No. 701,453. Patented June 3, 1902.

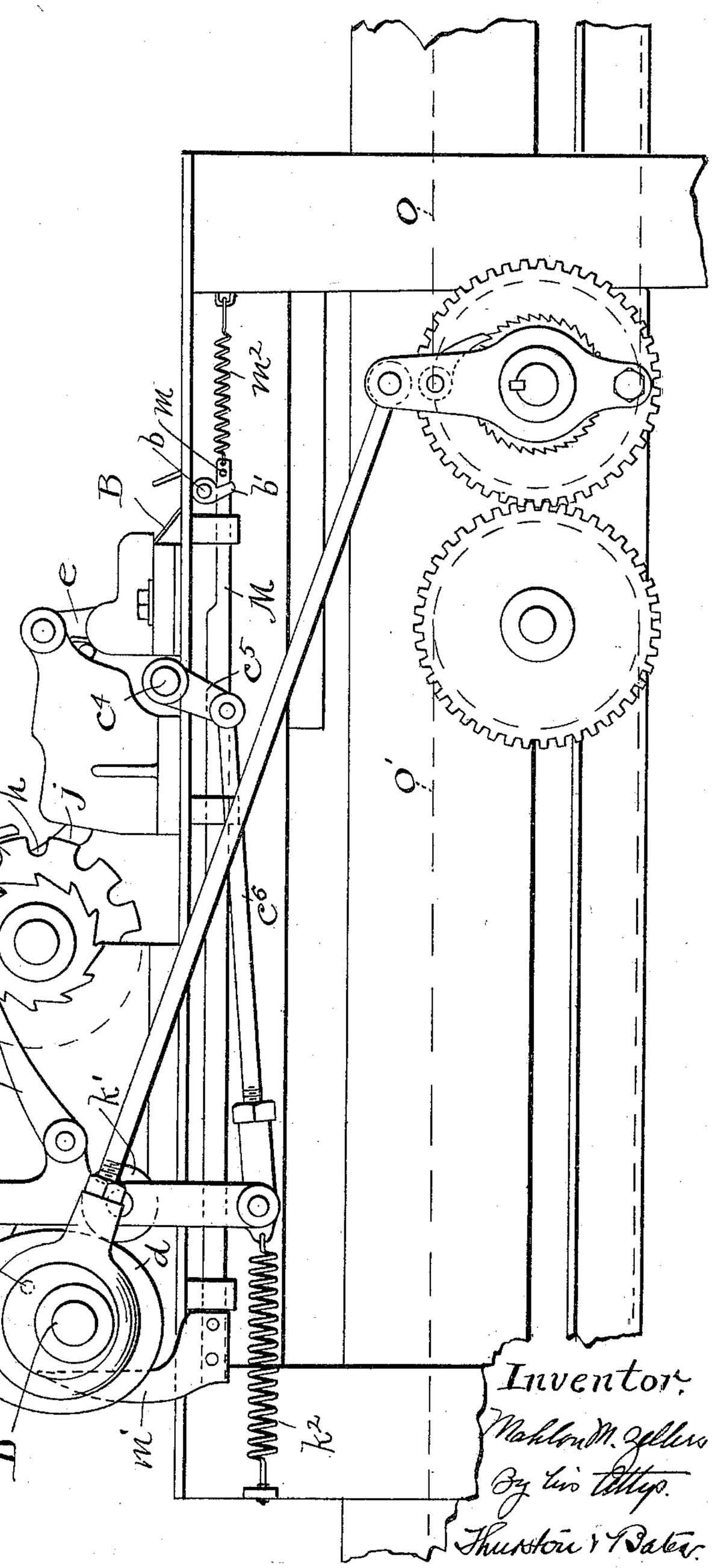
M. M. ZELLERS.

CARBON SORTING MACHINE.

(Application filed Feb. 15, 1902.)

(No Model.) 4 Sheets—Sheet 1.

Fig. 1.



Witnesses
E. B. Gilchrist
F. D. Ammen

Inventor:
Mahlon M. Zellers
By his Attys.
Thurston & Baker.

No. 701,453. Patented June 3, 1902.

