. Within each of these complementary clutch portions is a collar H^8. Each of these collars is for the purpose of keeping its respective gear in position on the shaft when the central piece is withdrawn therefrom. The central clutch H^3 is provided at each side with the complementary portion for engagement with the complementary clutch of the adjacent gear. This clutch H^3 is keyed on the shaft G^4 by a key or feather H^4 and reciprocates along said shaft over said feather.

Means for reciprocating the clutch H^3 consist of the levers H^9, each provided with the pin H^{10}, secured in position on its lever by a nut H^{12}, the pins entering a groove H^7 in the clutch H^3. The levers H^9 are fixed to the shaft H^{13}, journaled in bearings H^{14} H^{15}, the shaft being held in the journals by collars H^{16}, fixed on the shaft near the vicinity of said journal-bearings. For turning the shaft H^{13}, I provide a lever H^{17}, fixed to shaft H^{13}, pivoted at H^{25} to the bracket, H^{14} in turn connected to the flange of the saddle B^4. Means for setting the lever and holding it in position consist of the spring-lever H^{18}, pivoted to the main lever H^{17} and elastically held out by spring H^{19} in the vicinity of the handle of the main lever, said lever H^{18} in turn connected to the latch-bolt H^{21}, reciprocating in guides H^{23} and engaging at will any one of the three notches in the arc H^{24}. Moving and setting the said lever H^{17} in one direction causes the clutch H^3 to engage one of the gears H^2 or H, and moving the lever in the opposite direction the full length of its stroke causes the clutch H^3 to engage the other of said gear, thus changing the speed of the machine from fast to slow or from slow to fast, according as the lever is set. When the lever is set in the middle arc, the central clutch is out of engagement with either of the gears H H^2 and the machine is at a standstill.

I will now describe the mechanism which I have invented for insuring ease in the opera-

tion of the various parts of the driving apparatus while the machine is in a curve and for preventing breakage of the said parts. (For details of the said construction see more particularly Sheets 9 and 10 of the drawings.) This construction is as follows: I is a differential shaft journaled in the left-hand bearings B^8 B^8, aforementioned. The right-hand end of said shaft is journaled in the sleeve I^2, supported at its right-hand end in the right-hand bearing B^8 aforementioned and supported at its left-hand end by its junction with the shaft I, as shown. Each of the driving-wheels B^{17} carries an internal gear-wheel B D concentric therewith and fastened to the said wheel by bolts or stirrups D^{12}, substantially as shown in Fig. 2.

At the right-hand end of Fig. 18 is seen a pinion I^8, keyed on the sleeve I^2. This pinion engages the adjacent interior gear-wheel B D of wheel B^{17}. On the left-hand end of the differential shaft I is a pinion I^{20}, fixed thereto and engaging an interior gear B D in the adjacent wheel B^{17}. In the chamber I^4 of the sleeve I^2 is located an eye I^3, provided with the bolt or screw extensions I^5, which pass through a cap I^7, secured to the sleeve I^2 over the chamber I^4. On this bolt, above the cap, is screwed a nut I^6. By tightening this nut I^6 the shaft I is forcibly pressed against one side of the sleeve and greater frictional contact there created between the sleeve and shaft, thereby causing the shaft and sleeve to move as one, but permitting the one to slip against the other where the resistance to the turning of either one or the other is so great as to endanger the breakage of the operating parts. This lock is put into operation for the purpose of guiding the machine out of a hole, as when tightened it enables both wheels B^{17} to be positively driven at the same rate of speed, thereby preventing the machine when one of the wheels is in a hole from standing still and the driving-wheels slipping, as would be the case where the one wheel B^{17} would be allowed to turn more than the other, which latter condition is the case when the lock is not in use, as will be more fully hereinafter understood.

