No. 750,421. PATENTED JAN. 26, 1904.

G. C. ANTHON.

ELECTRIC BRAKE.

APPLICATION FILED NOV. 30, 1901.

NO MODEL. 4 SHEETS—SHEET 1.

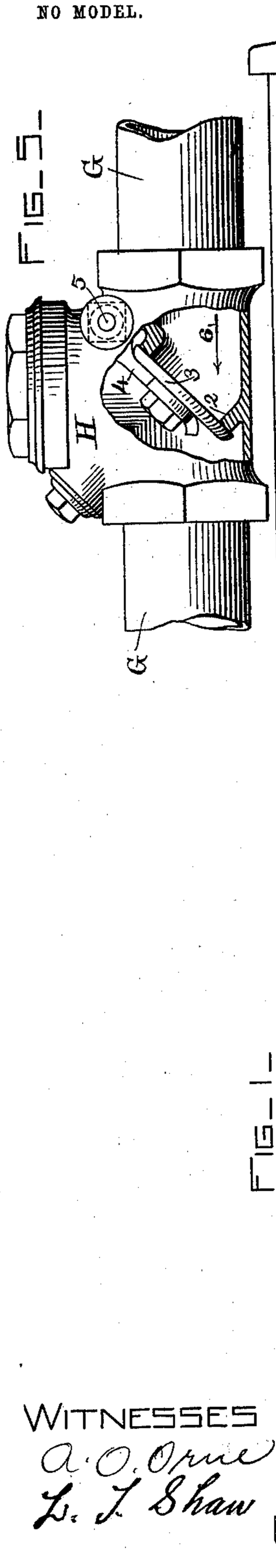

FIG. 5.

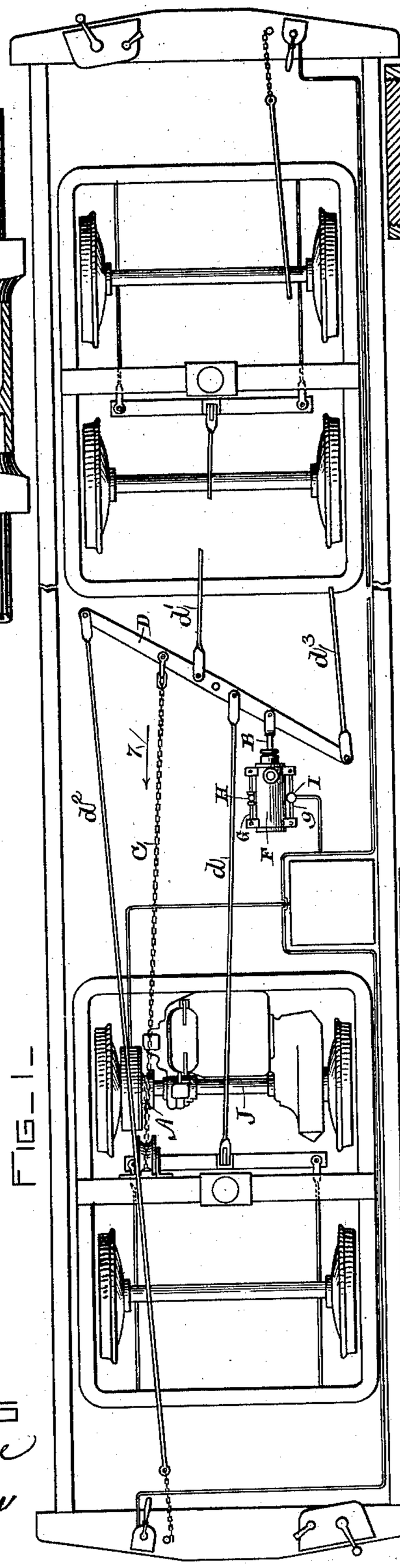

FIG. 1.

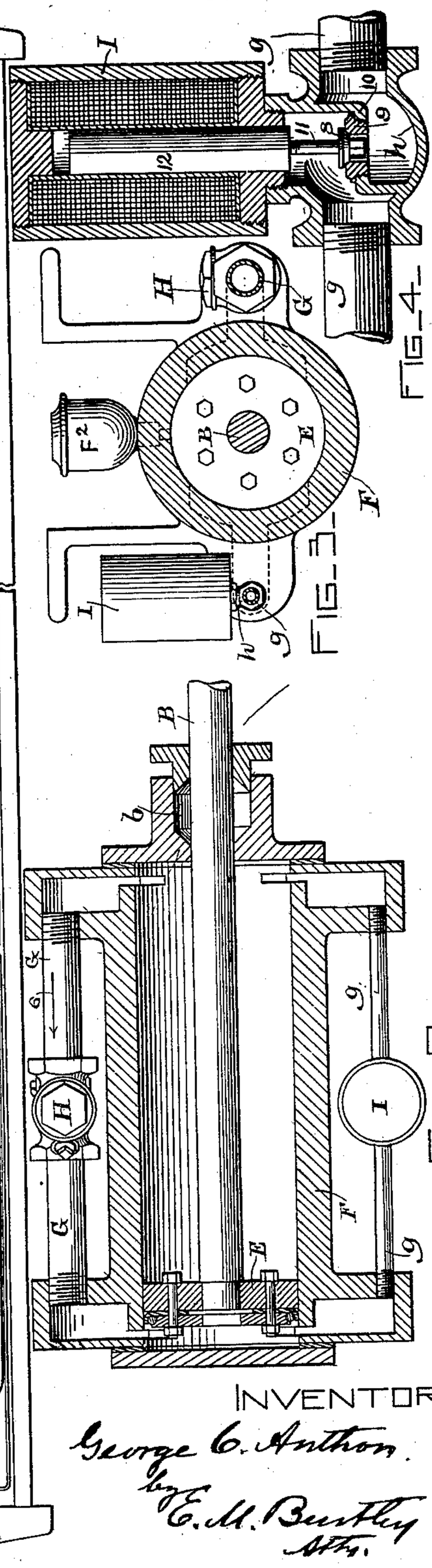

FIG. 4.

FIG. 3.

FIG. 2.

WITNESSES

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NO MODEL. 4 SHEETS—SHEET 2.

FIG. 6.

