(No Model.)

D. S. RANDOLPH.

AMALGAMATOR.

No. 311,258. Patented Jan. 27, 1885.

Fig. 1.

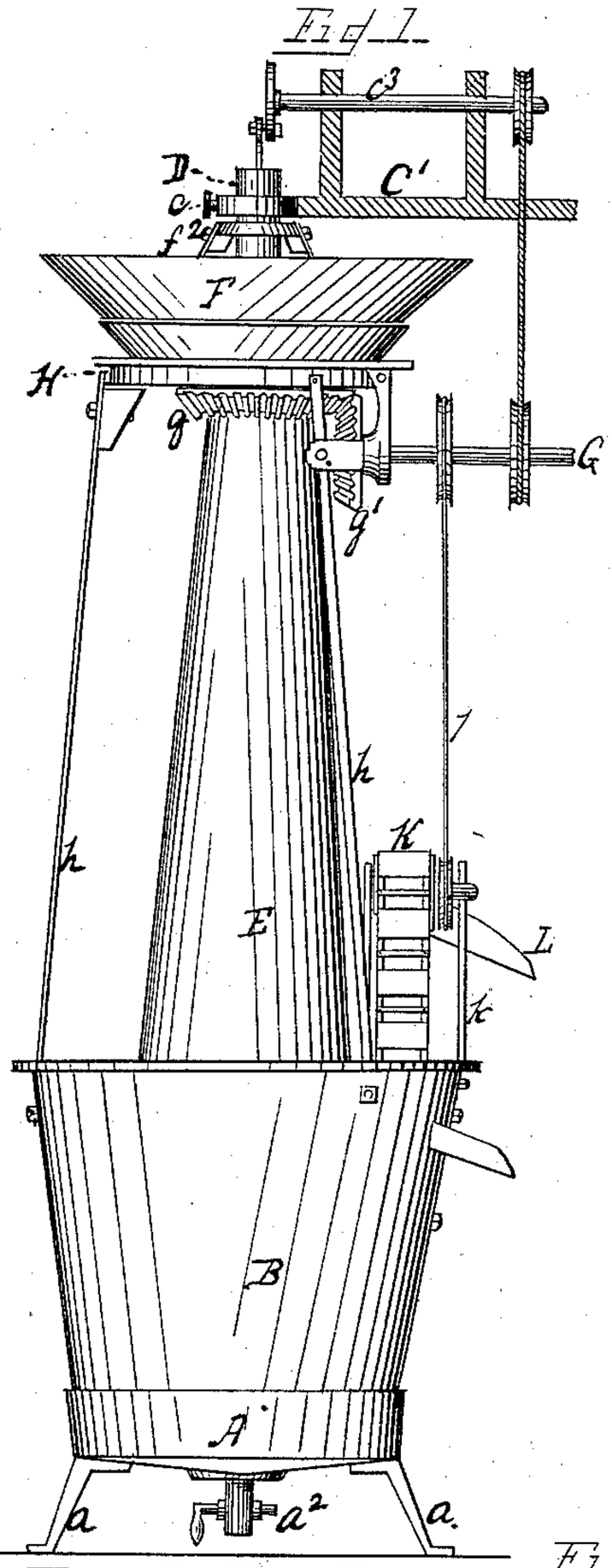


Fig. 2.

