(No Model.) 3 Sheets—Sheet 1.

H. L. PHILLIPS.

AUTOMATIC AMALGAMATOR SLUICE BOX.

No. 528,969. Patented Nov. 13, 1894.

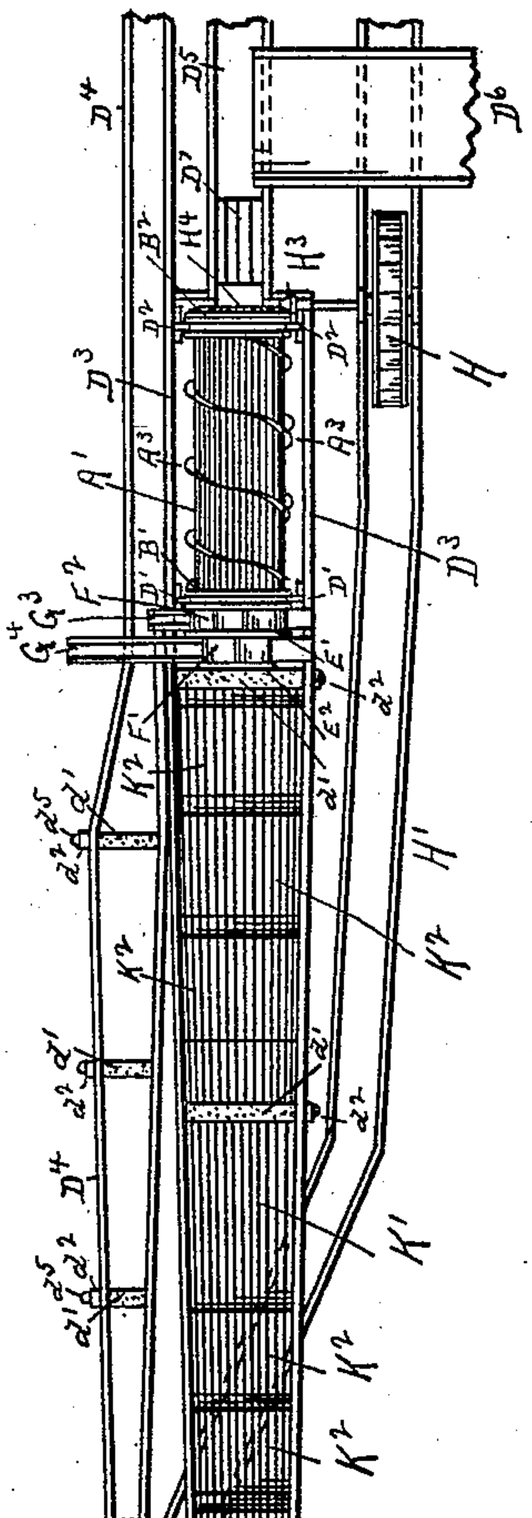

FIG. 1.

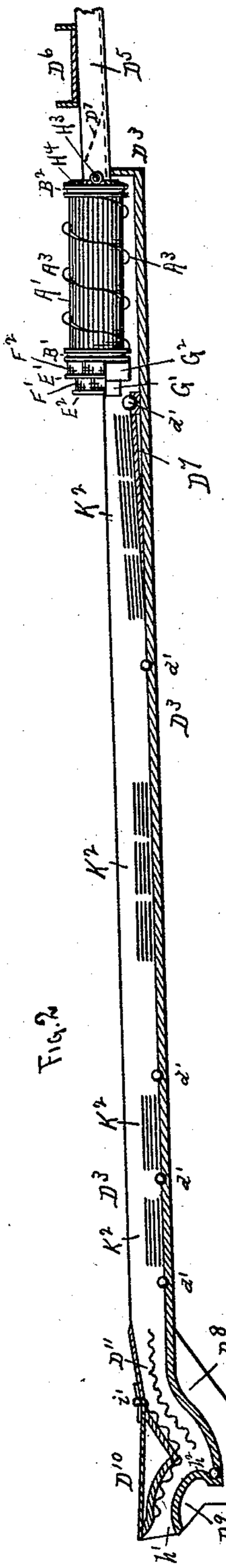

FIG. 2.