On the left-hand end of the sleeve I^2 is a beveled spur-wheel I^9, and farther along on the said shaft is fixed a second beveled spur-gear I^{16}, keyed to the shaft I. Between these two beveled spur-wheels are the beveled pinions I^{12} I^{12}, respectively located at opposite sides of the shaft and respectively rotating each on its own axle I^{13}, said axle being secured to the spur-gear I^{10}, rotating loosely on shaft I by means of the boss I^{14}, cast to the spur and embracing the axle, and a set-nut I^{15}, screwed through the boss against the axle I^{13}. The lower end of each axle is kept in place by being stepped or laid into the hub I^{21} of the spur-wheel I^{10}. At the left of the wheel I^{10} is the plate I^{17}, whose peripheral rim is fixed to the outer portion of the spur-wheel I^{10} and whose hub portion is connected to the sleeve I^{18}, rotating loosely on the shaft I and forming a hub upon which the spur-wheel I^{19} is concentrically keyed. It will be here observed that the spur-wheel I^{19} meshes with the fast-speed gear H aforementioned. When the slow-speed gear H^2 is driven and becomes the operating-wheel, it rotates the spur-wheel I^{10}, which in turn rotates the beveled pinions I^{12}, in turn rotating the beveled spur I^9, which latter rotates the sleeve I^2, and the said pinions I^{12} also rotate the spur-wheel I^{16}, which in turn rotates the shaft I. Thus both wheels B^{17} are positively rotated. When the machine is running in a curved direction, the operation of the beveled gear is such as to allow that wheel B^{17} which is at the inner side of the curve and which has a tendency to drag to substantially accommodate itself, and thus prevents it from being forced to slip over the ground, and thereby detracting from the motive power of the machine. This creeping of the beveled gear whereby several teeth are taken up in the course of a revolution is successfully accomplished by my invention.

When the fast-speed wheel H is in operation, the slow-speed wheel H^2 is not positively driven, and the first-named wheel positively drives the spur-wheel I^{16}, thereby positively communicating motion to the spur-wheel I^{10}, aforementioned, which communicates motion to the beveled gear as it did before, and the operation of the machine in its traveling around a curve is the same as it was before. Therefore whether the machine travels fast or slow these features of my invention enable it to successfully turn a curve without any slippage of the driving-wheels and consequent loss of power.

I will now describe the means for stopping the friction-shell when the expander is disengaged therefrom. (See Sheet 6, Figs. 6 and 7 thereon.) Usually when the expander has been in contact with the friction-shell F^3 and is thrown out of engagement therewith the shell F^3 will continue to revolve. This continued rotation of the friction-shell would prevent the operator in charge of the machine from using the reverse-gear for the reason that the wheel or friction-shell continues to revolve, and if the machine is suddenly reversed the gear-teeth are likely to be broken.

J is a brake-band nearly surrounding the friction-shell F^3. One end of the brake-band is connected at J^2 to the bracket F^{15}, and at its other end is connected at J^6 to the crank-lever J^4, pivoted at J^5 in the supporting-bracket J^3. The opposite end of this crank-lever is pivotally connected at J^7 to the rod J^8, whose free end is connected to the crank foot-lever J^{10}, pivotally fulcrumed at J^{12} to the bracket J^{13}, connected to the platform C, heretofore mentioned.

For the purpose of enabling the brake-band J to be loosened out of engagement with the friction-shell when the foot of the operator is withdrawn from the treadle J^{10}, I provide a spring J^{16}, embracing rod J^8 and at one end

abutting against the vertical flange B^{34} on top of the saddle B^4. The front end of the spring is held in engagement by the set-collar J^{14} on rod J^8, of which collar J^{15} is the set-bolt, impinging against the rod J^8, the spring being compressed between the abutting flange B^{34} and the collar J^{14}. When the expander has been thrown out of engagement with the friction-shell F^3 and it is desired that the further rotation of the friction-shell shall be prevented, the operator promptly depresses treadle J^{10}, thereby tightening the friction-band J on the friction-shell F^3. Releasing the treadle J^{10} throws friction-band J out of engagement with the friction-shell.

Means for retarding the speed of the machine on level ground, when desired, and more particularly in going down a hill, is as follows: K is a brake-wheel keyed on the differential shaft I. (See Figs. 6, 7, and 18.) Embracing the brake-wheel K is a brake-band K^2, formed in two pieces K^3 K^4, pivotally united at K^5. The end of the portion K^3 of the brake-band is fastened at K^6 to the flange B^{34}, aforementioned. The free end of the other portion K^4 of the brake-band is pivotally connected at K^7 to link K^8, whose other end is pivotally connected at K^9 to one end of the brake-lever K^{12}, pivotally fulcrumed at K^{10}. The other end of lever K^{12} carries a nut K^{13}, pivoted at K^{14} thereto. Through this nut passes a screw K^{15}, the central portion of whose shank turns loosely in the vertical supporting-sleeve K^{16}, in turn supported by the bracket K^{18}, secured to the bracket B^8 of the journal-box, as aforementioned. The screw-shaft K^{15} is prevented from vertical displacement by means of the set-collars K^{17} K^{17}, one directly above and the other immediately below the sleeve K^{16}. The screw-shaft K^{15} is operated by hand-wheel K^{19} or other suitable device. The rotation of the screw and its mode of operation are obvious. The rotation of the screw-shaft depresses the adjacent end of lever K^{10}, which in turn, through intermediate connections, tightens the brake-band on the brake-wheel and then applies the brake to the machine and decreases the speed of the latter or prevents its speed from being accelerated in going downhill. Rotation of the screw in the other direction in the reverse manner disengages the brake-band from the brake-wheel.

