(No Model.) 2 Sheets—Sheet 1.

J. S. FORBES.

LITHOTRITE.

No. 538,827. Patented May 7, 1895.

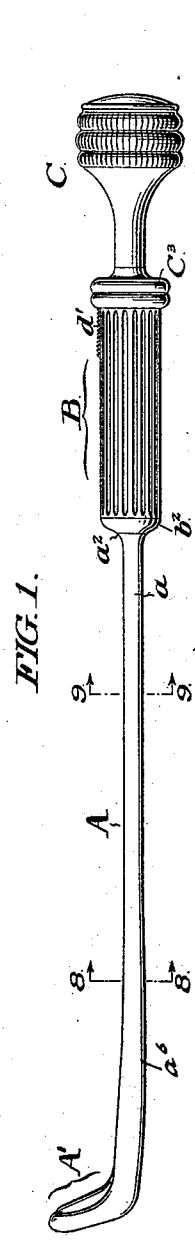

FIG. 1.

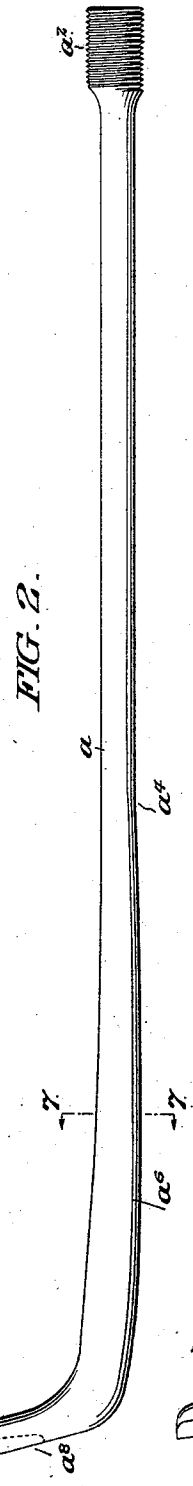

FIG. 2.

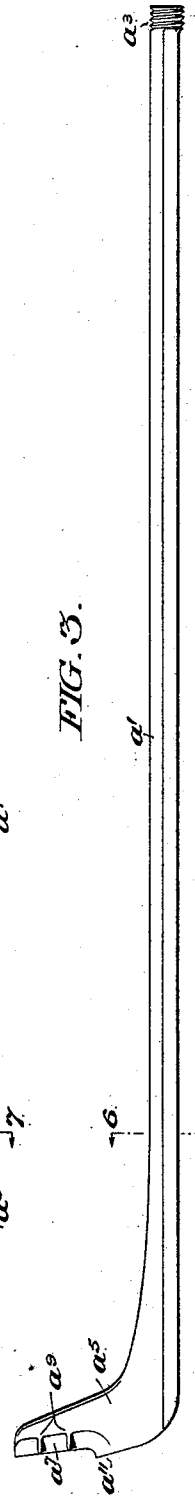

FIG. 3.

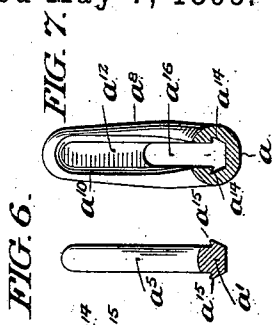

FIG. 6.

FIG. 7.

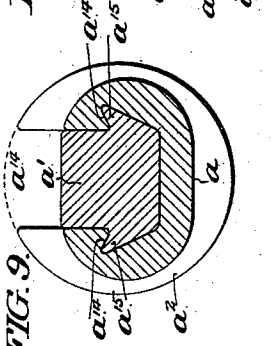

FIG. 9.

FIG. 8.

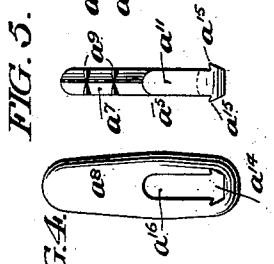

FIG. 5.