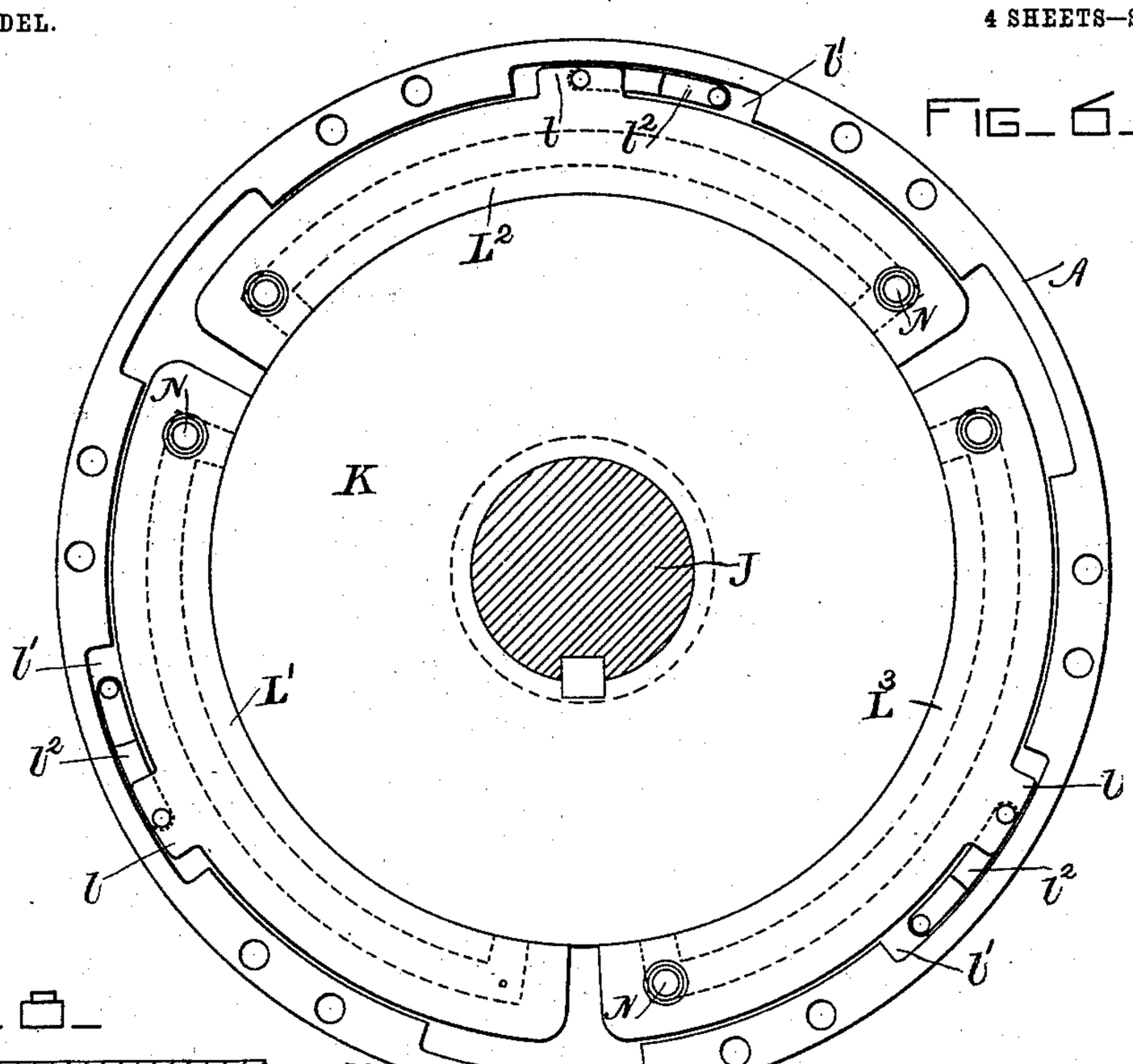

FIG. 5.

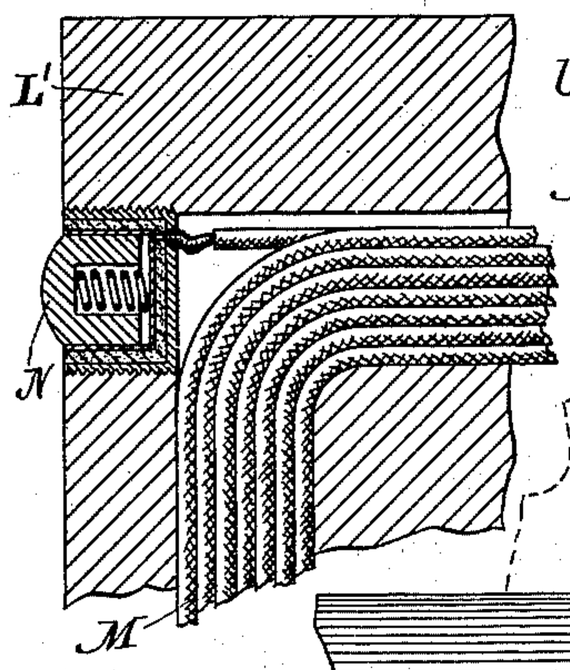

FIG. 9.

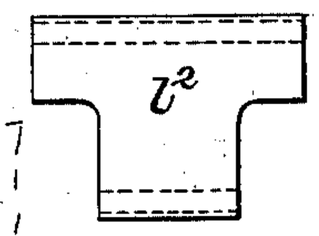

FIG. 7.