I will now describe the driving-pulley whereby motion is communicated from my engine to any engine temporarily connected thereto and which it is desired my engine shall operate. (See more particularly Sheets 1, 2, 4, and 5.)

M indicates the expander-key on the crank-shaft F, constructed similarly to the expander F^2 on the crank-shaft heretofore described. This expander is operated by a shifting device in connection with a lever similar in construction to the shifting device F^5 F^{13} and lever F^{12} and expander-lever F^7 with adjustable set F^{10}, substantially as shown on Fig. 12 of the drawings, Sheet 8. Surrounding the expander is the friction-shell M^2, and this shell is similar to the shell F^3, (shown in Fig. 12,) with the exception that the flange on the left-hand side of the friction-shell is not connected to any gear F^4 and that the right-hand side of the friction-shell is bolted to a ring loose on shaft F for keeping it in place on the expander. Inasmuch as such an annular plate is well known, further description of it is omitted.

The belt M^3 for engaging the pulley M^6 and for communicating motion from said belt to any machine which it may be desired to be operated by my engine for convenience runs over an idler M^4. This idler is also used for tightening the pulley M^6, the axle M^5 of the idler being reciprocally adjustable to and from the belt. A pulley N, (see Fig. 2, Sheet 2,) fixed upon the crank-shaft F, operates the centrifugal pump L^5 on the tank L, hereinbefore mentioned, by engaging a pulley L^7 on the shaft L^8 of said pump through the agency of the belt N^2. A suitable cover for the operator while on the platform C is shown and consists in general of the uprights N^3 N^3, fixed at their lower ends to the saddle B^4 and at their upper ends carrying the horizontal cover N^4, preferably also braced by the brace N^5, secured to the upright N^3 at its mid-length, and by the additional brace N^6 to the jacket.

The gasolene tank or reservoir for supplying the engine with gasolene is present and is indicated by the character O^2. This tank is suitably supported, preferably by the upright O^3, whose lower end is fixed in the bracket O^4 of the engine-frame. For economy of construction the upright supports O^3 are made of piping. A clamp O^5 for clamping the said uprights O^3 in place to the bracket O^4 is present on each side and is bolted to its adjacent bracket by nuts O^6. These nuts also perform the additional function of holding the bolts O^7 in place and securing the brackets O^4 and their clamps O^5 tightly against their respective reaches by piping A^2, substantially as shown in Sheet 18, Figs. 43 and 44. On the upper end of the column of the uprights O^3 is a saddle O^8, in which the tank O^2 rests. From one end of the bracket a band O^9 extends up, over, and down around the gasolene-tank O^2 and is bolted to the opposite end of the bracket, thereby securing the tank O^2 firmly in position. An oblique brace O^{10} extends from said saddle-bracket O^8 diagonally to the rear side of the tank and has its lower end there bolted to the tank L.

For the purpose of protecting the elbow-piping A^3 at the front end of the machine I provide a buffer P. (See Sheet 18, Figs. 43 and 45.) This buffer is made in a box shape, substantially as shown, to cover the piping A^4 and A^6, and is secured at each end to the adjacent cap P^2, screwed on the end of the adjacent pipe A^2 to render the connection between the latter and A^4 and A^6 water-tight. At the

center of the buffer is a concave shield P^3, in which may be placed an auxiliary buffer, as a block of wood or any suitable material, for taking the impact of anything the machine may push, and thus relieve the other parts of the buffer from the said impact.