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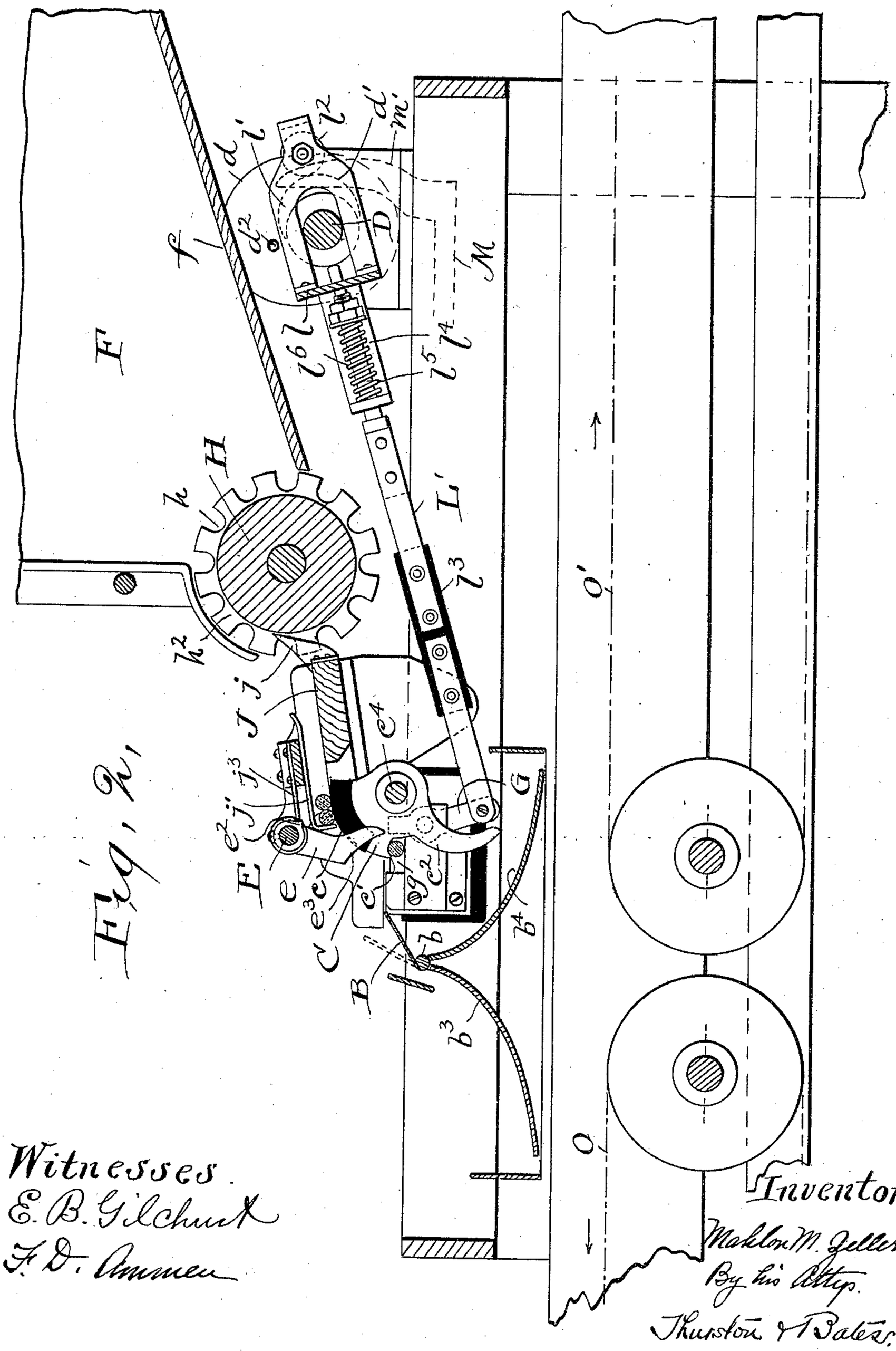
(No Model.) 4 Sheets—Sheet 2.



Witnesses.
E. B. Gilchrist
F. D. Ammen

Inventor:
Marlon M. Zellers
By his Attys.
Thurston & Bates.

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(No Model.) 4 Sheets—Sheet 3.

Fig. 3.

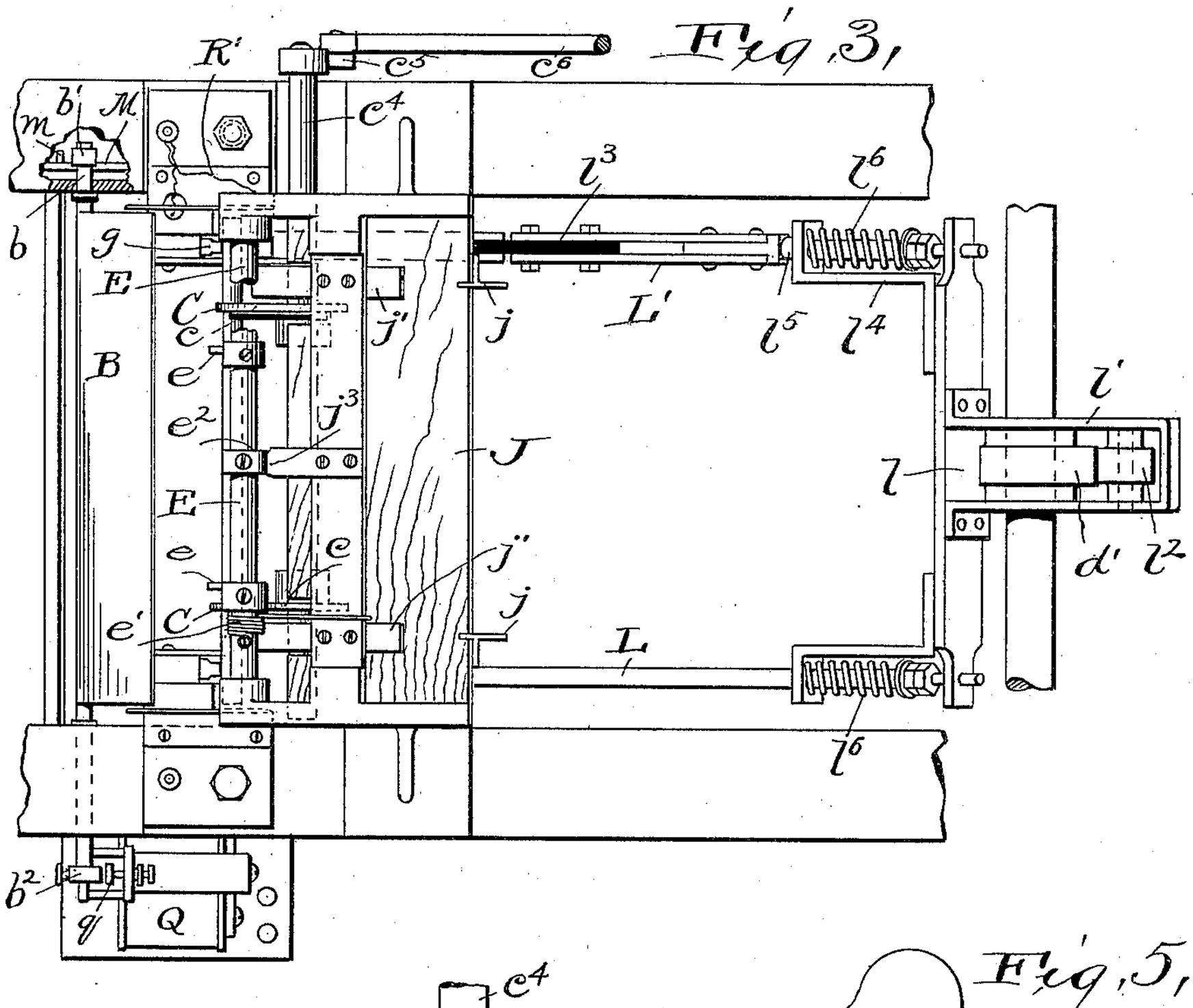


Fig. 4.