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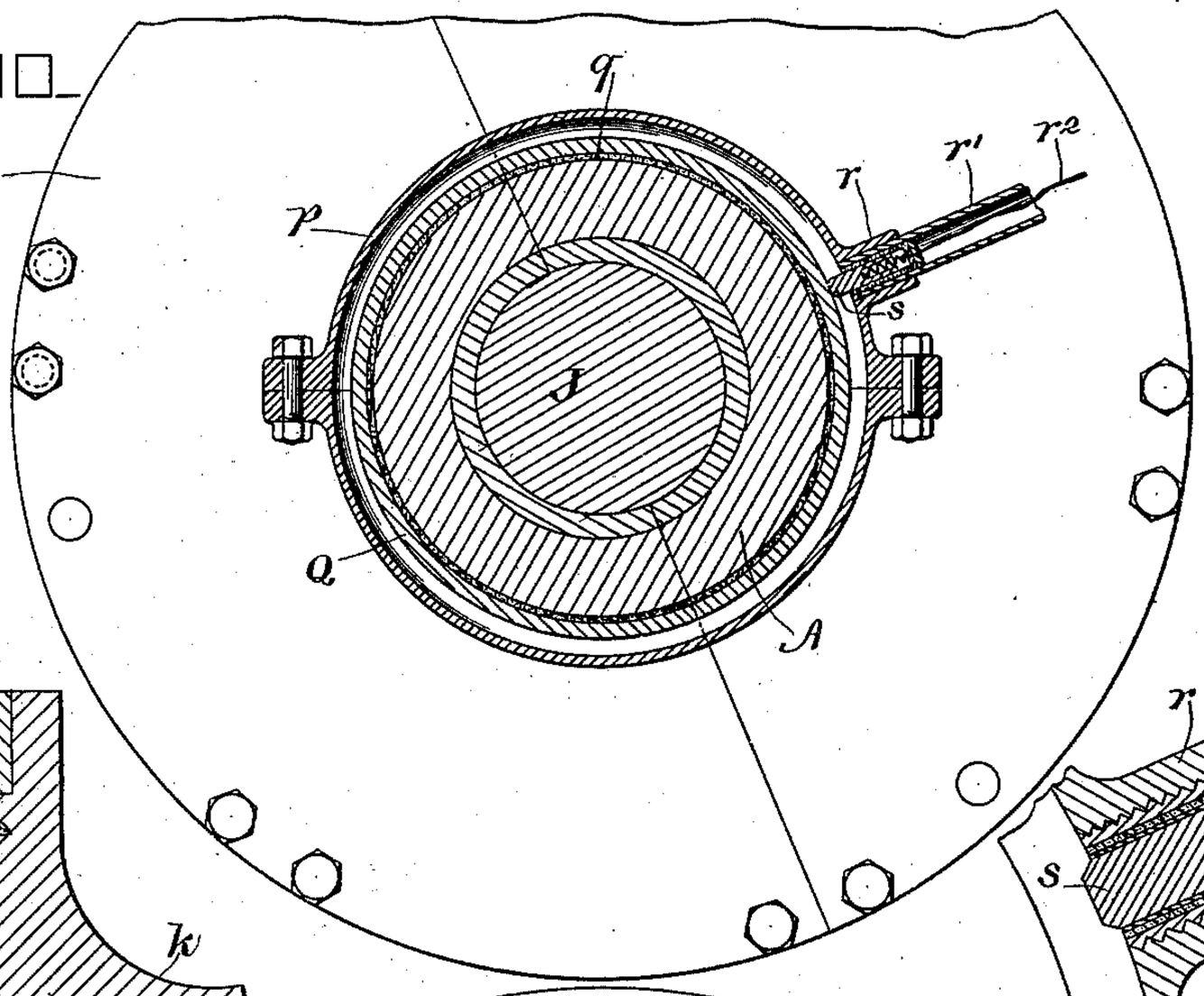
NO MODEL. 4 SHEETS—SHEET 3.

FIG. 10.



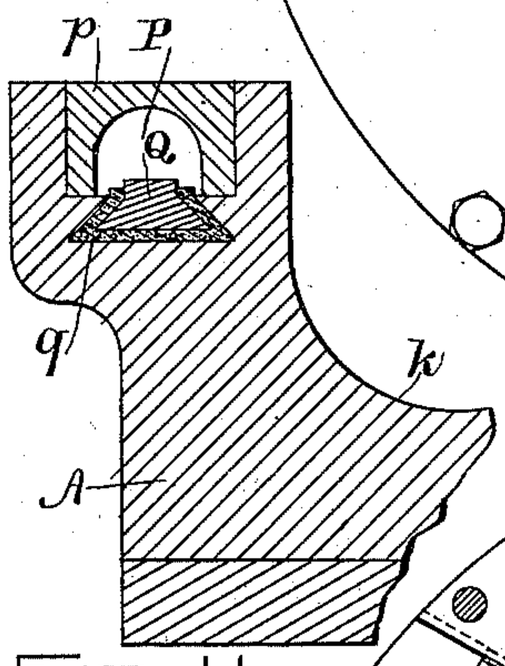


FIG. 11.

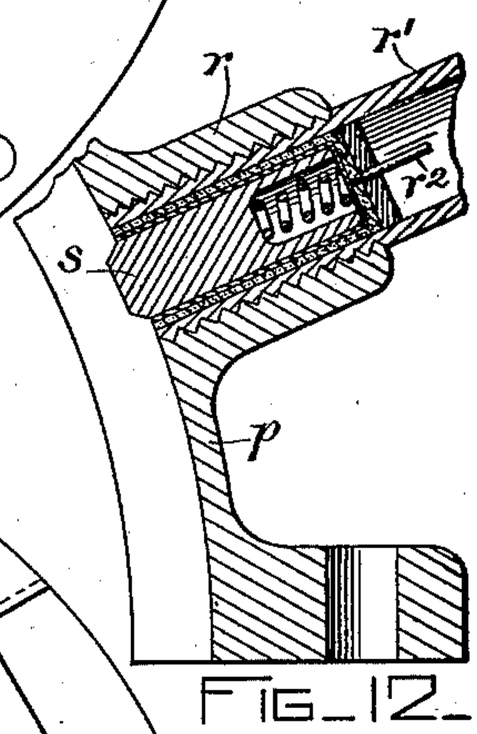


FIG. 12.