FIG. 4.

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(No Model.) 2 Sheets—Sheet 2.

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LITHOTRITE.

No. 538,827. Patented May 7, 1895.

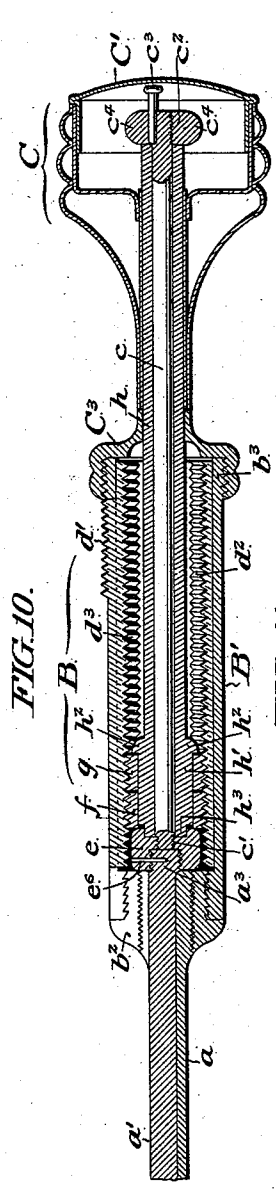

FIG. 10.

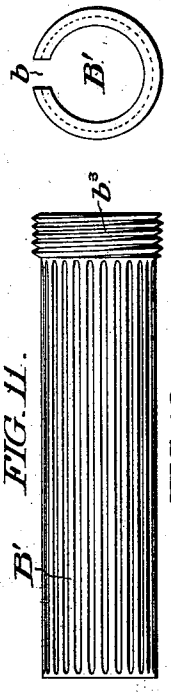

FIG. 11.

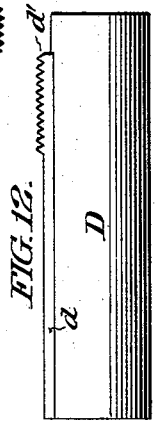

FIG. 12.

FIG. 14.

FIG. 16.

FIG. 15.

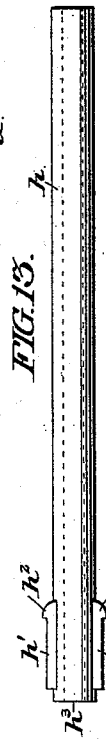

FIG. 13.

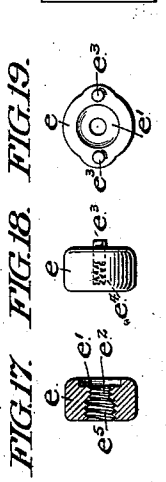

FIG. 19.

FIG. 18.

FIG. 17.

FIG. 20.

FIG. 21.

FIG. 22.

FIG. 23.

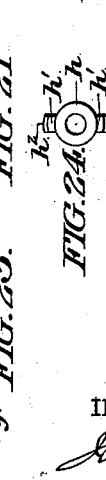

FIG. 24.

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JOHN SIMS FORBES, OF PHILADELPHIA, PENNSYLVANIA.

LITHOTRITE.

SPECIFICATION forming part of Letters Patent No. 538,827, dated May 7, 1895.

Application filed July 19, 1894. Serial No. 517,954. (No model.)

To all whom it may concern:

Be it known that I, JOHN SIMS FORBES, of Philadelphia, in the State of Pennsylvania, have invented an Improved Lithotrite, whereof the following is a specification, reference being had to the accompanying drawings.

Like other instruments of this class, the device comprises a handle, a slide, one member of which is fixed with relation to the handle, the other member sliding longitudinally with relation to the fixed member, a pair of jaws carried by said members, and actuating mechanism whereby the movable member may be shifted, so as to open or close the jaws.

For convenience of description in the following specification, the fixed member will be called the shank, and the jaw mounted thereon, the stationary jaw, the movable member being termed the carrier-stem and its jaw the movable jaw.