I will now continue the description of the passage of the water in performing its functions of cooling the cylinder and of itself being cooled. There are connections between that chamber or space which is between the jacket and the cylinder on the one hand and the chambers in the cylinder-head on the other. The cylinder is provided with a suitable valve, in turn surrounded by a suitable water-space, the valves being secured to the cylinder-jacket. This water-space around the valve is connected to the water-jacket chamber around the jacket by a connecting-passage. The tank being filled with water and the engine started in operation, the pump forces water through the pipes on opposite side of the frame and continuing pipe, and then flowing upward through further conduits enters and fills the water space or chamber around the cylinder. The water then passing through the connecting-passage fills the chamber around the valve and next fills the chambers in the head of the cylinder, and then flowing out through the overflow-pipe passes to the spraying device. The water in its first contact with the cylinder and the valve was cold and in turn has become heated. As it passes through the overflow-pipe it has become slightly cooled and through the agency of the spraying-device its temperature is greatly lowered, so that it now enters the pump in a comparatively cool condition, from which point it is again pumped to the cylinder, as aforementioned, and thus its temperature is reduced to the desired working point, and it enters the cylinder in as cool a condition as it did in the first instance.

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

1. In a traction-engine, having chains for guiding the front axle, the drum E^{16} for operating the chains, supported in a bracket E^{17} partially embracing the reaches and being connected to a superincumbent jaw, substantially as and for the purposes specified.

2. In a traction-engine, having chains for guiding the front axle, the drum E^{16} for operating the chains, supported in a bracket E^{17} partially embracing the reaches, and being connected to a superincumbent jaw, and tie-rods E^{18} connecting the bracket E^{17} to the rear axle-saddle B^4, substantially as and for the purposes specified.

3. In a traction-engine, having chains for guiding the front axle, the drum E^{16} for operating the chains, supported in a bracket E^{17} partially embracing the reaches, and being connected to a superincumbent jaw, provided with worm-wheel E^{20} and also carrying the journal-bearings E^{24}, E^{24}, worm E^{21}, on the shaft E^{23}, journaled in the bearings E^{24} and E^{25}, substantially as and for the purposes specified.

4. In a traction-engine, having chains for guiding the front axle, the drum E^{16} for operating the chains, supported in a bracket E^{17} partially embracing the reaches, and being connected to a superincumbent jaw, and the bracket B^{32} clamped to the reaches, and carrying and pivotally holding one end of the oscillating reaches B^{29}, and front axle to which are attached the chains E^{12}, and the king-bolt holding the forward end of the oscillating reach, substantially as and for the purposes specified.

5. In a traction-engine, the rear axle and the saddle B^4 provided with the vertical flange B^5 arranged to lie against one side of the axle, and the vertical bolts B^6 and the eyebolts B^7, respectively embracing the other side of the axle and the bottom thereof, substantially as and for the purposes specified.

6. In a traction-engine, the rear axle provided with the saddle supporting and connected to the journal-bearings B^8, the saddle being provided with the downwardly-extending flange B^5 to which are secured the bars B^{12} of the platform, the bars being supported at rear by the diagonal brace B^{14} connected to the platform at one end and to the journal B^8 on the other, substantially as and for the purposes specified.

7. In a traction-engine, the rear axle provided with the saddle supporting and connected to the journal-bearings B^8, the saddle being provided with the downwardly-extending flange B^5, to which are attached below the axle, bars B^{12} of the platform, these bars being connected together by the brace B^{18} and receiving support at the rear by the braces B^{14} respectively connected to the brace B^{16} of the journal-bearings B^8, substantially as and for the purposes specified.

8. In combination with the rear axle and saddle B^4 provided with the flange B^5 extending down at the side of the axle, the draw-bar D supported at one end in said flange and at the other in the bracket D^2 supported by the platform, substantially as and for the purposes specified.

9. In a traction-engine, the supporting-frame consisting of reaches between the front and rear axles, said reaches being made of piping, forming a conduit for the passage of water through the same for the purposes substantially as specified, and the front cross head or head-block B^{23}, provided with sleeves B^{24} shrunk upon the piping and the king-bolt B^{28} connected thereto and to the saddle B^{25} on the front axle, substantially as and for the purposes specified.

10. In a traction-engine, the supporting-frame consisting of reaches (between the front and rear axles) made of piping, and forming a conduit for the passage of water through the same for the purposes substantially as specified, and the front cross head or head-block B^{23}, provided with sleeves B^{24} shrunk

upon the piping, and the king-bolt B^{28} connected thereto and to the saddle B^{25} on the front axle, the saddle B^{25} having vertical flange B^{26}, and a central enlargement for the passage of the king-bolt, the king-bolt receiving the oscillating reach B^{29}, whose rear end is pivoted to a portion of the frame at the rear, substantially as and for the purposes specified.