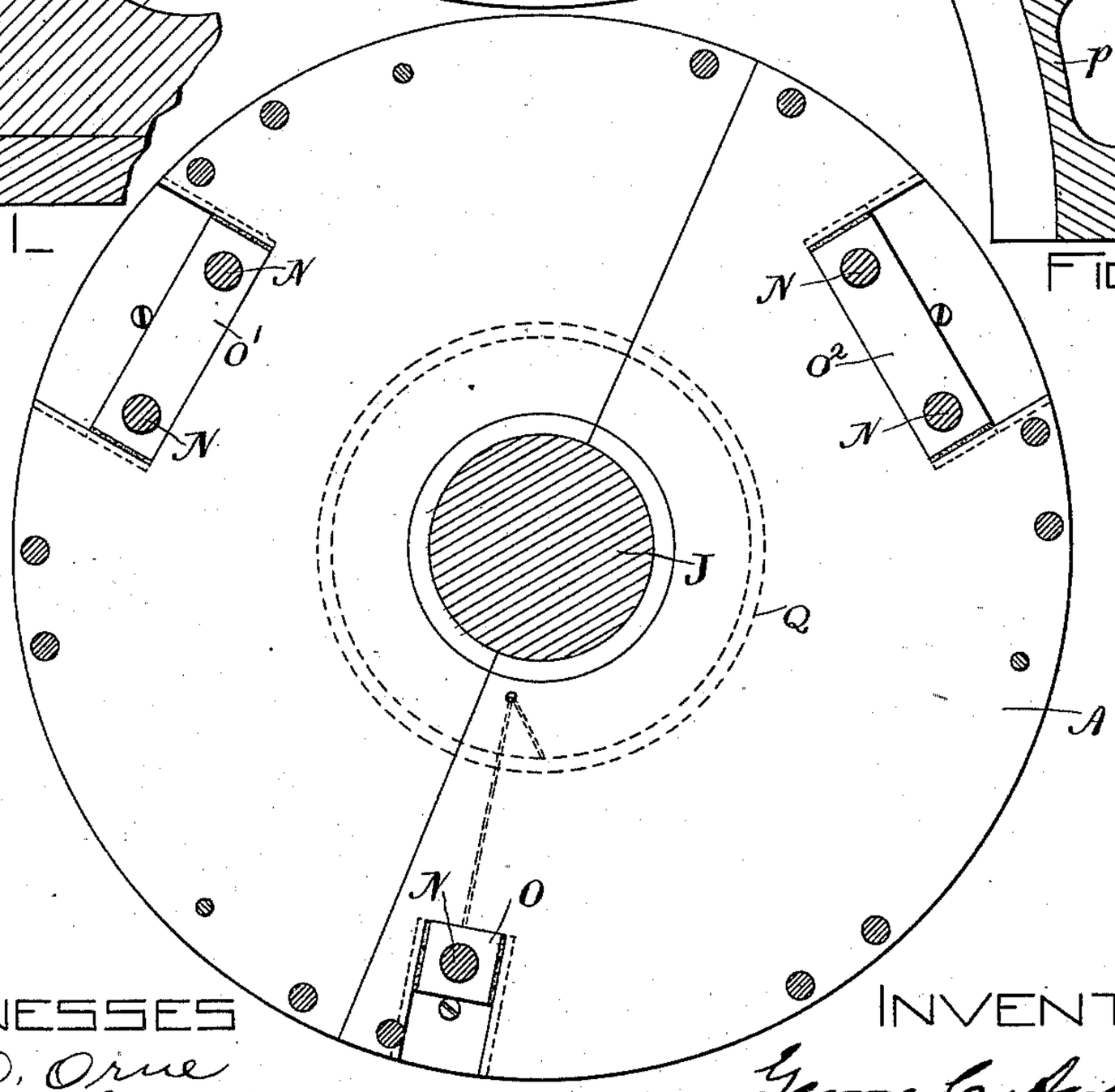


FIG. 13.

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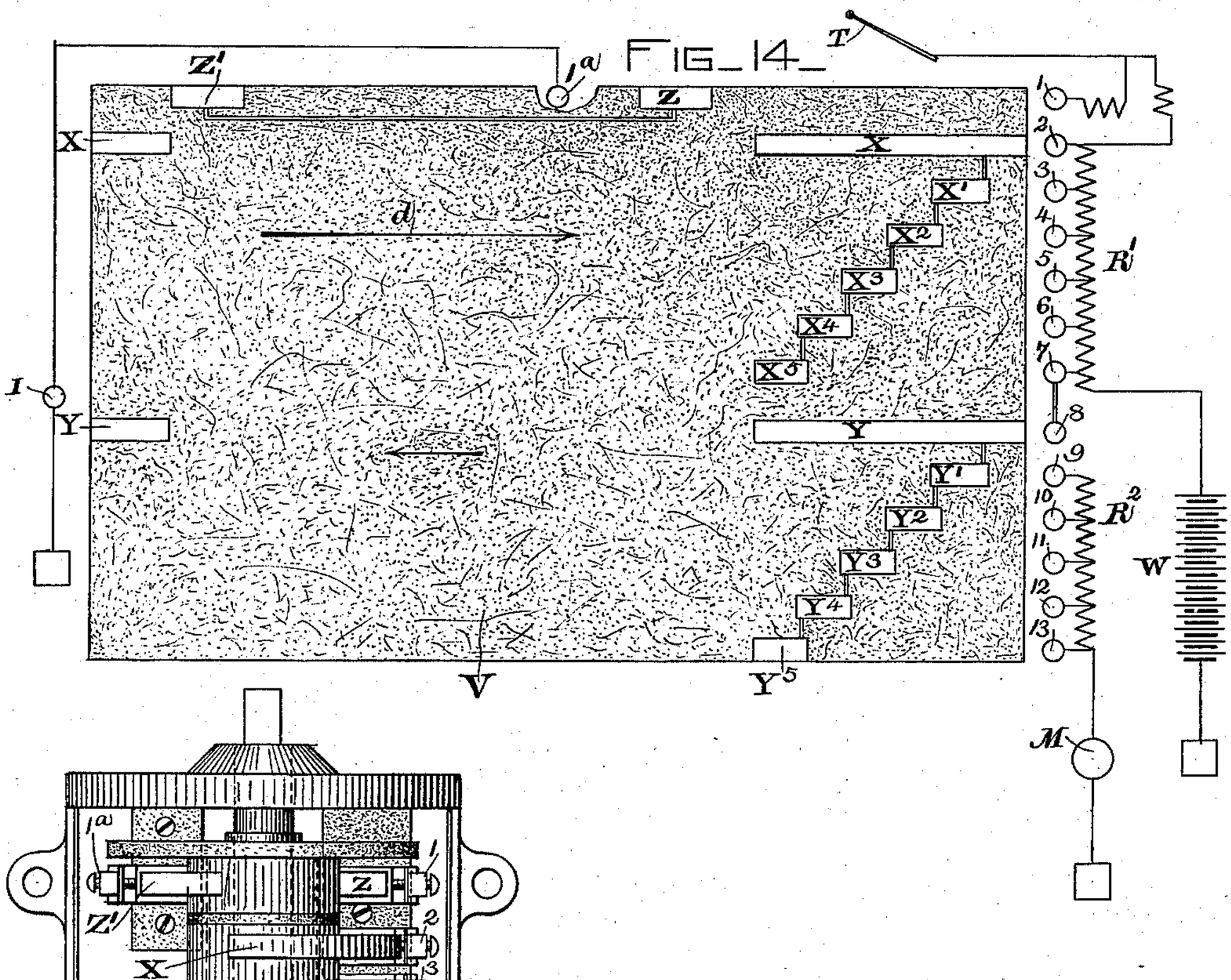
NO MODEL. 4 SHEETS—SHEET 4.