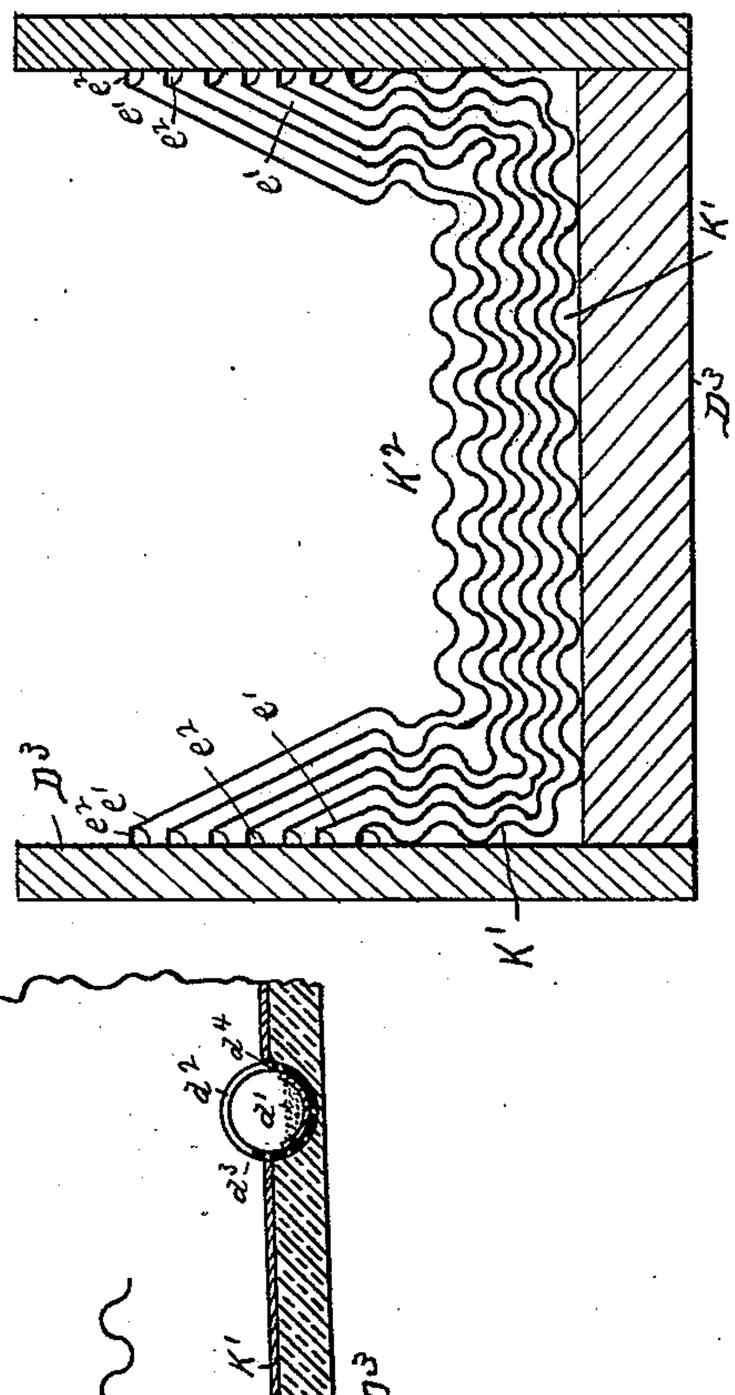

FIG. 4.

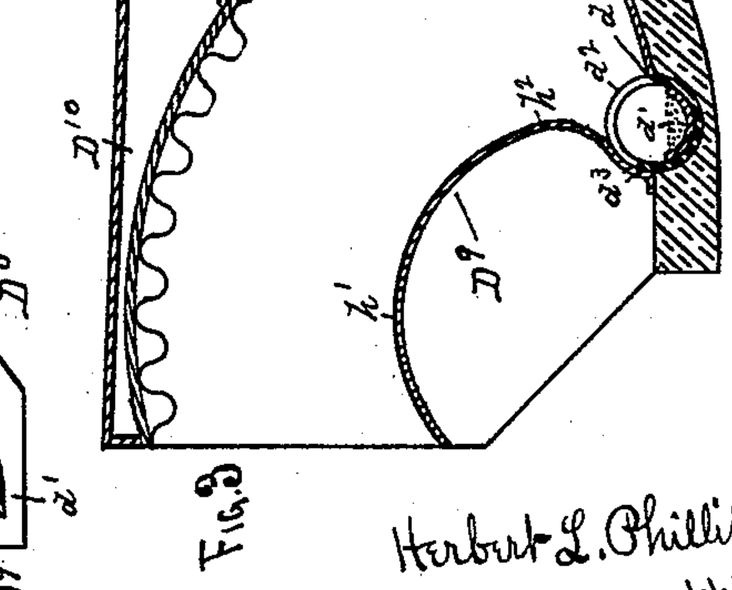

FIG. 3.

WITNESSES.
Wm A Peterson.
H. S. Webster

Herbert L. Phillips.
INVENTOR.
By Charles N. Woodward Atty.

(No Model.) 3 Sheets—Sheet 2.

H. L. PHILLIPS.

AUTOMATIC AMALGAMATOR SLUICE BOX.

No. 528,969. Patented Nov. 13, 1894.