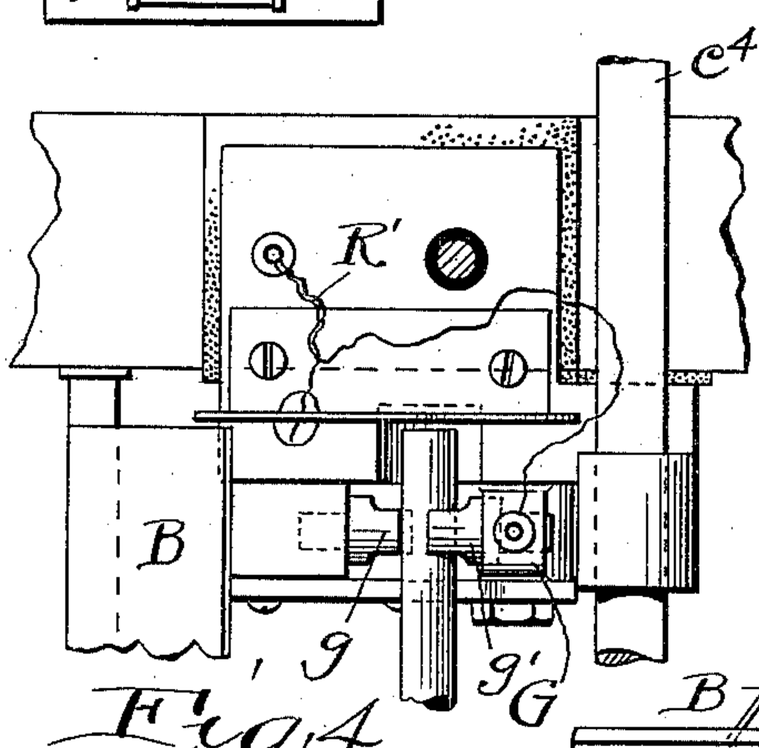


Fig. 5.

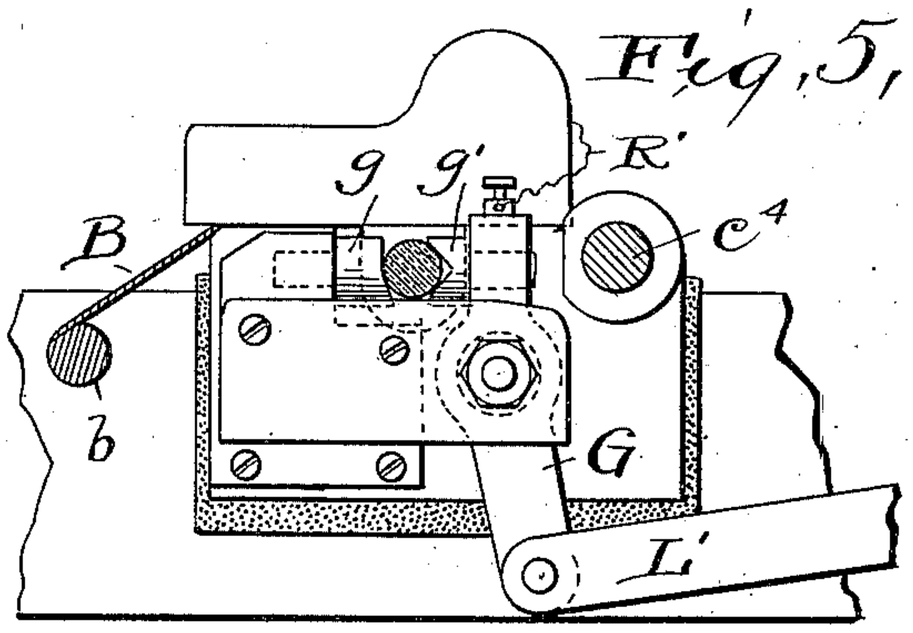
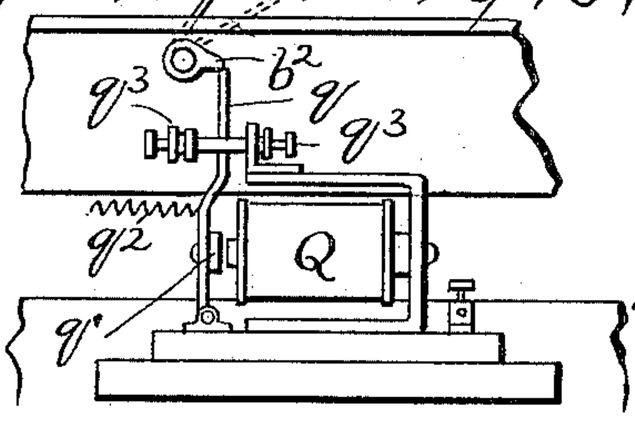


Fig. 6.



Witnesses,
E. B. Gilchrist
F. D. Amnicen

Inventor,
Melvin M. Zellers
By his Attys.
Thurston & Bates.

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M. M. ZELLERS.

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(No Model.) 4 Sheets—Sheet 4.

Fig. 7.