FIG. 14.



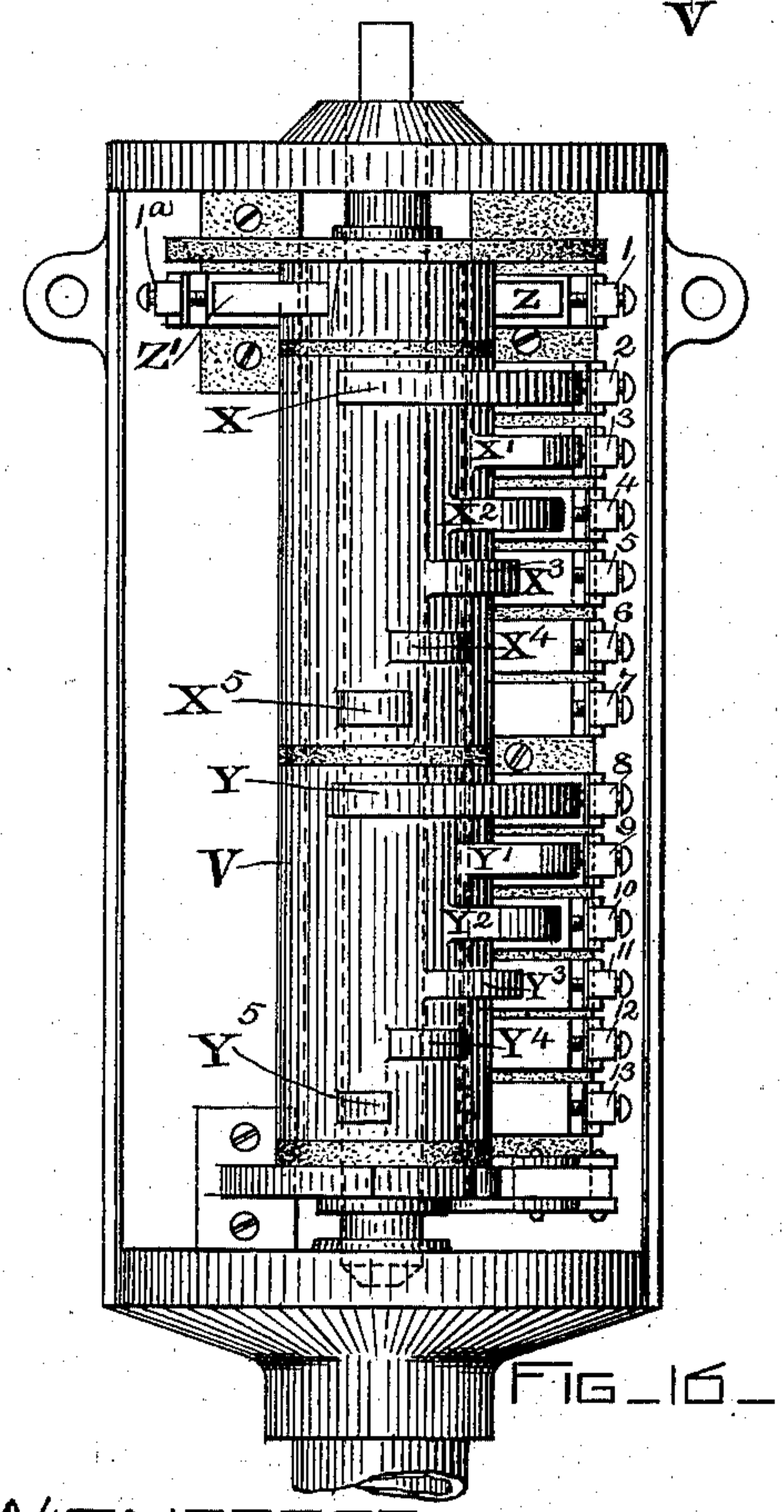
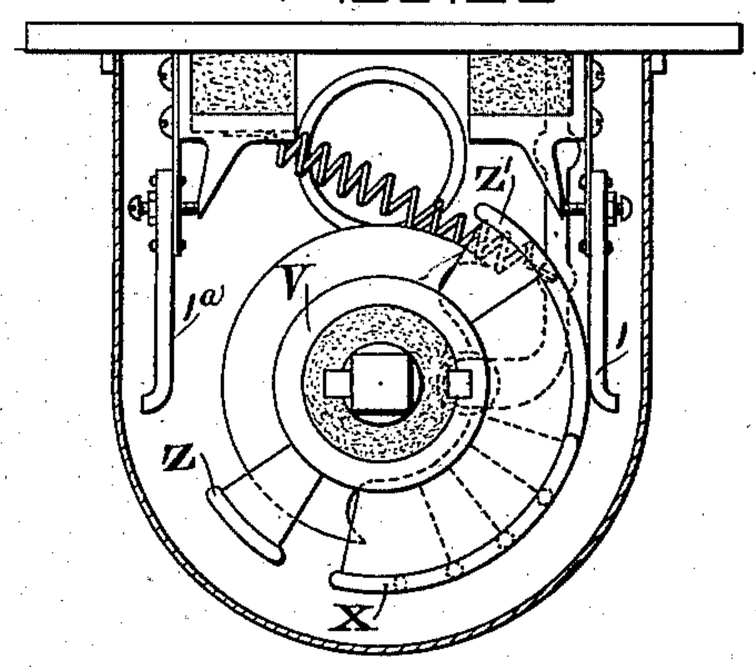


FIG. 16.

FIG. 15.



WITNESSES

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L. T. Shaw

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No. 750,421. Patented January 26, 1904.

UNITED STATES PATENT OFFICE.

GEORGE C. ANTHON, OF MEDFORD, MASSACHUSETTS, ASSIGNOR, BY MESNE ASSIGNMENTS, TO ALGONQUIN ELECTRIC BRAKE CORPORATION, OF BOSTON, MASSACHUSETTS, A CORPORATION OF MAINE.

ELECTRIC BRAKE.

SPECIFICATION forming part of Letters Patent No. 750,421, dated January 26, 1904.

Application filed November 30, 1901. Serial No. 84,191. (No model.)