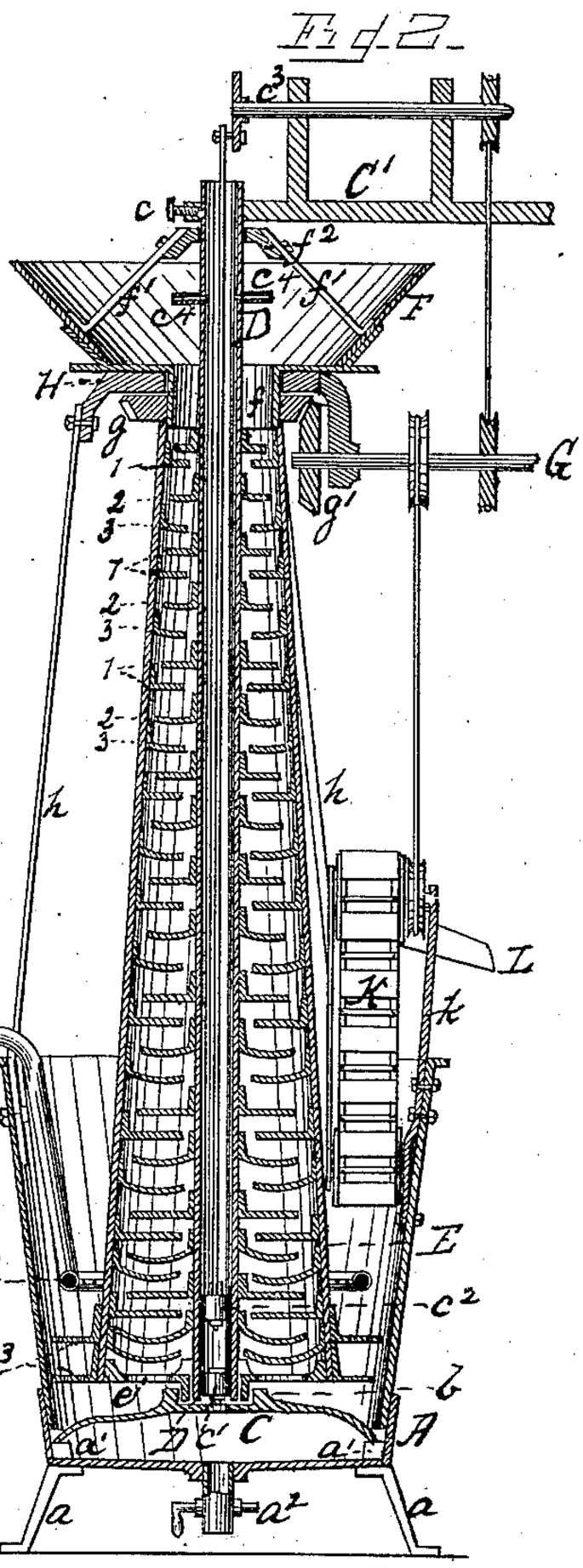


Fig. 5.

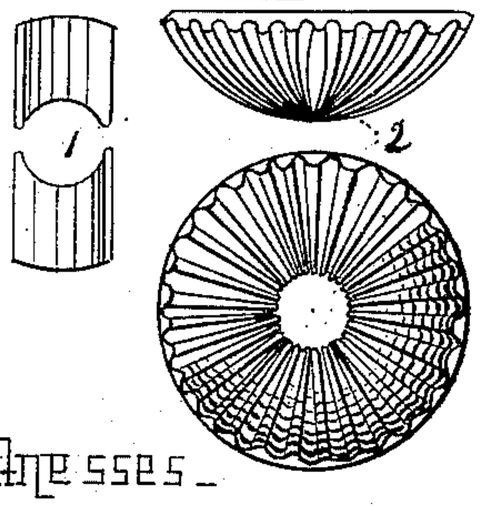


Fig. 6.

Fig. 3.

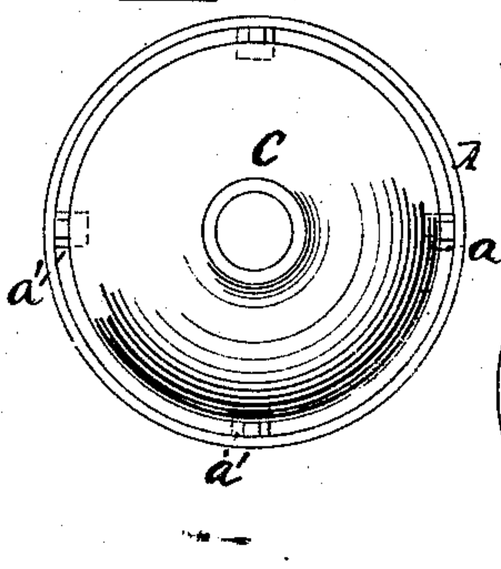


Fig. 7.

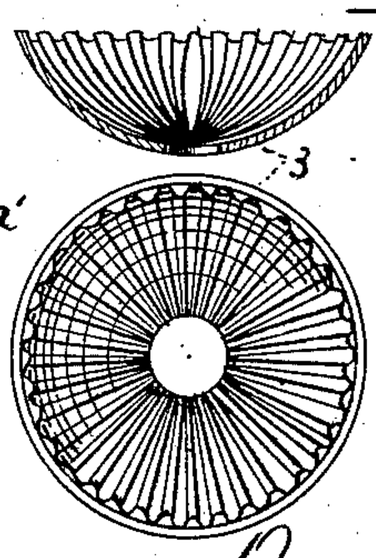
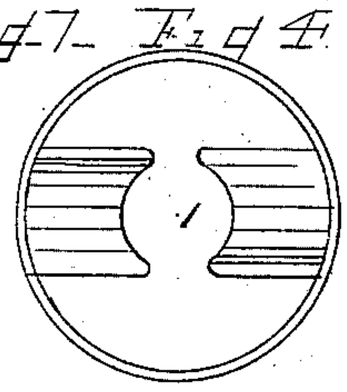


Fig. 4.



Witnesses.

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UNITED STATES PATENT OFFICE.

DAVID S. RANDOLPH, OF ST. LOUIS, MISSOURI, ASSIGNOR OF ONE-HALF TO JOHN A. CABLE, OF SAME PLACE.

AMALGAMATOR.

SPECIFICATION forming part of Letters Patent No. 311,258, dated January 27, 1885.

Application filed November 1, 1884. (No model.)

To all whom it may concern:

Be it known that I, DAVID S. RANDOLPH, a citizen of the United States, residing at St. Louis, in the State of Missouri, have invented certain new and useful Improvements in Ore Amalgamators, Separators, and Concentrators; and I hereby declare the following to be a full, clear, and exact description of the same, reference being had to the accompanying drawings, in which—

Figure 1 is an elevation of devices embodying my invention. Fig. 2 is a central vertical section of the same. Fig. 3 is a top view of the tank-bottom and the false bottom arranged therein, whereon the revolving cylinder or frame is stepped. Figs. 4 and 5 are detail views of the blades or propellers for feeding the pulp through the amalgamator. Figs. 6 and 7 (and the sections thereof) are detail views of the corrugated amalgamating-disks.