11. In a traction-engine, the combination of the parallel conduits A^2, A^2, and the cylinder-engine bed, set directly on the conduits, and partly embracing the same, and clamped thereto, substantially as and for the purposes specified.

12. In a traction-engine, the rear axle B, saddle B^4, mounted thereon, and a supporting-frame, comprising the cylindrical reaches or perches of the vehicle, and sleeves B^3 respectively shrunk on the adjacent perches, and rigidly secured to the saddle B^5, substantially as and for the purposes specified.

13. In a traction-engine, the rear axle B, saddle B^4 mounted thereon, and a supporting-frame, comprising the cylindrical reaches or perches of the vehicle, and sleeves B^3 respectively shrunk on the adjacent perches, and rigidly secured to the saddle B^4, and the front cross-head B^{23}, and sleeves B^{24} shrunk upon the reaches or perches, and the king-bolt B^{28} connected thereto and to the saddle B^{25} on the front axle, substantially as and for the purposes specified.

14. In a traction-engine, the combination of the reaches forming the sides of the frame, the bracket B^{32} consisting of the lower portion B^{35}, holding the idlers E^{14} and the lower half of the clamp B^{36}, partially embracing the reaches, and the lower portion of the engine-bed resting upon said reaches and partially embracing the same, and forming the opposite jaw of the clamp, and clamped by bolts B^{37}, and the oscillating reach-brace B^{29}, secured at one end to the clamp B^{32}, and at the other end to the king-bolt, substantially as and for the purposes specified.

15. The clamp-bracket B^{32}, secured to the supporting-reaches, and carrying idle-pulleys E^{14}, as abutments for guiding the chains E^{12} to the drum E^{16}, and partially holding one end of the oscillating reach B^{29}, substantially as and for the purposes specified.

16. In combination with the rear axle and saddle B^4 provided with the flange B^5 extending down at the side of the axle, the draw-bar D supported at one end in said flange and at the other in the bracket D^2 supported by the platform, the said draw-bar being provided with means for making it elastically yield in the direction of its length within limits, namely, spring D^4 surrounding the draw-bar D and compressible between the flange B^5 and the enlarged head preferably consisting of the washer D^5 and the nut D^6, substantially as and for the purposes specified.

17. In combination with the rear axle and saddle B^4 provided with the flange B^5 extending down at the side of the axle, the draw-bar D supported at one end in said flange and at the other in the bracket D^2 supported by the platform, the said draw-bar being provided with means for making it elastically yield in the direction of its length within limits, namely spring D^4 surrounding, by the casing D^3, the draw-bar D and compressible between the flange B^5 and the enlarged head preferably consisting of the washer D^5 and the nut D^6, the spring being surrounded by the tube D^3, substantially as and for the purposes specified.

18. In a traction-engine whose supporting-frame consists of piping A^2 forming the reaches of the gear, the clamp-brackets B^{32} secured to the piping substantially as described, and carrying the idle-pulleys E^{14}, substantially as and for the purposes specified.

19. In a traction-engine, the combination of the piping forming the reaches between the axles, the sleeve surrounding the conduit and the head-block connected to the said sleeve, saddle or axle, king-bolt connecting said saddle and head-block and also receiving the forward end of the oscillating reach B^{29}, and the bracket-clamp B^{32} at rear, connected to the piping and holding the pivot E^{34} upon which the rear end of the said oscillating brace oscillates, substantially as and for the purposes specified.

20. The combination of the piping A forming the reaches of a traction-engine, the bracket B^{32} consisting of the lower portion B^{35} holding the idlers E^{14} and the lower half of the clamp B^{36} partially embracing the piping A^2, A^2, and the lower portion of the engine-bed resting upon said piping and partially embracing the same and forming the opposite jaw or complementary portion of the clamp and being connected to the opposite portion of the clamp by bolts B^{37}, substantially as and for the purposes specified.

21. In a traction-engine, the piping A^2, A^2, forming a part of a conduit for the flow of water for cooling the engine, the lower jaw E^{36} of the clamp whose upper jaw or complementary portion is the engine-bed, each jaw partially embracing the piping, the jaws being connected together by bolts, and the low jaw carrying the bolt or projection B^3, forming the pivot of the rear end of the oscillating brace, substantially as and for the purposes specified.

22. In a traction-engine having the conduit-piping as a supporting-frame between the rear axle and the front head-block, the chains E^{12} connected to the front axle and guiding against deflecting-abutments as E^{14} and wound in opposite directions around the drum E^{16}, the drum being supported in a bracket E^{17}, partly embracing the piping, and being connected to the complementary por-

tion or opposing clamp, resting on the piping, substantially as and for the purposes specified.