To all whom it may concern:

Be it known that I, GEORGE C. ANTHON, a citizen of the United States, residing at Medford, county of Middlesex, State of Massachusetts, have invented certain new and useful Improvements in Electric Brakes, of which the following is a specification, reference being made to the accompanying drawings, wherein—

Figure 1 is a general plan of a car frame and trucks with my invention applied thereto. Fig. 2 is a horizontal section of the hydraulic check. Fig. 3 is a vertical section thereof. Fig. 4 is a vertical section of the magnet and releasing-valve for the said check. Fig. 5 is an elevation, partly in section, of the check-valve. Fig. 6 is an elevation, partly in section, of my magnetic clutch. Fig. 7 is a vertical section of the said clutch. Figs. 8 and 9 are details thereof. Figs. 10, 11, 12, and 13 illustrate the arrangements for connecting the coils of the clutch to the circuit. Fig. 14 is a plan of the controller-cylinder. Fig. 15 is a top view of the controller with the cover removed; and Fig. 16 is a side elevation of the same.

My invention relates to electric brakes; and it consists in an improved liquid or fluid lock and release for the brakes and means for controlling the same and also in certain improvements in electromagnetic clutches by which a brake winding-drum is brought into frictional engagement with a driven axle.

The invention also involves means for connecting the coil of the said clutch with the circuit external thereto and an electrical controller by which both the application and release of the brakes is controlled and a storage battery is so manipulated as to compensate for local or temporary differences in the line pressure and serve for the operation of the brakes in the event of an interruption between the car and the supply line.

In the accompanying drawings one of the forms which may be assumed by each of the respective features of my invention is illustrated, it being understood that the invention may also be embodied in various other forms.

In Fig. 1, A is a winding-drum containing an electromagnetic clutch adapted to be brought into frictional engagement with one of the axles of a car and to thereby set the winding-drum in rotation, which takes up the chain C and applies the brakes to the vehicle. The brakes may be of any well-known description. For example, the chain C draws on the lever D, to the opposite sides of whose center the rods d and d', respectively, are jointed, and draw in turn upon the brake-beams of the respective trucks. The same lever D may be operated by hand by the rods d^2 and d^3, reaching to opposite ends of the car, respectively. I will describe hereinafter the construction of the clutch A and will now explain the liquid or fluid lock, by means of which the brakes after being applied by the pull of the chain C may be released wholly or partly or may be held in their applied position at will.

Referring to Figs. 1 and 2, B is a piston-rod jointed at its outer end to the lever D and provided at its inner end with a piston E, working in a cylinder F. The piston-rod enters the cylinder through a stuffing-box b. The opposite ends of the cylinder F communicate with each other on one side by a tube G, containing the check-valve H, and on the other side by a tube g, containing the valve h. The construction of the valve H is shown in detail in Fig. 5. In the interior thereof is the valve-lip 3 on a seat 2, having its surface in a plane lying at an angle to the axis of the pipe G. The valve-lip 3 is attached to the outer end of arm 4, pivoted at 5. Obviously this arrangement will permit a free flow of liquid through the pipe G in the direction of the arrow 6, but will prevent its flow in the opposite direction. Therefore, referring to Fig. 1, the drawing of chain C in the direction of the arrow 7 will pull upon lever D, which in turn will draw on piston-rod B and pull the piston E from the position shown in Fig. 2 to the opposite or right-hand end of cylinder F. The cylinder will be filled with oil or other suitable fluid, and as the piston E is drawn forward the oil will flow freely through the

pipe G in the direction of the arrow 6, such flow being permitted by the check-valve H. It will also flow freely through the pipe *g*, as the valve *h* also allows such flow in one direction. After the brakes have been applied, however, the piston E cannot return to the position which it occupies in Fig. 2, because the flow of the liquid in the reverse direction through pipe G is prevented by check-valve H. Consequently the brakes will be locked in their applied position.

To release the brakes, I provide an electromagnet to operate the valve *h* in pipe *g*. This valve *h* is of an ordinary type and is shown in detail in Fig. 4, wherein 8 is the valve, which normally rests on the valve-seat 9 in a horizontal partition 10, extending across the body of the valve. The valve-stem 11 is connected with the lower end of the core of an electromagnet I, the circuit of which is under the control of the operator. The energizing of the magnet will thus open a passage-way between the opposite ends of the cylinder and allow the liquid to gradually flow back at such a rate as the operator may desire. It will also act as a check-valve, like valve G. I may, if I wish, use the valve *h* only, which would in that case be of sufficient size to permit a ready flow in the locking direction and a graduated controlled flow in the opposite direction.

Heretofore it has been proposed to operate brakes by means of an electromagnet and to lock them in position by means of a ratchet or a mechanical clutch and to release them by a second magnet acting upon said clutch. In such an arrangement, however, it is difficult, if not impossible, to avoid a sudden and complete release of the brakes, which are drawn back by the release-spring with a sudden and heavy shock. The gradual release of the brakes by such means is impracticable. By the arrangement I have just described, however, it becomes possible to release the brakes as gradually as desired and to reduce their tension to any required point and leave it there as long as may be necessary. In other words, the valve *h* acts as a bleeding-valve to reduce the pressure of the brakes gradually and gently. The cylinder F communicates, on the right of the piston, with an open oil-reservoir F^2, which serves to prevent the accumulation of air in the cylinder, since any air leaking in through the stuffing-box will rise through the oil into the reservoir, and so escape. The supply of oil may also be maintained through the reservoir.

Turning next to the clutch and the winding-drum as they are shown in Figs. 6 to 13, J is the car-axle, to which is rigidly keyed a disk K, having the cross-section shown in Fig. 7. The peripheral face of the disk is wider than the center, which is seated on the axle. This is to enable the disk and winding-drum to be placed between the motor and the wheel, the hub of the wheel projecting into the dished portion of the drum and disk, as shown at the left-hand side in Fig. 7.

The winding-drum is made in the form of a casing, which incloses the disk K, and is provided with a groove *k*, in which the chain C may be wound, the end link of the chain being held by pin *c* in the aforesaid groove.