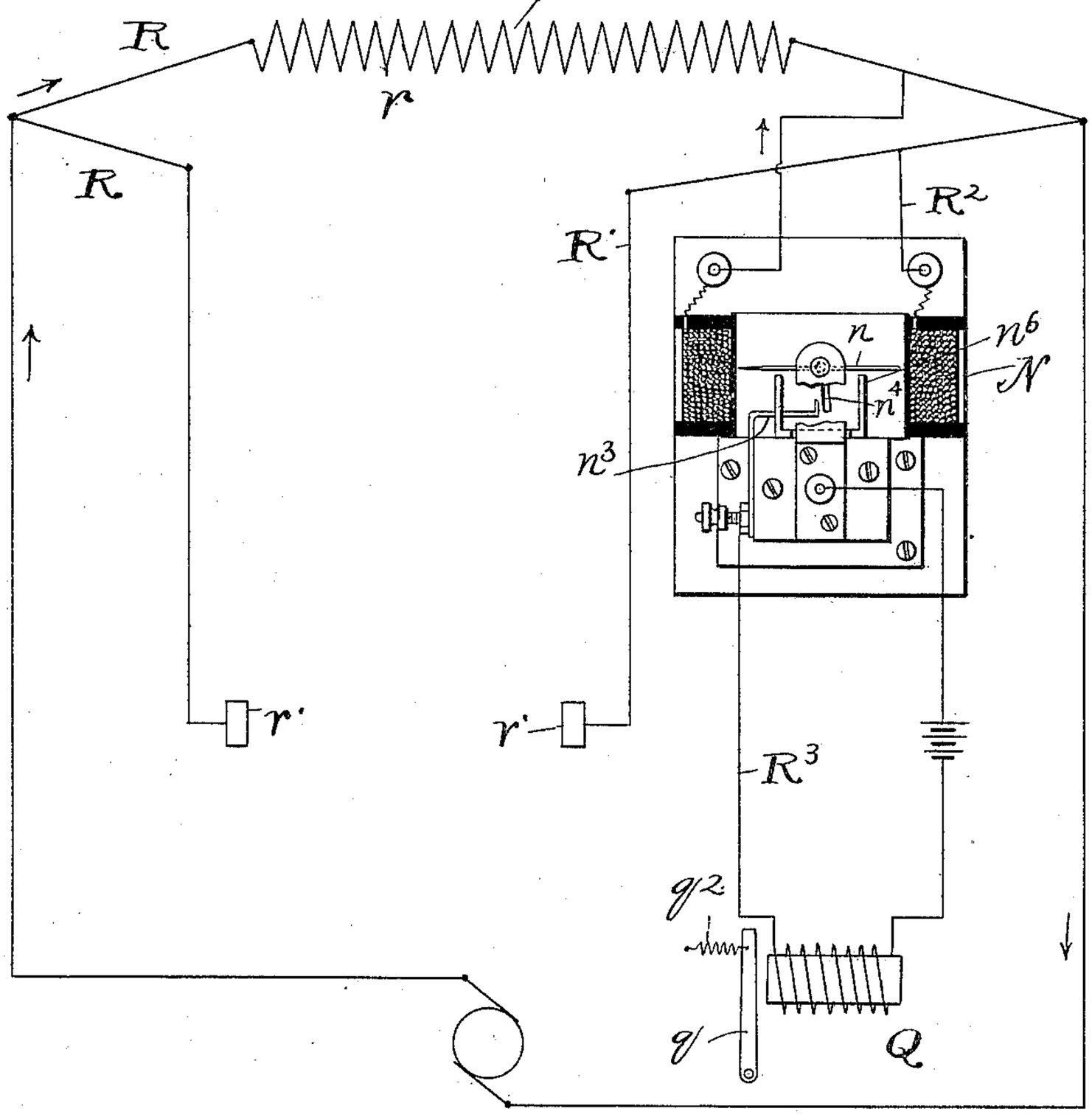
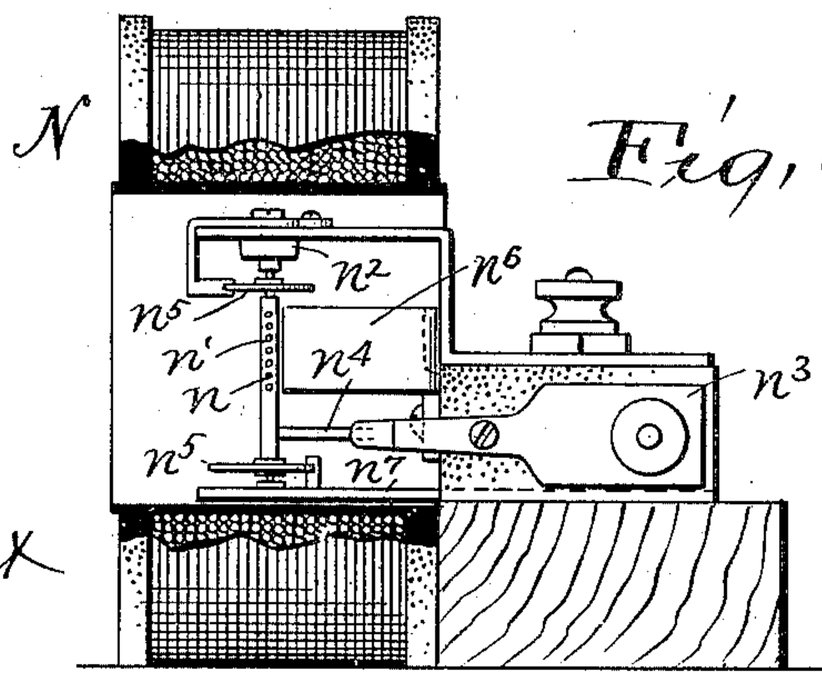


Fig. 8.