In the drawings, Figure 1 represents an exterior side view of the complete instrument. Fig. 2 is a side elevation, on an enlarged scale, of the shank and stationary jaw detached from the handle. Fig. 3 is a similar side elevation of the carrier-stem and movable jaw, also detached from the handle. Fig. 4 is a front end view showing the outer or non-operative face of the stationary jaw. Fig. 5 is a front end view of the movable jaw, showing its operative face. Fig. 6 is a sectional view of the carrier-stem, on the line 6 6 of Fig. 3, showing the rear or non-operative face of the movable jaw. Fig. 7 is a sectional view of the shank, on the line 7 7 of Fig. 2, showing the inner or operative face of the stationary jaw. Figs. 8 and 9 are sectional views, on an enlarged scale, of the shank and carrier-stem combined, taken respectively upon the lines 8 8 and 9 9. Fig. 10 is a longitudinal central section through the handle and actuating mechanism. Figs. 11 to 24 are detail views of portions of the actuating mechanism, which will be more specifically referred to hereinafter.

Referring to Fig. 1, A represents the slide, and A′ the jaws thereof in a closed position. B represents the handle and C the knob or rotating device connected with the handle and serving to actuate the carrier-stem.

The shank, a, is screwed at its threaded rear end, a^2, into the front end of the handle, B. Substantially the rear half of the shank, a, is straight and of a flattened oval cross-section, as shown in Fig. 9; but at or near its longitudinal center, a^4, (see Fig. 2) the shank enlarges gradually to a nearly circular cross-section, as shown in Fig. 8, said enlarged portion being forwardly continued with a slight upward bend from the point, a^6, and terminating in the upright stationary jaw, a^8.

In the upper face of the shank, a, is a deep longitudinal groove, a^{14}, whose cross-section has the form indicated in Fig. 8; that is to say, the walls of the upper portion of the groove are perpendicular, but the lower portion is laterally enlarged and provided with upwardly extending under-cut recesses along each side, the cross-section being approximately in the shape of a conventional key-stone. Said slot is forwardly prolonged entirely through the stationary jaw, as indicated in Fig. 4, and an elongated opening, a^{16}, upwardly continuous from the groove, a^{14}, and having a rounded top, is also formed entirely through the stationary jaw. Above the opening, a^{16}, a depression, a^{12}, (see Fig. 7) is formed in the rear face of the stationary jaw, said depression having a beveled periphery, a^{10}, as indicated.

The carrier-stem is shown in Fig. 3, at a'. It is provided at its rear end with a screw thread, a^3, engaging with the actuating device, and its cross-section throughout the greater portion of its length, is substantially that of the groove, a^{14}, in the shank, a—that is to say, the upper portion of the carrier-stem has perpendicular sides and a flat top, while its lower portion is laterally enlarged and provided along each side with upwardly extending angular flanges, a^{15}, fitting snugly in the lateral recesses of the groove, a^{14}. Near its front end, the vertical diameter of the carrier-stem is increased somewhat, as indicated in Fig. 3, and it terminates in the upright movable jaw, a^5. The upper portion of the front face of said jaw is recessed, as indicated at a^7, so as to allow the lower portion, a^{11}, to project somewhat, and said lower portion, a^{11}, has the configuration of the opening, a^{16}, in the stationary jaw, so that when the jaws are closed together, the projecting portion, a^{11}, of the movable jaw extends through said opening, a^{16}, and is flush with the outer face of the

stationary jaw. The front face of the recessed portion, a^7, of the movable jaw is beveled at a slightly less angle than the bevel of the recess, a^{12}, in the stationary jaw, and is also provided on each side with angular projections, a^9, so that when the jaws are closed only the extreme front edges of the portion, a^7, and of the projection, a^9, are in actual contact with the inner face of the recess, a^{12}, in the stationary jaw, leaving spaces between the projections on each side for clearance.

The actuating devices will now be described.