On the outside of the disk K, but within the winding-drum A, are three brake-shoes L′, L^2, and L^3, (see Fig. 6,) which are curved to conform to the outer surface of the disk K and are seated loosely in the space between the disk and the drum or casing A. By this arrangement I avoid the necessity of employing retractile springs for the brake-shoes to hold them normally away from the disk, and the shoes are so small and light that the friction is inconsiderable when one of them rests upon the rotating disk. Moreover, the brake-shoes on the under side of the disk tend to fall away by gravity, leaving only one to ride upon the disk. In order to retain the disks in position without binding, they are provided with lugs *l* on their rear side, which rest in recesses *l′*, formed in the outer cylindrical wall of the drum A and are pivoted to one end of a short link l^2, (see Fig. 9,) whose opposite end is pivoted to the drum or casing A.

Each of the shoes L′, L^2, and L^3 is energized magnetically by a coil M, set into its bearing-surface, as shown in Fig. 7. The center of the shoe is thus of one polarity and its outer edge of the opposite polarity, while the magnetic circuit will be completed by the disk K. This arrangement provides a very short magnetic circuit, which may be energized by a small number of ampere-turns, while the location of the shoes on the periphery of the large disk K permits of the drum A being clutched to the disk by a very slight magnetic friction. Each shoe, with its contained coil, is made up as a separate article, the terminals of coil M being each brought to a spring-button N, as shown in detail in Fig. 8. Therefore the shoes may be readily placed in position and renewed as occasion may demand. As shown in Fig. 13, the inside wall of the drum A is provided with three insulated plates (lettered, respectively, O, O′, O^2,) the first one being shorter than the other two and connected to one terminal of the incoming circuit, as will be hereinafter described.

When the three brake-shoes are in position, their terminal contact-buttons N will rest against the insulated plates aforesaid, and the plate O′, for instance, will receive the buttons forming the outgoing terminal of shoe L^3 and the ingoing terminal of the shoe L^2, thereby establishing a series connection between the coils of the two shoes. Similarly the coils of the shoes L^2 and L′ will be connected in series by the plate O^2. The two end terminals of the series of coils will rest one against the plate O, so as to receive the incoming current, and the other against the metal of the casing

to thereby establish a connection to ground. In this manner the three brake-shoe coils are connected in series between the ground and the circuit leading thereto from the controller.

For introducing the current into the winding-drum A, I provide a recess P on the flange, which forms one side of the groove *k*. This is covered by the ring *p*, and on its bottom is seated an insulated copper ring Q. The details are shown more fully in Fig. 11. The ring Q is dovetailed and set in a corresponding seat on a layer of insulation *q*. The ring Q is connected electrically by an insulated conductor with the contact-plate O, as is indicated in Fig. 13.

In order to maintain contact with the ring Q, I provide the arrangement shown in detail in Figs. 10 and 12, wherein the hollow ring-cover *p* of the groove P is held stationary, so as to rotate in the groove, and is provided at one point with a socket *r*, into which is screw-threaded the tube *r'*, containing at its inner end a spring-pressed contact-button S, which bears upon the insulated ring Q and which is connected with the external circuit by an insulated conductor r^2 within the tube *r'*. By this means the current is introduced into the brake-shoes without any exposure of the conducting parts.

In Figs. 14, 15, and 16 is illustrated the controller which I prefer to employ in connection with the braking apparatus already described. The controller is of the well-known cylindrical type, in which a drum provided with a series of contact-plates is rotated against a vertical row of contact points or fingers with which the plates make connection, and thereby establish the desired arrangement of circuits. The controller is composed of a vertical drum or cylinder V, carrying contact-plates X X' X^2, &c., Y Y' Y^2, &c., and Z Z'. The contact-points on one side are arranged in a vertical row, numbered from 1 to 13; but on the opposite side is a single point 1^a.

In Fig. 14 a plan of the cylinder-drum is shown with the several contacts thereon and the contact fingers or points arranged adjacent thereto. The point 1 is connected directly to the trolley T, and the point 1^a is connected to the release-magnet I and thence to ground. The point 2 is also connected to the trolley T, and the several points 2 to 7 are connected to intermediate points in a series of resistances R', these resistances being also connected at the lower end to one terminal of a storage battery W, whose opposite terminal is connected to ground. The point 8 is connected to point 7, and the points 9 to 13 are connected to the resistance R^2, which also leads to the brake-magnet M and thence to ground.

It will be understood that in its normal or off position the controller-points 2 and 8 bear, respectively, upon the long contact-plates X and Y, the extreme ends of these plates being shown at the left of the diagram. This leaves the circuit closed through the resistance R' and the storage battery W, which is consequently being charged to a slight degree. A movement of the controller in the direction indicated by the arrow *d* brings the plate X' against the point 3 and the plate Y' against the point 9. This cuts out one section of resistance R' in the storage-battery circuit and introduces a small amount of current through the resistance R^2 and the brake-magnet M. As the controller is turned both of the resistances R' and R^2 are gradually short-circuited until at the last position the brake-magnet M and the battery W are both in circuit without any resistance. This will actively charge the battery and energize the brake-shoes, causing them to adhere to the disk K, so that the winding-drum is turned by the disk and the brake-chain wound thereon. In the event of the trolley being off the wire or the circuit from the trolley otherwise interrupted the discharge of the storage battery will pass to the contact-point 8, and thence energize the brake-magnet in the same manner as it is energized normally by the trolley-current. The storage battery will also be discharged in the same manner in the event of the pressure on the trolley-wire falling below its normal amount.

In order to release the brakes, the controller will be turned back to the off position and slightly beyond, when the plate Z' will come against point 1 and the connected plate Z will come against the point 1^a. This will establish a circuit from the trolley T through the release-magnet I to ground, and the energizing of the magnet will in the manner I have already described operate the valve *h*, and if the contact is maintained it will allow the brakes to come completely off; but if energized momentarily it will release the brakes to the degree corresponding to the length of time that the circuit is maintained. In this way the brakes can be applied as hard as desired and then gradually released in order to check the speed of the car at a desired rate, and finally the brakes can be again applied to bring the car to a standstill. This provides for the most improved method of applying and regulating the pressure of the brakes in the operation of a railway-vehicle.

It will be understood that the apparatus herein shown is merely an illustration of one of the ways in which my invention may be embodied and that it also may be embodied in other apparatus of the same fundamental character as that illustrated.

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

1. The combination with an electrically-applied brake of a liquid or fluid locking device, an automatic check-valve therefor, and releasing means controlled by the operator.

2. The combination with a railway-brake of an operating connection between it and the car-

axle, an automatic liquid or fluid lock for the brake and a releasing device therefor under the control of the operator.

3. The combination with a railway-brake of an operating connection between it and the car-axle, an electromagnetic device controlling the said connection, an automatic liquid or fluid lock therefor and a releasing device under the control of the operator.