Witnesses.
E. B. Gilchrist
F. D. Ammen

Inventor.
Mahlon M. Zellers
By his Attys.
Thurston & Bates

UNITED STATES PATENT OFFICE.

MAHLON M. ZELLERS, OF CLEVELAND, OHIO, ASSIGNOR TO NATIONAL CARBON COMPANY, OF CLEVELAND, OHIO, A CORPORATION OF NEW JERSEY.

CARBON-SORTING MACHINE.

SPECIFICATION forming part of Letters Patent No. 701,453, dated June 3, 1902.

Application filed February 15, 1902. Serial No. 94,172. (No model.)

To all whom it may concern:

Be it known that I, MAHLON M. ZELLERS, a citizen of the United States, residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented a certain new and useful Improvement in Carbon-Sorting Machines, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings.

In the commercial manufacture of carbon designed more especially for use in inclosed-arc lamps the effort is made to so construct them that they shall all have the same theoretically proper resistance. This is a result which, however, cannot be secured by methods of manufacture which are commercially practicable. The carbons of the same lot, all of which during their manufacture are subjected to the same treatment under the same conditions as near as may be, will vary as to their resistance. It is, however, necessary to sort the carbons with reference to their resistance, and the present invention is an apparatus designed to effect this sorting rapidly and automatically.

The invention includes an open electric circuit in which the carbons may be connected to be tested, a guide-plate by which the carbons when withdrawn from said circuit are guided in one direction or another, and mechanism for controlling the movement of said guide-plate, which mechanism is caused to operate according as the resistance of the carbon being tested is less or greater than the theoretically correct resistance.

The invention consists in the combination of parts above recited and in the more specific combination including other elements having certain characteristics of construction, all of which will be hereinafter explained, and pointed out definitely in the claims.

In the drawings, Figure 1 is a side elevation showing the essential parts of the machine. Fig. 2 is a sectional side elevation from the opposite side of the machine. Fig. 3 is a plan view with the ends of the machine broken away and the hopper and cylinder removed. Fig. 4 is an enlarged plan view of the electrical contact device and parts adjacent thereto at one side of the machine. Fig. 5 is an enlarged side view of the parts shown in Fig. 4, some parts being shown in section, as will appear. Fig. 6 is an enlarged side view of the latch for holding the switch-plate in a certain position and the magnetic trip for said latch. Fig. 7 is a diagrammatic view of the electric circuits employed in the device and a sectional plan view of the galvanometer. Fig. 8 is a sectional side elevation of the galvanometer.

The embodiment of the invention shown includes a Wheatstone's bridge arrangement of electrical connections and a galvanometer N, as shown diagrammatically in Fig. 7. One branch, R, which may be called the "main circuit," includes certain known or standard resistance in the form, preferably, of a resistance-coil r. The other branch, R′, which may be called a "shunt-circuit," is broken, the terminals r' r' formed by the break being of a form suitable for making contact near its opposite ends with a carbon whose resistance is to be tested by comparison with the resistance in the main circuit. It is not necessary to watch the galvanometer-needle to learn in which direction the current is flowing over the bridge-circuit R′, in which the galvanometer N is connected, so as to learn in which branch of the circuit is the greater resistance, because the movement of the needle n of the galvanometer operates a switch by which the circuit of an electromagnet Q is closed and broken. This electromagnet by its operation controls the position of a guide-plate B, capable of being moved into and out of the path through which the carbons must travel after they are removed from the electric circuit, and the position of this guide-plate determines whether the carbon shall be guided in one direction or another toward suitable receivers therefor.

The machine contains mechanism whereby the carbons are automatically carried into contact with the terminals of the shunt-circuit R′, and then removed therefrom and advanced toward suitable receptacles therefor through a path in which said guide-plate B may or may not be projected.

The machine for convenience employs a hopper F of familiar form having an inclined

bottom *f*, down which the carbons slide into the longitudinal grooves *h* in a rotating feed-cylinder H, mounted in the mouth of the hopper. This feed-cylinder is rotated step by step by means of a ratchet *h'*, secured to it, and a pawl *k* on a rocking lever K. This lever is pivoted to a suitable support, and it is rocked in one direction by the engagement of a cam *d* on the main shaft D with a friction-roller *k'*, carried by said lever. This lever is moved in the opposite direction by a spring k^2.

As the feed-cylinder is turned the carbons are withdrawn singly from its grooves by the upturned fingers *j* on the inclined board J, which fingers project into circumferential grooves h^2 in said cylinder behind the carbons. The carbons roll down these fingers and board and rest against retaining-fingers *j'*, fixed to the frame of the machine, and are supported by the curved edges *c* of the feeders C, the function of these feeders being to move the carbons singly into the embrace of the clamping devices which constitute the terminals of the shunt-circuits R' and then to withdraw them from said clamping devices and to initiate their movement toward the discharge end of the machine. These feeders C are secured to a rock-shaft c^4, and their circumferential edges *c* are cut away at suitable points to form shoulders *c'*, which as the feeders are rocked backward pass beneath the carbon lying against the retaining-fingers *j*. This carbon falls down behind said shoulders, which as the feeders swing forward carry the carbons and push them into the embrace of certain jaws which are connected with the terminals of the shunt-circuit R'. The carbons are held against said shoulders *c'* by the arms *e*, attached to a rock-shaft E, which is under the influence of one or more springs *e'*, tending to rock it so as to press said arms yieldingly against said carbons. This movement is limited by an arm e^2, secured to said shaft, which engages with a fixed plate j^3. These feeders C have likewise the curved arm c^2, which as the feeders are rocked backward cooperate with the curved face e^3 of the arm *e*, so as to lift the carbons out of the embrace of said jaws and then permit them to roll down the inclined face of said arms c^3 toward the guide-plate B. This rock-shaft c^4 is oscillated, as described, by means of an arm c^5, which is connected with the lever K by a link c^6.