23. In a traction-engine having the conduit-piping as a supporting-frame between the rear axle and the front head-block, the chains connected to the front axle and guiding against deflecting-abutments as E^{14} and wound in opposite directions around the drum E^{16}, the drum being supported in a bracket E^{17}, partly embracing the piping, and being connected to the complementary portion or opposing clamp, forming the engine-bed, substantially as and for the purposes specified.

24. In a traction-engine, where the main portion of the frame constitutes a conduit-pipe for the purposes specified, the bracket E^{17} fastened to the piping and provided with the journal-bearings E^{24} and the drum and worm-wheel E^{20} and worm E^{21}, the said bracket also being provided with the journal-bearings E^{24}, E^{24}, in which the journals of the said worm revolve, shaft E^{23} of said worm, the shaft being further provided with the journal-bearing E^{25} connected to the frame of the machine, and the band-wheel E^{27}, substantially as and for the purposes specified.

25. The combination of the bracket-clamp E^{17}, clamped to the frame A^2, A^2 of the machine, and the rear axle, saddle B^4 secured to the axle, having downwardly-extending flange B^5, the said bracket being connected to the machine by tie-rods E^{18}, the bracket carrying the drum E^{16}, provided with a concentric worm E^{20} and also carrying the journal-bearings E^{24}, E^{24}, worm E^{21} on shaft E^{23} revolving at its lower end in the said journals E^{24} and revolving in its upper end in the journal E^{25}, support E^{26} of the journals E^{25} connected to the saddle B^4, substantially as and for the purposes specified.

26. In a traction-engine having front axle, capable of being turned on a pivot connected to the frame of the machine, and chains connected respectively to the outer or end portions of the axle and converging rearwardly against the deflecting-abutments, and connected with means for drawing in one chain and loosening the other simultaneously, the spring being suitably connected with the bolt E^2 having semispherical bearing E^{13} rotating against the curved bearings in the saddle or projection, the recess in said saddle through which the bolt passes being enlarged rearwardly, substantially as and for the purposes specified.

27. In a traction-engine having front axle, capable of being turned on a pivot connected to the frame of the machine, and chains connected respectively to the outer or end portions of the axle and converging rearwardly against the deflecting-abutments, and connected with means for drawing in one chain and loosening the other simultaneously, the spring being suitably connected with the bolt E^2 having buttons or semispherical bearing E^{13} rotating against the curved bearings in the axle saddle or projection, the recess in said saddle through which the bolt passes being enlarged rearwardly, the bolt E^2 being provided with the head E^3 and the cylinder E^5, the said head lying within the cylinder E^5 and against the head E^4 of the latter, and the spring E^6 within the cylinder, and held in place by the cap E^9 and the draw-bolt E^7 whose head E^8 is within the cylinder and against that end of the spring which is opposite to the one which bears against the cap E^9, the bolt E^7 passing through the cap being provided with the hook E^{10} for connection with the chain, substantially as and for the purposes specified.

28. In a traction-engine having front axle, capable of being turned on a pivot, connected to the frame of the machine, and chains connected respectively to the outer or end portions of the axle and converging rearwardly against the deflecting-abutments, and connected with means for drawing in one chain and loosening the other simultaneously, the spring being suitably connected with the bolt E^2 having semispherical bearing E^{13} rotating against the curved bearings in the axle saddle or projection, substantially as and for the purposes specified.

29. In a traction-engine having front axle, capable of being turned on a pivot connected to the frame of the machine, and chains connected respectively to the outer or end portions of the axle and converging rearwardly against the deflecting-abutments, and connected with means for drawing in one chain and loosening the other simultaneously, the spring being suitably connected with the bolt E^2 having semispherical bearing E^{13} rotating against the curved bearings in the axle saddle or projection, the recess in said saddle through which the bolt passes being enlarged rearwardly, substantially as and for the purposes specified.

30. In a traction-engine, the frame for supporting the machine and constituting the reaches between the front head or cross block and the rear axle, consisting of piping A^2, A^2, forming the conduit, the piping at one end of the machine being connected by the conduit A^3 and the other end of the machine, one of the pipes A^2 being connected with the pipe A^6 connected in turn to the space between the jacket of the engine and the cylinder thereof, the adjacent end of the other pipe being connected by the auxiliary pipe A^4 to the pump, substantially as and for the purposes specified.