The shank, a, is screwed into a cap, b^2, at the front end of the handle, B. Said handle is provided with a cylindrical casing, B′, longitudinally fluted to afford a good grip, and terminating in a threaded rear end, b^3. A longitudinal slot, b, is formed through the entire upper face of the casing, as shown in Fig. 14. A cylindrical inner casing, or sleeve, D, (see Fig. 12) fits snugly within the casing, B′, having a very slight longitudinal play therein, (say one thirty-second of an inch) and is provided along its upper side with a projecting rib, d, which extends into the slot, b, of the casing, B′, so as to lock the sleeve, D, against rotative movement with relation thereto. The exterior surface of the rib, d, is serrated near its near end at d', to enable the operator to shift the sleeve longitudinally to the slight extent mentioned, when necessary, as will hereinafter be explained.

The inner surface of the sleeve is provided with longitudinal recesses, d^4, d^5, between which are the projections, d^2, d^3, of segmental cross-section, each recess, and consequently each segment being substantially a quadrant of the transverse section of the sleeve. The projections, d^2, d^3, which will be termed the sleeve-segments, are internally threaded in continuous relation to one another, allowing of course for the interruptions due to the recesses. Said recesses, d^4, d^5, afford open ways from end to end of the sleeve, D, to permit the free longitudinal movement of a pair of nuts, f and g, (which will hereinafter be described in detail,) when said nuts are brought into proper relation thereto.

The rear end, a^3, of the carrier-stem, a', is screwed into a collar, e, and when screwed fast the collar is locked against rotation by means of a pin, e^6. Said collar is shown in longitudinal section at Fig. 17, in side elevation at Fig. 18, and in rear elevation at Fig. 19. The rear face of the collar, e, is recessed as shown at e', and provided with an internally threaded cavity, e^2, extending inward from said recess and meeting the larger cavity, e^5, in the front face. Outside of the recess, e', of the collar, pins, e^3, are mounted in holes in its rear face, light springs, e^4, being seated in said holes beneath the pins so as to normally thrust them outward, as indicated in Fig. 18.

A tubular shaft, h, whose front end, h^3, fits snugly within the recess, e', of the collar, e, extends axially through the handle and projects outward from the rear end thereof into the knob, C. Said shaft is provided near its front end with short longitudinal ribs, h', arranged diametrically opposite to one another, said ribs having near their rear ends outwardly projecting offsets, h^2, as shown.

A rod, c, fits freely within the tubular shaft, h, and engages at its threaded front end, c', with the threaded cavity, e^2, in the collar, e. When screwed home the rod, c, bears against and forms a continuation of the carrier-stem, a', the collar, e, being also rigidly connected with, and surrounding both portions at their joint. The rear end of the rod, c, extends beyond the tubular shaft, h, and is threaded so as to receive a nut, c^3, which prevents the shaft from slipping rearwardly upon the rod, but does not bear hard against the same, thus permitting free rotation of the shaft with reference to the rod. Said nut is provided with wings, c^4, for convenience of actuation, and a pin, c^3, fitting in a cavity formed partly in the nut c^3, and partly in the threaded end of the rod, c, locks the nut against rotation, said pin being prevented from slipping out by contact with the inner surface of the removable end cap, C′, of the knob, C. Said knob is hollow and is soldered fast to the exterior of the shaft, h. Between the rigidly attached portion of the knob and the proximate rear face of the casing, B′, a screw-cap, C^3, is freely mounted upon the exterior of the shaft, h, said cap being internally threaded to engage with the threaded portion, b^3, of the casing, B′. Thus by rotating the knob, C, the tubular shaft, h, and its ribs, h', will be rotated both with relation to the rod, c, and to the sleeve, D, of the handle, B.