The contact devices forming the terminals of the broken shunt-circuit R' are placed suitable distances apart and are in the form of clamping-jaws which will take hold of the carbons and temporarily hold them in the circuit. In the form shown each clamping device consists of the fixed jaw *g* and the movable jaw *g'*.

With every revolution of the main shaft D the jaws *g g'* open to receive a carbon, close to connect the carbon into the shunt-circuit, and then open to permit it to be released. The same shaft by its revolution causes the carbons to be fed one by one into position to be taken hold of by said clamping devices G and also advances the feed-roller step by step to supply a carbon for each movement of the parts referred to. Suitable electrical connections are made with one or the other, or both, of the jaws of this clamping device and the broken terminals of the shunt-circuit R'.

The movable jaws are secured to the upper ends of levers G, which connect, respectively, with links L L', which extend rearwardly and are suitably connected with a cross-bar *l*, and this cross-bar is provided with a rearwardly-extended bracket or yoke *l'* which embraces the main shaft and has behind the shaft a friction-roller l^2, which engages with a cam *d'* upon said shaft D. The ends of the link L' should be insulated, as shown at l^3. In order to dispense with nice adjustments and to prevent any possibility of crushing the carbons between the jaws *g g'*, I provide a common form of flexible spring connection. It consists of a bracket l^4, which coöperates with the cross-bar *l* to form a guide for the extension l^5 and a spring l^6 is interposed through which the force is transmitted to the link.

A number of the parts above described must be insulated; but it is thought unnecessary to specifically define what parts. It is necessary that all of the current which flows over the shunt-circuit R' shall pass through the carbon which is being tested when said carbon is in the embrace of the clamping devices with which the terminals of said shunt-circuit are connected. Any one skilled in the art will provide suitable insulation to prevent the current from being diverted from this path.

The guide-plate B is attached to a shaft *b*, on the projecting ends of which are the two fingers *b' b²*. One of these fingers *b'* is in the path of a pin *m*, attached to a sliding bar M, mounted in suitable guides at the side of the machine and having at its rear end an arm M', which will be engaged by a pin d^2 on the cam *d* and drawn backward. By the backward movement of this bar this pin *m* is brought into engagement with the said finger *b'* and causes the guide-plate to be moved up out of the path in which the carbons necessarily travel after they have been advanced from the engagement of the clamping devices. A spring m^2 constrains the sliding bar M toward an extreme position. The other finger b^2 is on the opposite end of the shaft and adjacent to the upper end of the lever *q*, to which is secured the armature *q'* of the electromagnet Q. When the guide-plate is elevated in the manner described, this lever is drawn beneath the finger b^2 by the spring q^2 and holds the guide-plate in this position until the lever is withdrawn, as it will be when the circuit of the magnet is

completed. Suitable adjustable stops q^3 afford means for limiting the movement of the lever.

Referring now to the diagrammatic view, Fig. 7, and particularly to the galvanometer therein shown connected in the bridging-circuit R^2, the ends of the needle-spindle n' are mounted in the insulated metallic plates n^2 n^7, the latter of which constitutes a terminal of the circuit in which the magnet is connected, while the other terminal of this circuit is connected with a contact-plate n^3, whose end is bent round, so that an arm n^4, attached to the needle-spindle, will come in contact with it when the needle is deflected in one direction. Hair-springs n^5 operate to hold the needle-spindle, so that the arm n^4 is normally out of contact with the contact-plate n^3. A bracket n^6 is adapted to limit the movement of the needle. I provide a circuit R^3, which includes a battery and the electromagnet Q, (shown more in detail with its connected parts in Fig. 6,) and the plates n^2 and n^3 referred to constitute terminals for the same. Now when a carbon has been connected in the shunt-circuit, as described, the current will divide when it reaches the bridging-circuit R^2, and if the resistance of the carbon is less than the resistance in the main circuit R the most of the current will pass through the carbon and to and through the galvanometer in the direction indicated by the arrow. The result will be that the needle will be deflected in the direction indicated by the arrow, wherefore the arm n^4 on the needle-spindle will contact with the plate n^3, thereby completing the circuit R^3 through the electromagnet. The lever q, Fig. 6, is withdrawn and allows the plate B to fall into its inclined position. The tested carbon therefore rolls over this plate into the inclined receiver b^3, from which it falls onto the movable apron O, which carries it to a suitable receptacle. If, however, the carbon being tested has a greater resistance than that of the resistance-coil in the main circuit R, the current will flow over the bridging-circuit R^2 and through the galvanometer in the opposite direction, thereby turning the needle in the opposite direction. This does not cause the completion of the magnetic circuit, and therefore the guide-plate remains in its elevated position, and the carbon which has been thus tested when discharged from the embrace of the clamping devices falls upon the oppositely-inclined receiver b^4, from which it is passed to the other movable apron O', which carries it to another receptacle.

By the described mechanism the carbons whose resistance is less than that of the main circuit will be discharged into one receptacle, while the other carbons will be discharged into another receptacle, thus separating the carbons automatically according to their electrical resistance.

The resistance r may of course be adjustable—that is to say, a greater or less resistance may be connected in the branch R—whereby to render the described apparatus universally adaptable whatever may be the standard of resistance to which the articles being tested are to be compared.

While the apparatus described is designed especially for testing electric-light carbons, it may obviously be used in connection with rods made of any material to sort them according to their electrical resistance.

Having described my invention, I claim—

1. In combination, an electric circuit, means for inserting carbon rods therein, means for determining the resistance thereof, and automatic means for guiding said rods to different receivers, substantially as described.