31. In an engine, the crank or driving shaft F carrying the expander F^2 fixed thereon, the expander having the opening F^9 in its outer portion, and the friction-shell F^3 surrounding the expander and connected to the driving-gear F^4, the shell and gear mounted loosely on the shaft, and the beveled expander-key F^6 and expander-lever F^7 arranged to be moved outwardly from the shaft by key F^6 and still farther separate the portions of the expander

opposing each other at the slit or opening F^9, thereby increasing the diameter of the expander, substantially as and for the purposes specified.

32. In an engine, the crank or driving shaft F, the driving-gear F^4 provided with the shell F^3 turning loosely on the shaft, and an expander F^2 fixed to the shaft and provided with a lever pivoted substantially at F^8, in connection with the slot F^9 of the expander for enabling the movements of the lever to increase the size of the expander, the free end of the lever carrying the adjustable set-screw F^{10} and expander-key F^6 in contact with the set-screw and reciprocating under and in contact with the set-screw, and means for reciprocating the key, substantially as and for the purposes specified.

33. In an engine, the crank or driving shaft F, the driving-gear F^4 provided with the shell F^3 turning loosely on the shell, and an expander F^2 fixed to the shaft and provided with a lever pivoted at F^8, and in connection with the slot F^9 of the expander for enabling the movements of the lever to increase the size of the expander, the free end of the lever carrying the adjustable set-screw F^{10} and expander-key F^6 in contact with the set-screw, and sliding in the groove F^{25} in the shaft and means for reciprocating the expander-key, substantially as and for the purposes specified.

34. In an engine, the crank or driving shaft F, the driving-gear F^4 provided with the shell F^3 turning loosely on the shaft, and an expander F^2 fixed to the shaft and provided with a lever pivoted substantially at F^8, in connection with the slot F^9 of the expander for enabling the movements of the lever to increase the size of the expander, the free end of the lever carrying the adjustable set-screw F^{10} and expander-key F^6 in contact with the set-screw, and sliding in the groove F^{25} in the shaft, and means for reciprocating the expander-key, and the shifter-sleeve F^5 provided with abutments F^{13} and the forked lever F^{12} operating between said abutments and pivoted at F^{14} to the bracket F^{15} connected at F^{26} to the engine, substantially as and for the purposes specified.

35. In an engine, the combination of the driving-shaft F and driving-gear F^4, pinions G and G^2 meshing with the spur-wheel G^3 mounted on the clutch-gear shaft G^4, the said pinions and gear being located in the frame G^5, G^5, oscillating on the said shaft G^4, and the nut G^9 located in said frame, and the screw G^8 passing through and engaging the nut G^9 and journaled in the bracket G^{13}, substantially as and for the purposes specified.

36. In an engine, the combination of the driving-shaft F and driving-gear F^4, pinions G and G^2 meshing with the spur-wheel G^8 mounted on the clutch-gear shaft G^4, the said pinions and gear being located in the frame G^5, G^5, the said frame oscillating on the said shaft G^4, and the nut G^9 located in said frame, and the screw G^8 passing through and engaging the nut G^9 and journaled in the bracket G^{13}, set-screw rod being provided with the collar G^{14}, provided with the notch G^{19} and the lever G^{16} pivoted at G^{17} having the latch G^{18} for engaging said notch G^{19}, and tailpiece G^{20}, and having the elastic spring-set G^{21} having a point provided with two beveled sides engaging the point G^{23} on the bracket, which latter point also has two beveled sides, screw-shaft having nut or detent G^{15} preventing it from riding out of the bracket G^{13}, substantially as and for the purposes specified.

37. In combination with the oscillating frame G^5, G^5, pivoted on a shaft G^4, the spur-gear G^3 and pinions G^2 and driving-gear F^4 mounted on its separate shaft, the screw G^3 working in the notch G^9 in one portion of the oscillating frame G^5, G^5, and mechanism for preventing the rotation of the rod except by human agency, to wit: lever G^{16}, pivoted at G^{17}, and having latch G^{18} for engaging the notch G^{19} of the screw and tailpiece G^{20}, spring-set G^{21} pressed down by means of the spring G^{27} located in the chamber G^{26} of the lever, and the spring-set being provided with the nut or detent G^{25} and at its free or operating end being provided alternately with two bevels for engagement with two bevels on the latch-point of the bracket G^{13}, substantially as and for the purposes specified.