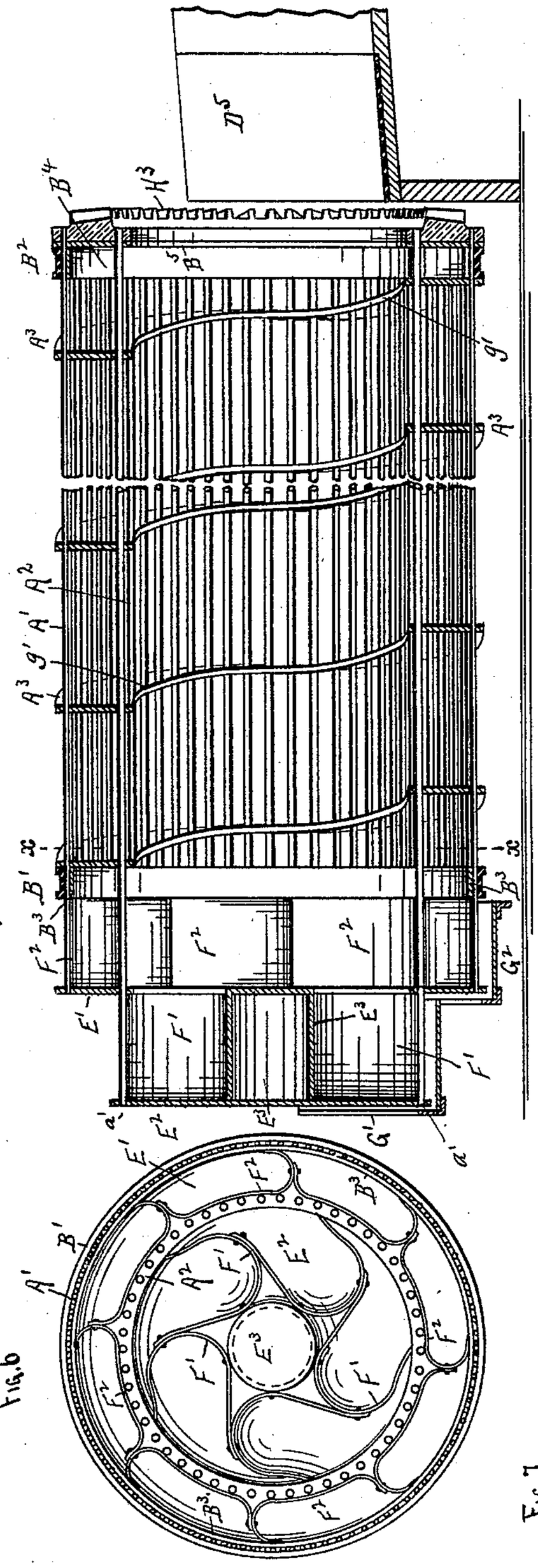

FIG. 5.

FIG. 6.

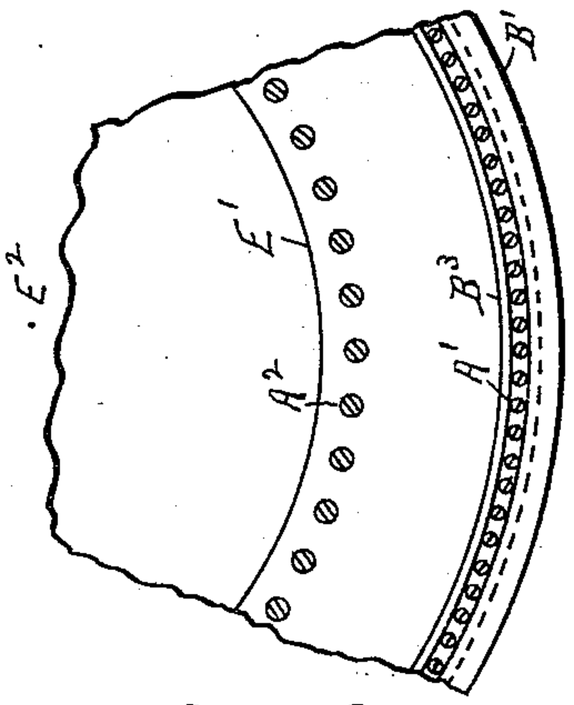

FIG. 9.