Longitudinal movement of the shaft, h, rod, c, and carrying stem, a', is effected in the following manner:

Mounted upon the front end of the shaft, h, are two nuts, f, g. The nut, f, is shown in side elevation in Fig. 20, and in end elevation in Fig. 21. The exterior face thereof is provided with radially projecting segmental portions, f', f^2, respectively, each extending throughout substantially a quadrant, between which are the non-threaded recesses, f^3, f^4. The projecting threaded portions, which will be termed the nut segments, are adapted to engage with the internal thread upon the sleeve segments. The central opening through the nut is, throughout a portion of its periphery, of such size as to fit snugly upon the exterior of the tubular shaft, h, but said opening has radially projecting recesses, f^5, whose depth corresponds with the radial projection of the ribs, h', upon the said shaft, so that when the nut is in position upon the shaft, h, and ribs, h', a limited rotative play is permitted, the range of movement being such that in one extreme position the threaded nut segments, f', f^2, are in correspondence with the non-threaded recesses, d^4, d^5, of the sleeve, D, and consequently the non-threaded recesses, f^3, f^4, of the nut are in correspondence with the

sleeve segments, d^2, d^3, while in the other extreme position, the threaded nut-segments, f', f^2, are in engagement with the threaded sleeve segments, d^2, d^3. The front face of the nut, f, is provided with notches, f^6, which engage in one direction with the pins, e^3, of the collar, e, so that the nut is held by the collar against rotation in one direction, but is permitted to rotate in the opposite direction by reason of the fact that the inclined surface of the notches forces the pins, e^3, inward against the tension of the springs, e^4.

The second nut, g, is mounted upon the tubular shaft, h, in rear of the nut, f, the rear face of the nut, g, being in contact with the step, h^2, at the ends of the ribs, h'. Said nut, g, is shown in side elevation in Fig. 22, and in end view in Fig. 23.

In exterior configuration, the nut, g, is precisely similar to the nut, f, having segmental projecting threaded portions, g', g^2, with intervening non-threaded recesses, g^3, g^4. The interior cavity of the nut, g, differs from that of the nut, f, in that no rotative movement with reference to the shaft, h, is possible, said interior cavity upon the nut, g, conforming throughout the greater portion of its extent with the exterior periphery of the shaft, h, and the radial recesses, g^5, of the cavity being just sufficient to admit the ribs, h'. The screw-thread upon the nut, g, is similar to that upon the nut, f, and is so formed as to be an accurate continuation thereof when the nut, f, is in that extreme position, where its threaded segments are in line with the non-threaded recesses of the nut, g. Consequently when the nuts are in said positions relatively to one another, they together constitute a compound nut some portion of whose thread is at all times in engagement with the sleeve segments, d^2, d^3. When, however, the nut, f, is in its other extreme position, its threaded segments, f', f^2, are respectively in line with the threaded segments, g', g^2, of the nut, g, and the recesses of both nuts are in line, at the same moment. Moreover the nut segments are in juxtaposition with the non-threaded recesses of the sleeve and vice versa.

The necessary rotative adjustment of the nut, f, with relation to the shaft, h, to attain this position, is effected by the pins, e^3, of the collar, which engage with the notches, f^6, of the nut, f, when the shaft, h, is turned backward (or in the direction for opening the jaws) and hold the nut, f, until the ribs, h', of the shaft bring up against the rear sides of the recesses, f^5. When the ribs and sleeve are in this relative position, the entire system (comprising the knob, C, shaft, h, nuts, f, and g, rod, c, collar, e, and carrier-stem, a'), can be thrust longitudinally throughout the whole range permitted by the handle, so that a very rapid opening and closing of the jaws may be effected. When, however, the knob, C, and shaft, h, are turned so as to throw the nuts into the other extreme position, the continuous thread thereof will engage operatively with the threaded sleeve segments, and by rotation, the carrier-stem will be moved longitudinally to close the jaws with a slow and consequently powerful movement. Thus the jaws can be opened and closed very rapidly when desired, and can also be closed with great force for crushing purposes.