2. In combination, an electric circuit, means for inserting carbon rods in said circuit, automatic means for guiding said rods therefrom, said last means being controlled by the electrical resistance of said rods, substantially as described.

3. In combination, an electric circuit, means for inserting carbon rods in said circuit, receivers, means for guiding said carbons thereto, said last means being controlled by the resistance of said carbon rods, substantially as described.

4. In combination, an electric circuit, means for inserting carbon rods in said circuit, means for comparing their resistance with a standard resistance, receivers, means for guiding said carbons thereto, means for controlling said last means by the electrical resistance of said carbons, substantially as described.

5. In combination, an electric circuit including two branches, one of said branches containing a known resistance, means for inserting carbon rods in the other of said branches, a bridge-circuit connecting points of said branches and means controlled by the current flowing in said bridge-circuit for guiding said rods to receivers, substantially as described.

6. In combination, an electric circuit having two branches, one of said branches containing a known resistance, means for connecting carbon rods in the other of said branches, means for comparing the resistance of said carbons with that of said known resistance, and automatic means for guiding said carbons to a receiver, said last means being controlled by the resistance of said carbons relative to said known resistance.

7. In combination, an electric circuit including two branches, a bridge connecting points of said branches, an electrically-controlled apparatus located in said bridge, a second circuit controlled by said apparatus, means for inserting carbon rods in one of said branches, means for guiding said rods in passing out of said circuit, said last means being controlled by said second circuit, substantially as described.

8. In combination, an electric circuit including two branches, one of said branches containing a known resistance, means for inserting carbons in the other of said branches,

a bridge-circuit connecting points of said branches, means for guiding said carbons to different receivers, a galvanometer located in said bridge-circuit, means whereby said galvanometer may close a second electric circuit, and means whereby the closing of said second circuit may guide said carbons to different receptacles, substantially as described.

9. In combination, an electric circuit including two branches, one of said branches containing a known resistance, means for inserting carbons in the other of said branches, a bridge-circuit connecting points of said two branches, a second electric circuit, means whereby a current flowing in said bridge-circuit may close said second circuit, means for guiding said carbons to different receptacles, said means being controlled by said second circuit, substantially as described.

10. In combination, an electric circuit including two branches, one of said branches including a known resistance, means for inserting carbons into the other of said branches, a bridge conductor connecting points of said branches, a galvanometer therein, a second circuit, means whereby said second circuit may be closed by a movement of the needle of said galvanometer, means for guiding said carbons to different receptacles, said means being controlled by said second circuit, substantially as described.

11. In combination, an electric circuit including two branches, one of said branches having a known resistance, means for inserting carbons in the other of said branches, a branch conductor connecting points of said two branches, said branch conductor including a galvanometer, a second electric circuit including the spindle of said galvanometer, a contact-arm carried by said spindle, whereby the needle of said galvanometer may close said second circuit through said arm, means for guiding said carbons to different receptacles, said means being controlled by said second circuit, substantially as described.

12. In combination, an electric circuit, members forming terminals therefor and adapted to receive carbons, means for feeding electric-light carbons to said members, means for withdrawing said carbons from said members, receivers therebeyond, means for advancing said carbons to said receivers, and means for guiding said carbons to said receivers, said last means being controlled by the resistance of said carbons, substantially as described.

13. In combination, an electric circuit, jaws forming terminals therefor and adapted to grasp a carbon, means for feeding carbons between said jaws, means for closing said jaws, means for releasing said jaws, means for guiding said carbons, and means whereby said last means is controlled by the resistance of said electric-light carbons, substantially as described.

14. In combination, an electric circuit, means for inserting carbons between the terminals thereof, a second electric circuit, means whereby the resistance of said carbons controls the condition of said second circuit, means for guiding said carbons when advanced from said terminals, said guiding means being controlled by said second circuit, substantially as described.

15. In combination, an electric circuit including two branches one of said branches including a known resistance, means for advancing carbons into a position between terminals in the other of said branches, a bridge conductor connecting points of said branches, receivers, means for advancing said carbons toward the same, means for guiding said carbons to said receivers, said last means being controlled by the flow of current in said bridge conductor, substantially as described.

16. In combination, an electric circuit, means for feeding carbons between terminals thereof, means for advancing said carbons therebeyond, receivers, a guide-plate, means whereby said guide-plate determines the direction of said carbons with respect to said receivers, and means whereby the resistance of said carbons determines the position of said guide-plate, substantially as described.

17. In combination, an electric circuit, means for feeding carbons one by one between terminals of said circuit, automatic means for advancing said carbons, receivers, means for guiding said carbons with respect to said receivers, said last means being controlled by the resistance of said carbons, substantially as described.

18. In combination, an electric circuit, means for feeding carbons between terminals thereof, means for comparing the resistance of said carbons with a standard resistance, receivers, means for advancing said carbons, means for guiding said carbons into said receivers, and means whereby said last means is controlled by the resistance of said carbons, substantially as described.

19. In combination, a support adapted to receive a plurality of carbons, feeders, means whereby said feeders may advance said carbons from said support, members adapted to contact said carbons, an electric circuit, said members constituting terminals for the same, receivers, means for guiding said carbons to the same, said last means being controlled by the resistance of said carbons, substantially as described.

20. In combination, feeders adapted to support carbons, retaining-fingers for said carbons, means for moving said feeders so that they may engage one of said carbons, members adapted to grasp said carbons, said members constituting terminals for an electric circuit, and automatic means for withdrawing said carbons from said members, substantially as described.

21. In combination, feeders adapted to support carbons, retaining-fingers thereabove, means for moving said feeders so that the supporting-faces thereof pass from beneath the

outermost of said carbons, means whereby said feeders may remove said outermost carbon, members adapted to grasp said carbons, said members constituting terminals for an electric circuit, and means for withdrawing said carbons from said members, substantially as described.