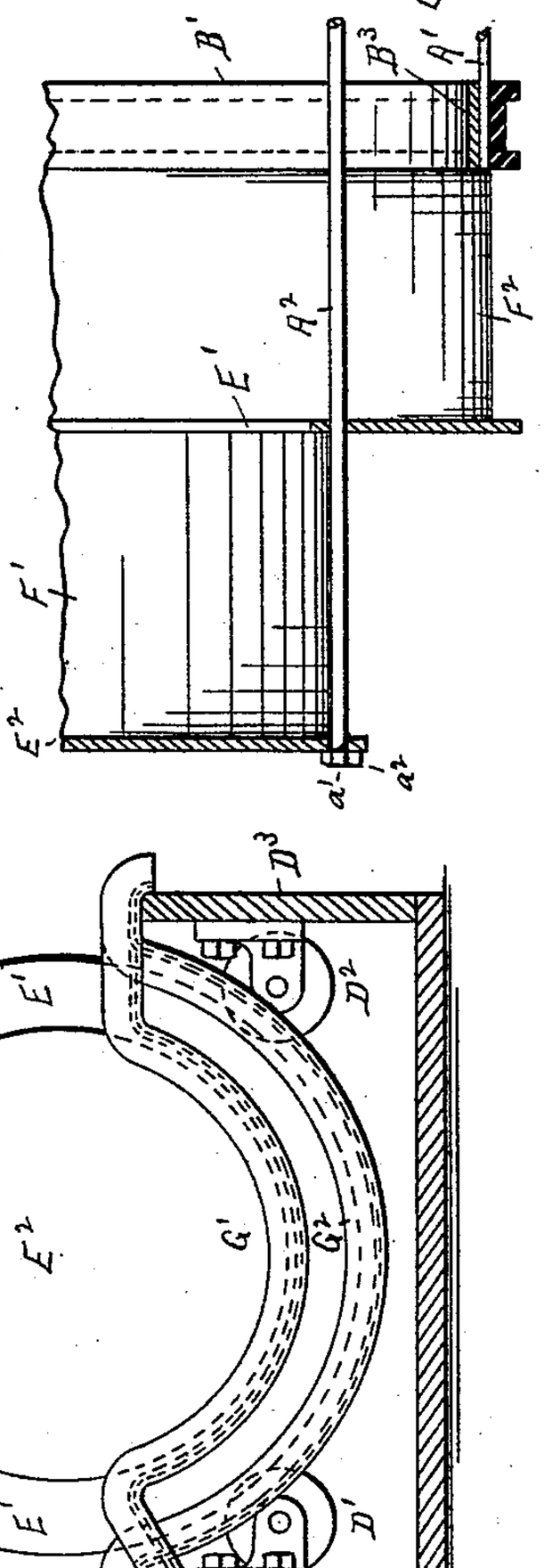

FIG. 8.

FIG. 7.

WITNESSES.
J. Walter Stevens.
Granville Paley

Herbert L. Phillips INVENTOR,
By Charles N. Woodward Attyi

(No Model.) 3 Sheets—Sheet 3.

H. L. PHILLIPS.

AUTOMATIC AMALGAMATOR SLUICE BOX.

No. 528,969. Patented Nov. 13, 1894.