I prefer to construct the sleeve with a straight longitudinal play, as stated, in order that when the nuts are about to engage with the sleeve segments, there may be no danger of jamming by reason of the threads not registering properly. A very slight longitudinal movement of the sleeve will always suffice to bring the parts into the proper relative position for engagement, and to facilitate control of this sleeve movement, I prefer to serrate a portion of the rib, d, as shown at d', thus giving a good hold for the thumb of the operator.

The peculiar configuration of the shank gives it the maximum strength at the points where injurious strain is usually found to occur, and at the same time facilitates its introduction, the slight upward bend of the shank near its front end, as indicated at a^6, being found especially valuable in this connection.

It will of course be noted that while the exterior lines of the shank assume this bend, the groove, a^{14}, thereof remains straight, as do also the lower face and guiding flanges of the carrier-stem.

Having thus described my invention, I desire to call attention to the fact that the actuating devices, above described, embody features which are susceptible of application to other uses than that indicated. Hence in my claims hereinafter made I do not limit myself to the employment thereof in a lithotrite.

I claim—

1. The combination, of the handle; the grooved shank mounted therein, said shank being of a flattened oval cross-section at its rear portion and enlarging to an approximately circular cross-section at its front portion, and having a slight upward bend near its front end; a stationary jaw carried by said shank; a carrier-stem having flanges substantially as described engaging in the groove of the shank; a movable jaw mounted at the front end of said carrier-stem; and actuating mechanism, substantially as set forth, for said carrier-stem and movable jaw.

2. The combination with the carrier-stem; the upwardly extending angular flanges thereon; the shank, having a groove conforming to said stem and its flanges; the movable and stationary jaws carried by said stem and said shank respectively; and actuating mechanism, substantially as set forth, for said stem.

3. In a lithotrite having a handle, a shank, a carrier stem, and actuating mechanism, the combination, with the stationary jaw having an elongated depression with beveled periphery in its operative face and an opening below said depression; of a movable jaw having a recessed front face, the lower portion of

which extends through said opening, while the upper or recessed portion is beveled to the vertical central edge, and provided on each side with wedge shaped projections having clearance spaces between them, substantially as set forth.

4. The combination, with the sleeve having longitudinal recesses with intervening segmental threaded projections; of a rotatable and axially movable shaft; a pair of segmentally threaded nuts mounted on said shaft, one of said nuts being fixed with relation to said shaft, the other thereof having a limited rotative play thereon, whereby in one extreme position its threaded segments are in line with the threaded segments of the fixed nut, and in the other extreme position are substantially in line with the non-threaded portions thereof forming a threaded surface some portion of which is at all times in engagement with the sleeve segments, substantially as set forth.

5. The combination, with the sleeve having longitudinal recesses with intervening segmental threaded projections; of an axial shaft having a longitudinal rib; a collar in which said shaft rotates; a segmentally threaded nut, mounted upon the ribbed portion of the shaft adjacent to said collar, and having a central opening with recesses adapted to permit a limited rotative play with relation to the rib; a spring actuated stop upon said collar, adapted to engage in one direction with said nut, while permitting free rotation thereof in the opposite direction; and a second segmentally threaded nut, mounted upon the ribbed portion of the shaft and fixed against rotation with reference thereto, the rotative play of the first mentioned nut being such that in one extreme position its threaded segments are in line with those of the fixed nut, and in the other extreme position are substantially in line with the non-threaded portions of the fixed nut, whereby a threaded surface is formed, some portion of which is at all times in engagement with the sleeve segments, substantially as set forth.

6. The combination of the shank and its stationary jaw; the carrier-stem and its movable jaw; the longitudinally slotted handle rigidly connected with the shank; the longitudinally recessed and segmentally threaded sleeve having a rib which engages in the slot of the handle; the collar rigidly connected with the carrier-stem; the shaft rotatably connected with said collar, the pair of segmental nuts mounted on the shaft, one of said nuts having the limited rotative play thereon, above set forth, the other being fixed against rotation with reference to the shaft; and the knob attached to the shaft, substantially as set forth.

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