22. In combination, feeders adapted to support carbons, retaining-fingers thereabove, means for moving said feeders so as to segregate one of said carbons, arms constrained against said segregated carbon, where it is retained by said feeders, members adapted to grasp said carbon, said members constituting terminals for an electric circuit, means for withdrawing said carbon from said members, and means for advancing the same, substantially as described.

23. In combination, feeders having supporting-faces, retaining-fingers thereabove, whereby carbon rods may rest thereon, means for moving said feeders so that said supporting-faces pass from beneath one of said rods, whereby it may be segregated from the rest, said feeders having an edge substantially perpendicular to their supporting-faces, spring-constrained arms adapted to press the segregated rod against said edges, means for moving said feeders to bring said rod adjacent to the terminals of an electric circuit, means whereby said terminals may grasp said rod, means for withdrawing said rod from said terminals, and means for advancing the same, substantially as described.

24. In combination, feeders, means for supplying carbons thereto, one by one, means whereby said feeders may advance said carbons to a point adjacent to the terminals of an electric circuit, means whereby said terminals may grasp said carbons, means for releasing the same therefrom, automatic means for advancing said carbons, receivers, means for guiding said carbons thereto, said means being controlled by the resistance of said carbons.

25. In combination, pivoted feeders having circumferential supporting-faces upon which carbons may rest, means for rocking said feeders so that said supporting-faces pass from beneath one of said carbons, whereby a carbon may be segregated, said feeders having a substantially radial edge, spring-constrained arms adapted to press a segregated carbon against said edge, means for rocking said feeders so that said segregated carbon is advanced, an electric circuit, the terminals whereof may grasp said carbons, means for releasing the same therefrom, means for advancing said carbons, means for guiding them, receivers into which said carbon may pass, said guiding means being controlled by the resistance of said carbons, substantially as described.

26. In combination, pivoted feeders having circumferential supporting-faces adapted to support a plurality of carbons, retaining-fingers thereabove, means for rocking said feeders so that said supporting-faces may pass from beneath one of said carbons, whereby one of said carbons may engage said feeders, means for rocking said feeders so as to advance said carbon, jaws adapted to grasp the ends thereof, said jaws constituting terminals of an electric circuit, means for advancing said carbon therebeyond, means for guiding said carbon, receivers into which said carbon may pass, said guiding means being controlled by the resistance of said carbon, substantially as described.

27. In combination, an inclined support adapted to receive a plurality of carbons, retaining-fingers, feeders adapted to support some of said carbons, means for moving said feeders so that one of said carbons may be engaged thereby, an electric circuit, means whereby said feeders may advance said carbon to a point adjacent to the terminals of said circuit, means whereby said terminals may grasp said carbon, means for withdrawing said carbon therefrom, receivers therebeyond, means for guiding said carbon thereto, said last means being controlled by the resistance of said carbons, substantially as described.

28. In combination, pivoted feeders having circumferential upper faces adapted to support carbons, said feeders having shoulders adapted to engage and segregate one of said carbons, pivoted arms constraining said segregated carbon against said shoulders, terminals of an electric circuit between which said segregated carbon is deposited, said feeders having curved faces adjacent to said shoulders, and said arms having curved faces adapted to coöperate therewith, whereby said carbon may be raised and advanced from said terminals, substantially as described.

29. In combination, an inclined board, retaining-fingers adapted to maintain a plurality of carbons thereupon, pivoted feeders having circumferential faces adapted to support the lowermost of said carbons, said circumferential faces having recesses, means for rocking said feeders so that the outermost of said carbons may pass into said recesses, arms adapted to be constrained so as to maintain a carbon within said recesses, jaws adapted to receive said carbons, an electric circuit including said jaws as terminals, said feeders having curved faces adjacent to said recesses, and said arms having curved faces adapted to form guides for said carbon, said feeders and arms coöperating, whereby said carbons may be raised from said jaws and advanced, substantially as described.

30. In combination, a support adapted to receive carbons, feeders adapted to advance said carbons one by one from said support, an electric circuit, jaws forming terminals therefor and adapted to receive said carbons, mechanism adapted to close said jaws, said mechanism including a spring through which the operating force is applied, substantially as described.

31. In combination, a support adapted to receive a plurality of carbons, feeders adapted to advance said carbons from said support, jaws adapted to receive said carbons when so advanced, said jaws constituting terminals for an electric circuit, mechanism for opening and closing said jaws, said mechanism including a link and a spring carried by said link, through which the operating force for said jaws is transmitted, substantially as described.

32. In combination, a hopper adapted to receive carbons, a cylinder having grooves which may receive said carbons, means for rotating said cylinder so as to feed said carbons one by one from said hopper, an inclined table upon which said carbons are delivered, retaining-fingers against which said carbons may rest, feeders adapted to advance said carbons one by one from said table, an electric circuit having terminals adapted to receive the ends of said carbons, means for withdrawing said carbons from said terminals and advancing the same, receivers, means for guiding said carbons thereto, said guiding means being controlled by the resistance of said carbons, substantially as described.

33. In combination, a hopper adapted to receive carbons, means for feeding said carbons one by one from said hopper, an inclined table upon which said carbons are delivered, retaining-fingers upon said table, pivoted feeders adapted to form supports for the outermost of said carbons, means for rocking said feeders so that they may engage the outermost of said carbons, terminals adapted to receive the extremities of said carbons, said feeders having curved faces, guides adapted to coöperate therewith so that said carbons may be raised and advanced from said terminals, receivers, means for guiding said carbons thereto, said guiding means being controlled by the resistance of said carbons, substantially as described.

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

MAHLON M. ZELLERS.

Witnesses:
V. C. ERNST,
N. C. COTABISH.