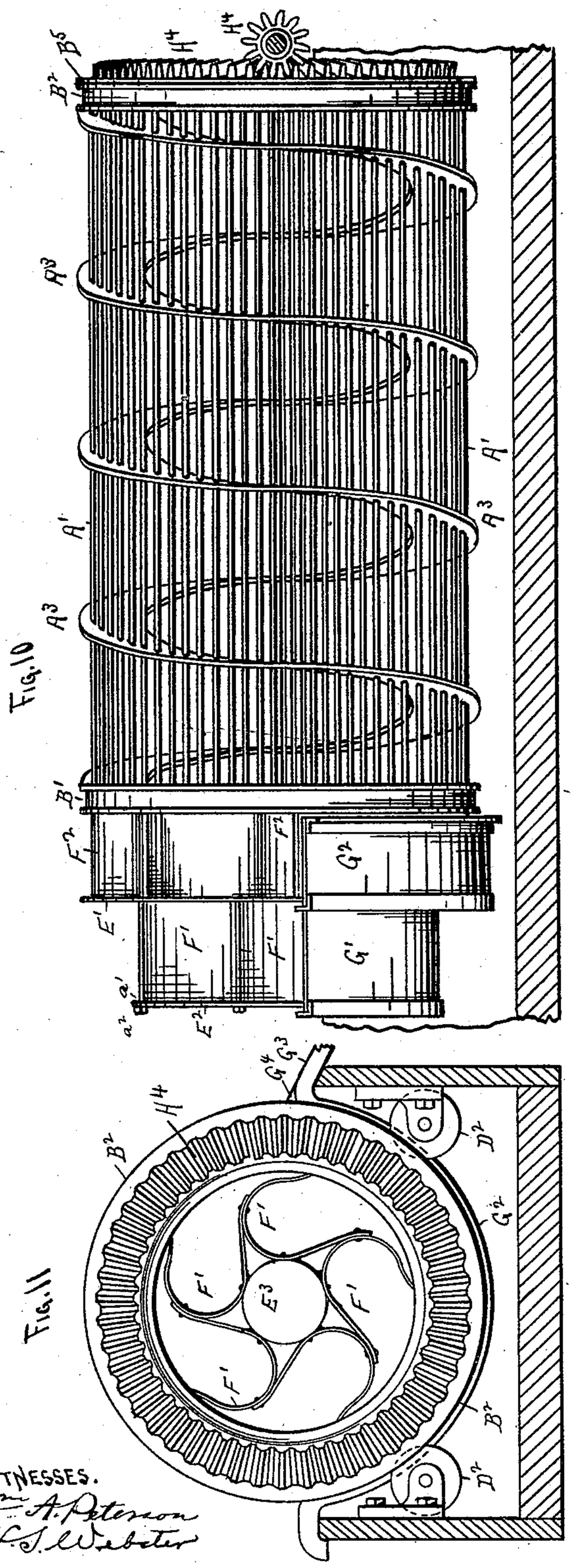

FIG. 10

FIG. 11

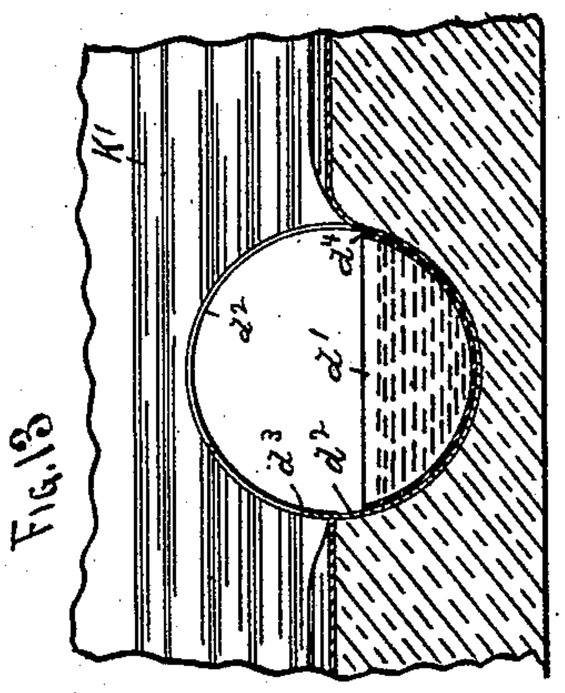

FIG. 13

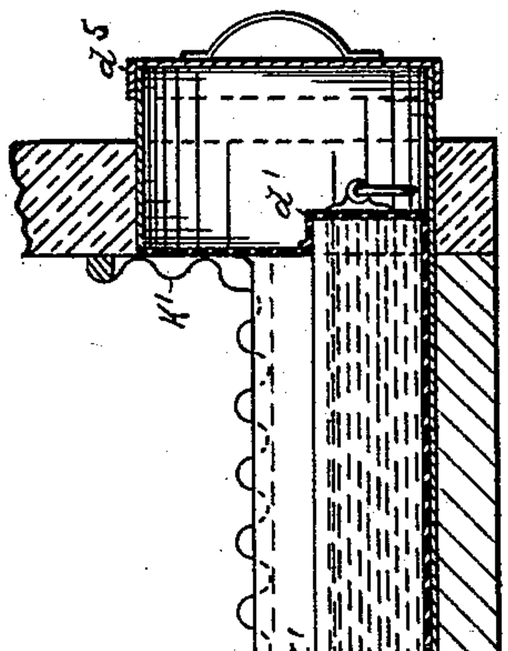

FIG. 12

WITNESSES.
Wm. A. Peterson
H. S. Webster

Herbert L. Phillips. INVENTOR.
By Charles N. Woodward Attty.

UNITED STATES PATENT OFFICE.

HERBERT L. PHILLIPS, OF ST. PAUL, MINNESOTA.

AUTOMATIC AMALGAMATOR SLUICE-BOX.

SPECIFICATION forming part of Letters Patent No. 528,969, dated November 13, 1894.

Application filed April 23, 1894. Serial No. 508,606. (No model.)

To all whom it may concern:

Be it known that I, HERBERT L. PHILLIPS, a citizen of the United States, residing at St. Paul, in the county of Ramsey and State of Minnesota, have invented certain new and useful Improvements in an Automatic Amalgamator Sluice-Box, of which the following is a specification.

This invention relates to apparatus employed in the separation of the free precious metals from the baser substances with which they are commingled, more especially in placer gold mining, and consists in the construction, combination, and arrangement of parts, as hereinafter shown and described, and specifically pointed out in the claims.

This invention is more particularly applicable to the separation of the particles of gold from the alluvial deposits of auriferous earth, but may be employed in any other localities where it may be found practicable.