4. The combination with a railway-brake of a locking-cylinder containing a piston and a suitable fluid, of an automatic check-valve controlling the flow of fluid from one end of the cylinder to the other and a releasing-valve controlled by the operator.

5. The combination with a railway-brake of a mechanical operating device therefor, an electrical controller for said device, an automatic liquid or fluid lock for the brake and an electric controller for the said lock.

6. The combination with a railway-brake of a winding-drum operated by the car-axle, an electromagnetic clutch for mechanically connecting the said drum to the axle, a controller for the said clutch, an automatic liquid or fluid lock for the brake, an electromagnetic releasing device for the said lock and a controller for the said releasing device.

7. A liquid or fluid lock for a railway-brake, comprising a cylinder and piston adapted to be connected to the brake, a check-valve contained in a tube leading from one end of the piston to the other and a release-valve in a second tube also leading from one end of the cylinder to the other.

8. A liquid or fluid lock for a railway-brake, comprising a cylinder and piston and two tubes or passage-ways for the liquid around the cylinder, one provided with an automatic check-valve and the other with a manually-controlled releasing-valve.

9. The combination with a railway-brake of an automatic liquid or fluid lock therefor, a release-valve for said lock and an electromagnet controlling said valve.

10. In an electric railway-brake the combination with a wheel and axle, of a propelling electric motor for the vehicles mounted upon said axle, a winding-drum for the brake mounted upon said axle between the motor and the wheel and an electromagnetic clutch for engaging the drum with the axle.

11. In a railway-brake the combination with a wheel and axle of a propelling electric motor for the vehicle mounted upon the axle, a winding-drum for the brake mounted on the axle between the motor and the wheel and a clutch for engaging the said drum with the axle so that it may be operated thereby.

12. In an electric railway-brake the combination with a wheel and axle of an electric motor mounted upon the axle, a winding-drum for the brake also mounted on the axle between the motor and wheel, a disk keyed to the axle, a friction-clutch mounted on the said drum engaging the external periphery of sa d disk to connect the drum and axle so that the former may be operated by the latter, and an energizing-coil for said clutch having its axis radial to the axle.

13. In an electric railway-brake the combination with a wheel and axle of a winding-drum mounted on the axle and adjacent to the wheel and embracing the hub thereof, a friction-clutch for engaging the said drum with the axle, and an energizing-coil for said clutch having its axis radial to the axle.

14. In an electric railway-brake the combination with an axle of a winding-drum thereon, a disk inclosed by said drum and keyed to the axle, a friction-clutch also contained within the said drum for engaging the drum with the axle, and an energizing-coil for said clutch having its axis radial to the axle.

15. In an electric railway-brake the combination with an axle of a disk keyed thereto, a winding-drum inclosing the said disk, frictional devices between the outside periphery of the disk and the inside wall of the drum, and an energizing-coil for said clutch having its axis radial to the axle.

16. In an electric railway-brake the combination with an axle of a disk keyed thereto, a winding-drum, electromagnetic friction-shoes surrounding the said disk and retracted therefrom when deënergized by gravity, and an energizing-coil for said clutch having its axis radial to the axle.

17. In an electric railway-brake the combination with an axle of a brake-disk thereon, a winding-drum, a friction-clutch between the disk and drum comprising electromagnetic brake-shoes inclosed by the drum and engaging with the periphery of the said disk, and an energizing-coil for said clutch having its axis radial to the axle.

18. In an electric railway-brake the combination with an axle of a disk mounted thereon, a winding-drum inclosing the said disk, and an internal brake-shoe contained within the said drum and carrying a coil having its axis radial to the axle and connected with the external circuit.

19. In an electric railway-brake the combination with an axle of a winding-drum and an intermediate electromagnetic clutching device comprising a separable brake-shoe and an energizing-coil thereon having its axis radial to the axle.

20. A detachable electromagnetic brake-shoe containing an embedded energizing-coil with its terminal connected to an external contact-button on the shoe itself.

21. A detachable electromagnetic brake-shoe comprising a coil embedded in its bearing-face, the terminal of the coil being connected to an external contact-button on one of the other faces of the shoe.

22. An electromagnetic friction-clutch comprising separable brake-shoes having an ener-

gizing-coil thereon, exposed contact-buttons connected to the respective terminals of the coil and a carrier for the shoe having contacts connected with the energizing-circuit and adjusted to connect with the buttons aforesaid when the shoe is placed in position.

23. In an electric railway-brake the combination with a winding-drum of a friction-disk inclosed within said drum, a magnet having its axis radial to the axle and a contact-ring on said drum with which a stationary contact-point makes connection.

24. An electromagnetic clutching device having exposed contact-buttons for the terminals of its energizing-coil, a contact-ring with which a stationary contact-point makes connection and a contact-plate connected to the said ring with which the said buttons connect when the parts are placed in position.

25. In an electric railway-brake the combination with an axle of a disk keyed thereto, a winding-drum embracing the said disk on both sides and bearing on the axle, a series of separable brake-shoes interposed between the outer periphery of the disk and the inner wall of the drum and connected to the latter, exposed contact-buttons for the energizing-coils of said shoes, a contact-plate on the interior walls of the drum, an external contact-ring for the drum connected to the said plate and a stationary contact connected with the said external circuit bearing upon the said brake.

26. In an electric railway-brake the combination of a winding-drum for the brakes, an electromagnetic clutch for connecting the said drum to the axle, a regulating resistance in the circuit of said clutch and a storage battery connected to line-circuit in multiple with the said clutch.

27. In an electric railway-brake the combination with a winding-drum, an electromagnetic clutch for connecting the said drum to the axle, the said clutch being connected to the supply-line and operated therefrom and a storage battery also connected to the said supply-line in multiple with the said clutch.

28. In an electric railway-brake the combination with a brake-controlling magnet connected to the line-circuit, a regulator thereof and a storage battery connected to the line-circuit in multiple therewith.

29. In an electric railway-brake the combination with an electromagnet controlling the said brake and connected to the supply-line, of a storage battery also connected to the supply-line in multiple with the said magnet and regulating devices for the said battery.

In witness whereof I have hereunto set my hand, before two subscribing witnesses, this 25th day of November, 1901.

GEORGE C. ANTHON.

Witnesses:

EDWARD NICHOLS CHASE,

HAROLD G. DONHAM.