38. In combination with the oscillatory frame G^5, G^5, carrying the gears in combination with the driving-gear, the screw G^8 arranged for oscillating the frame G^5 and passing through the bracket G^{13} and provided above the bracket with collar G^{14} and below the bracket with the nut or detent G^{15}, the passage through the bracket being enlarged from the center in both directions to allow the necessary oscillation of the groove as the frame G^5, G^5, oscillates, substantially as and for the purposes specified.

39. In combination, the driving-wheels, a shaft I for operating one of said driving-wheels, and a sleeve I^2 for operating the other of said wheels, the shaft being received into said sleeve, and the eye I^3 located in the recess I^4 of said sleeve, and surrounding the shaft I, the eye having a bolt I^5, and a cap I^7 over recess I^4, the bolt I^5 passing through the cap and nut I^6 thereof, substantially as and for the purposes specified.

40. In the mechanism for enabling the driving-wheels to rotate the one faster than the other, while both are positively driven, the combination of the driving-wheels shaft I supported near one end in journal-bearings B^8 and pinion I^{20} fixed on said shaft I and internal gear B D on the adjacent driving-wheel B^{17}, sleeve I^2 loosely receiving the other end of the shaft and journaled in a bearing as B^8, a pinion I^8 fixed on said sleeve and engaging internal gear B D, and said internal gear located on the adjacent driving-wheel B^{17}, a driving-wheel positively driven by the engine and engaging a pinion I^{10} or I^{19}, said

pinion being loosely journaled on shaft I, and beveled pinions I^{12} on opposite sides of hub of pinion I^{10} revolving loosely on shaft I, and the adjacent beveled gear I^{9} and I^{16} respectively engaging said pinion I^{12} on opposite sides thereof, one of these beveled gears being fixed to the shaft I and the other to the sleeve I^{2}, the sleeve I^{2} having a recess I^{4}, an eye I^{3} surrounding the shaft, and a bolt I^{5} connected to the eye and means for drawing the eye against the shaft I, substantially as and for the purposes specified.

41. In the mechanism for stopping the machine, the brake-wheel K, fixed on shaft I, operating the driving-wheels B^{17}, through suitable intermediate mechanism, and the brake-band K^{4}, K^{5}, attached at one end to the frame of the machine and at the other end at K^{7} to the nut K^{13}, nut K^{13}, and screw-sleeve K^{16}, and screw-rod K^{15} screwing through the nut K^{13}, secured in the sleeve by the collars K^{17}, substantially as and for the purposes specified.

42. In the mechanism for stopping the machine, the brake-wheel K, fixed on shaft I, operating the driving-wheels B^{17}, through intermediate mechanism, and the brake-band K^{4}, K^{5}, attached at one end to the frame of the machine and at the other end at K^{7} to the nut K^{13}, nut K^{13}, and screw-sleeve K^{16}, and screw-rod K^{15} screwing through the nut K^{13}, secured in the sleeve by the adjustable collars K^{17}, substantially as and for the purposes specified.

43. In the mechanism for stopping the machine, the brake-wheel K, fixed on shaft I, operating the driving-wheels B^{17}, through intermediate mechanism, and the brake-band K^{4}, K^{5}, attached at one end to the flange B^{34} of the axle-cap, and at the other end at K^{7} to the nut K^{13}, nut K^{13}, and screw-sleeve K^{16}, and screw-rod K^{15} screwing through the nut K^{13}, secured in the sleeve by the collars K^{17}, substantially as and for the purposes specified.

44. The combination of the shaft M and the pulley M^{6}, friction-shell connected to gear-wheel meshing with gear on the crank-shaft F and an expander and expander-key fixed to shaft M, and device for shifting the expander-key, substantially as and for the purposes specified.

45. In combination with the piping A^{2}, A^{6}, A^{2} and A^{4}, the caps P^{2}, P^{2}, on said piping A^{2}, A^{2}, and the buffer P, whose ends are connected to the said caps, substantially as and for the purposes specified.

46. In combination with the piping A^{2}, A^{6}, A^{2} and A^{4}, the caps P^{2}, P^{2}, on said piping A^{2}, A^{2}, and the buffer P, whose ends are connected to the said caps, and whose center is provided with the concave piece P^{3}, centrally located therein, the buffer being of a box shape, substantially as and for the purposes specified.

BENJAMIN C. VANDUZEN.

Attest:

JOHN E. FITZPATRICK,

K. SMITH.