This invention comprises a screening apparatus whereby the sand or gravel containing the particles of gold may be separated into particles of different sizes, and in which it is pulverized and dissolved; and sluice boxes through which the screened material is caused to pass and in which provision is made for the complete separation of the particles of gold from the baser material.

In the drawings, Figure 1 is a plan view, and Fig. 2 is a sectional side elevation, of the apparatus complete. Fig. 3 is an enlarged sectional detail of the siphon discharge mechanism of the sluice box. Fig. 4 is an enlarged cross section of the sluice box at one of the points where the amalgam plates are placed, illustrating the manner of arranging them. Fig. 5 is an enlarged longitudinal sectional elevation of the screen mechanism, and Fig. 6 is a cross section of the same, on the line x x of Fig. 5, looking toward the "tail" end of the screen. Fig. 7 is a rear elevation of the screen mechanism. Figs. 8 and 9 are enlarged sectional details of the screen cylinders illustrating their construction more fully. Fig. 10 is an enlarged side elevation, and Fig. 11 is an enlarged front end elevation, of the screen mechanism. Fig. 12 is an enlarged cross section, and Fig. 13 is a detail in enlarged longitudinal section, of the sluice box at the point where one of the mercury troughs is arranged, illustrating its construction.

The screening mechanism consists of an outer and inner set of revolving cylindrically arranged parallel rods, the outer set of rods being nearer together than the inner set, whereby the finer material is separated from the coarser material. The construction of the screen is shown in Figs. 5, 6, 7, 8, 9, 10, and 11, A' being the outer set of rods, and A^2 the inner set of rods.

B' B^2 are two rings having channels or tracks for the carrier rolls D' D^2 and against the interiors of which the outer set of rods A' are supported by rings B^3 B^4, the interstices between the rings B' B^3 B^2 B^4 and the rods A' being filled with "Babbitt" metal, or the rods otherwise secured firmly in place.

At the "head" end of the apparatus a ring B^5 is secured, and in this ring the "head" ends of the inner set of rods A^2 are riveted or bolted, as shown. The "rear" ends of the inner set of rods extend beyond the ring B' and are riveted through the inner edge of a ring E'. A sufficient number of the inner sets of rods A^2 are extended to support a plate or disk E^2 as shown at a', the plate E^2 forming the closed rear end of the screen. These extended rods serve to draw all the parts together, as hereinafter explained.

Attached to the center of the end plate E^2 is a small drum E^3, and attached to the outer surface of this drum are a series of curved sheet metal buckets F', the outer ends of the buckets being curved outward while the inner ends are riveted fast to the next bucket in advance, as shown in Figs. 5, 6, 10, and 11.

Within the space between the rings B' B^3 and E' and outside the inner rods A^2, are another series of sheet metal buckets F^2, the outer ends of these buckets being curved outward while their inner ends are curved around the outer surfaces of the rods A^2 and riveted by their other ends to the next bucket in advance, as shown. The buckets F' F^2 are secured by their outer ends by small brackets to the plates E' E^2.

The outer ends of the rods A^2 which are extended, as before stated, are provided with nuts a^2 so that they can be utilized to draw the plates E' E^2, buckets F' F^2, and other

parts all closely together and hold them firmly in place. By this arrangement the buckets F′ discharge the material which is too coarse to pass through the spaces between the rods A′, while the buckets F² discharge the material which is too coarse to pass through the spaces between the rods A′.

Between the sets of rods A′ A² are plates A³ arranged in screw form, as shown, so that the material will be conveyed along the screen rods and discharged upon the buckets F². The screw plates are secured in place by the rods A′ A² passing through them, as shown, and the inner edges *g′* project beyond the rods A² into the interior of the separator to a sufficient distance to act as a screw conveyer to carry the material along and discharge it into the buckets F′.

The rollers D′ D² are supported upon the inner sides of the main sluice box D³, as shown, so that all the material which passes through the spaces between the outer set of rods A′, will be caught in the sluice box.

G′ G² are spouts or troughs arranged beneath the buckets F′ and F² and resting by their ends upon the upper edge of the sluice box D³, and adapted to support the material passing over the ends of the rods A′ A², so that the buckets will pick it up and discharge it off to the sides of the machine, the trough G² being extended at G³ to convey the material into a secondary sluice box D⁴, while the trough G′ is extended at G⁴ to convey the material beyond the secondary sluice box to the waste heap.

The screen may be revolved in any suitable manner, or by any suitable or available means. Where the supply of water is sufficient, a portion may be employed to run a water wheel, as at H′, in a flume H², and adapted to actuate bevel gearing H³ H⁴ upon one end of the screen, but any suitable means may be employed to actuate the screen.

D⁵ represents the spout through which the supply of water will be fed to the screen, and D⁶ is the chute through which the material to be separated is fed to the spout, and conducted thence by the flowing water into the screen, the force of which must be sufficient to carry the material into and through the screen.

None of the particles of the material to be separated by the screen, should be larger than the buckets F′ can handle, and to prevent any particles which are too large from passing into the screen, I arrange within the spout D⁵ between the chute and screen a series of inclined rods D⁷ which thus serve to prevent too large pieces of stone or other material from passing into the screen.

Both of the sluice boxes D³ D⁴ are arranged gradually sloping downward from the screen, and with the sides gradually converging, toward the lower ends, as shown, so that the current of water will flow constantly through the sluice boxes and by the convergence of the sides be steadily contracted more and more, so that the force of the current will be steadily increased from the "head" to the "tail," the water constantly rising higher and higher in the sluice box as the sides are contracted, and thereby forming a constantly increasing upward suction upon the material carried along by the water, and effectually preventing its settling upon the bottom and "banking" therein. This is a very important feature, as it insures the free and unobstructed action of the apparatus and prevents clogging or "banking."

The material discharged into the secondary sluice box D⁴ consists of the coarser particles of gravel and earth and larger nuggets of gold, and some small quantities of dust gold, which may adhere to the larger particles of gravel, or undissolved earth, but will generally contain gold only in larger or nugget form.

The sluice box D³ is lined throughout its bottom and for a sufficient distance up its sides to insure their extending above the flow of water, with corrugated amalgam plates K′.

The sluice box D⁴ will not generally be provided with the amalgam plates, but may be provided with them if required.

At suitable intervals across both the sluice boxes D³ and D⁴ are inserted mercury troughs *d′* sunken into the bottom of the boxes, to receive and hold the pellets of gold charged amalgam detached from the plates and carried along by the current. These mercury troughs are made removable from the boxes without interfering with their action or shutting off the water, and the construction is shown in Figs. 12 and 13, which represents their details of construction on an enlarged scale. The mercury troughs *d′* are supported in secondary troughs *d²*, the latter having tubular ends and inserted through the sides of the sluice box so as to be revolved from the outside. One side of the trough *d²* rises higher than the other as shown at *d³*, so as to project above the bottom of the box and act as a "riffle" to retard or check the flow of the water and permit the particles of gold to sink into the mercury troughs.

When the mercury troughs are to be removed, the tubular outer trough *d²* is revolved one half a revolution, or until the "riffle" edge *d³* rests upon the opposite edge of the cavity made for it in the bottom of the sluice box, at *d⁴*, the trough *d²* then being turned upside down and cutting off the water from the mercury troughs so that the latter may be drawn out through the end of the trough *d²* when its cap *d⁵* is removed. By this means the mercury troughs may be readily removed and replenished without interfering with the action of the apparatus.

The first one of the mercury troughs next the separator, will be larger than the others, as it will receive the first instalment of the gold, which has been set free by the action of the separator.

For a short distance below the first mercury

trough, or the one next the separator, the bottom of the sluice box D^3 is formed with a slightly steeper incline, as shown at D^7, so as to elevate the bottom of the trough to conform to the first "riffle," and also to accelerate the flow of the water at the commencement of its passage through the wider end of the sluice box. At suitable intervals along the sluice box are inserted additional corrugated plates K^2 with amalgam material upon both sides and placed a short distance apart in parallel lines, between which the water flows, so that a very greatly increased amalgam surface is provided, to insure the thorough contact of every particle of the material carried along by the water with the amalgam surfaces. As many of these plates K^2 may be employed as may be required, and they may be placed at intervals sufficiently close to meet the requirements of the work to be performed or the condition of the material being treated. The plates K^2 will be made easily removable, as shown in Fig. 4, which represents a cross section of the sluice box at the point where a set of these plates occur, each of the edges e' of the plates being supported by a separate rib e^2. At the lower or discharge end of the sluice box it is curved downward, as shown at D^8 in Figs. 2 and 3, and is provided at the bottom of the curve with one of the mercury troughs d'.

Beyond the curved portion D^8 between the sides of the sluice box, is arranged a curved cross partition D^9, the upper portion h' being about on a level with the bottom of the main portion of the sluice box, while the lower portion of the partition is curved backward, just above the mercury trough, as shown at h^2, so as to cause the water to flow backward in whirling eddies in the "pocket" formed between the portions D^8 and D^9, and so retard and agitate the water to cause the particles carried by it to be precipitated with greater certainty. Above the partition D^9 and curved portion D^8 is arranged a "convex" cover or top D^{10} to the sluice box, the lower side of this cover being corrugated, the corrugations running crosswise of the sluice box, as shown. The cover D^{10} is hinged at i' so that it can be folded back upon the sluice box to afford easy access to the "pocket," when required.

D^{11} is a curved corrugated cross partition inserted above the curved portion D^8 between the sides of the sluice box, the corrugations running crosswise of the sluice box, and covered on both sides with amalgam material, the interior of the curved partition D^9, the outer surface of the curved portion D^8 and the lower surface of the convex portion D^{10} being also covered with the amalgam. By this arrangement the material just before being discharged from the sluice box is agitated and thrown into whirling eddies by passing through the depressed portion, the convex partition D^{10} forming a siphon like conformation which greatly adds in the separation and retention of any particles of gold which may escape contact with the amalgam surfaces or mercury troughs.

By this simple construction the material is fed to the spout D^5 and thence conveyed to the revolving screen where it is separated into three or more grades of fineness; first, the larger grade, which is only the coarse gravel or rock containing no valuable particles and remaining inside the central cylinder formed by the rods A^2 and conveyed by the combined action of the inner edges of the screw conveyer plates and the running water to the buckets F' by which it is discharged into the spout G^4; second, the next finer grade which passes between the spaces between the rods A^2, and are carried by the combined action of the water and conveyer plates into the buckets F^2 and are discharged by them into the secondary sluice box D^4, where the valuable particles are separated by the combined "riffle" and mercury troughs; and, third, the finer particles which pass between the small spaces between the outer set of rods A', which are carried by the rapidly flowing water into the main sluice box D^3, where every particle carried by the water comes in contact at some stage of its progress with some of the amalgam plates or mercury troughs. The action of the rods revolving in the water is to thoroughly pulverize and dissolve the particles or lumps of clay and earth, and thoroughly scour the sand and gravel, so that every particle of the gold is separated from all other matter so that when running down the sluice box and coming in contact with the amalgam plates, the particles of gold are readily seized by the mercury and none of them escape with the "tailings."

Having thus described my invention, what I claim as new is—

1. In an automatic amalgamator sluice box, a sluice box with the sides converging from the head to the tail and having a lining of amalgam plates with corrugations running lengthwise of the sluicebox, substantially as and for the purpose set forth.

2. In an automatic amalgamator sluice box, a sluice box with the sides converging from the head to the tail and having a lining of amalgam plates, and with mercury troughs at suitable intervals in the bottom of said sluice box, substantially as and for the purpose set forth.

3. In an automatic amalgamator sluice box, a sluice box lined with amalgam plates having corrugations running lengthwise of the box, and with a series of removable amalgam plates set in close parallel relations lengthwise of the box and corrugated to correspond to said plates, substantially as and for the purpose set forth.

4. In an automatic amalgamator sluice box, a sluice box lined with amalgam plates and with a downward curved end, a mercury trough at the extremity of the curved end, a backwardly and upwardly curving cross par-

tition forming a depression in the sluice box, and a convex cover above said partition and having a lining of amalgam plates, substantially as and for the purpose set forth.

5. In an automatic amalgamator sluice box, a sluice box with the sides converging from the head to the tail, a screen revolving in said sluice box and through which the material to be treated is passed and in which it is scoured and dissolved, the portion of the bottom of said sluice box next to the tail end of said separator being elevated to form a riffle or check to the flowing material, substantially as and for the purpose set forth.

6. In an automatic amalgamator sluice box, a sluice box having tubular troughs d^2 inserted in cavities across the bottom thereof and adapted to be oscillated and with one edge projecting upward to form riffles in the bottom of the sluice box, and adapted to support removable mercury troughs d', substantially as and for the purpose set forth.

7. In an automatic amalgamator sluice box, a sluice box with its sides converging from the head to the tail, substantially as and for the purpose set forth.

8. In an automatic amalgamator sluice box, a sluice box converging from the head to the tail, and provided with a depression or siphon at its discharge end, substantially as and for the purpose set forth.

9. In an automatic amalgamator sluice box, a sluice box lined with amalgam plates and with a downward curved end D^8, a mercury trough at the extremity of the curved end, a backwardly and upwardly curving cross partition forming a depression in the sluice box, a convex cover above said partition and curved portion, and a corrugated cross partition, substantially as and for the purpose set forth.

10. In an automatic amalgamator sluice box, a separator formed of an outer cylinder of horizontal rods and an inner cylinder of horizontal rods set a greater distance apart than the rods of said outer cylinder and connected by heads at their ends and adapted to be revolved in the sluice box, and with a screw conveyer plate between said cylinders of rods and with the rods passing through the screw conveyer plates, whereby the material is fed from the head to the tail of the screen when said screen is revolved, substantially as and for the purpose set forth.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

HERBERT L. PHILLIPS.

Witnesses:
C. N. WOODWARD,
H. S. WEBSTER.