Like letters refer to like parts wherever they occur.

My invention relates to the construction of that class of devices designed for the recovery of the precious metals from ore, placer-dirt, or sand by amalgamating the metal with mercury or its equivalent, and has for its object, first, the intimate association of the mercury with the crushed ore, placer-dirt, or sand, whereby the precious metal is perfectly eliminated therefrom; secondly, the aggregation of the amalgam for purposes of concentration; and, thirdly, the elutriation or thorough washing of the refuse ore for the recovery of the mercury entangled therein, and to allow the heavy or coarse part of the ore, which is still valuable, (except placer-dirt,) to concentrate on the top of the mercury and be conveyed to a receptacle outside the machine for further treatment. To this end the mercury is caused to circulate through the apparatus with the crushed ore, pulp, placer-dirt, or sand, being elevated from a well or tank wherein the precious metals settle and amalgamate with the mercury, while the heavier particles of the ore, which are valuable, concentrate above the mercury and are carried by the conveyer outside the machine, while the lighter or refuse ore is subjected to a spray or shower of water, which washes out the mercury, the refuse thus freed and devoid of valuable matter being carried out with the water.

The main elements constituting my apparatus, considered as a whole, are a tank or well, a central hollow shaft or pump-barrel, an outer revolving frame or cylinder, the fixed central shaft and revolving frame or cylinder being provided with feeding-blades and amalgamating-disks, a spray-pipe or water-jet, and a conveyer for removing the concentrate from the well or tank.

I will now proceed to describe my invention more specifically, so that others skilled in the art to which it appertains may apply the same.

In the drawings, A indicates the bottom of the tank or well, which may be of cast-iron, supported on suitable legs, *a*, having lugs or blocks *a'* at intervals on its interior, for the support of a false bottom, C, and provided with a draw-off cock, a^2, for removing the concentrate of precious metal. To this bottom A the sides of the tank or well B, which may be of sheet metal, copper, or iron, is secured by riveting and calking, or in other suitable manner.

C indicates a false bottom provided with a central opening surrounded by a socket or journal-box, *b*, wherein is stepped the foot of the fixed hollow central shaft or pump-barrel D and the spider which supports the revolving cylinder E. The false bottom C is elevated on the blocks *a'* on the interior of bottom A, so that a circulation of the mercury can take place around the periphery of the false bottom to the well-hole below the same.

D indicates a hollow central shaft around which the cylinder E revolves. This shaft is supported below or stepped upon the false bottom C, so that its bore is in line with the central hole in the false bottom, and is secured above by means of a set-screw or clamp, *c*, in a fixed or stationary bracket, C'. The hollow shaft D constitutes a pump-barrel, which is provided with discharge nozzles or spouts c^4, is in communication with the mercury-well

below, as before specified, and has a standing valve, c', and a valve-plunger, c^2, which latter is operated from a shaft, c^3, on the bracket C'.

e indicates a spider, having a hub which incloses the fixed hollow shaft D, and is journaled in the box *b* of the false bottom C. This spider *e* supports a suitable skeleton frame, which is attached thereto, and which frame in turn supports a water-tight sheet-metal shell, which is slipped over the skeleton frame and secured to the same and to the spider, the whole constituting the vertical revolving cylinder E, which preferably tapers from top to base, as shown.

Upon the upper end of cylinder E is a hopper, F, terminating in a collar, *f*, to which the cylinder E, or the skeleton frame supporting the cylinder, is attached. Formed with or secured to collar *f* is an annular gearing or cog-wheel, *g*, which meshes with a bevel-gearing, *g'*, on the power-shaft G. At the lower end of the cylinder E are annular flanges e^3, which not only serve to strengthen the cylinder and balance the same, but also to deflect the amalgam as it escapes from the lower end of cylinder E, directing the same down into the mercury-well, while the lighter matter is permitted to escape past the flanges and rise into the water-zone of the tank.

Surrounding the collar *f* is a ring, H, which forms a bearing for the upper end of the revolving cylinder E, and this ring is supported by stays *h*, secured below to the sides B of the tank or well.

In order to keep the central hollow shaft, D, in place, a series of stays, f', are secured below to the hopper F, and above to a ring, f^2, which encircles the upper end of said shaft just below the fixed bracket C'.

I will next describe the devices contained within the revolving cylinder E, their construction and arrangement. Such devices are of two general characters—first, those which may be termed "feeders," (shown enlarged and in detail in Figs. 4 and 5,) the same being propellers or smooth blades set at an angle and attached either to the frame-work of E, as in Fig. 4, in which case they are inclined at an angle to grind downward as they rotate to the right with cylinder E, or are inclined in the opposite direction, as in Fig. 5, to feed or direct downward the passing ore, the blades in the latter case remaining stationary, as they are attached to the fixed central shaft, D. The second class are the amalgamating-disks, of general saucer shape, of which the smaller, (see Fig. 6,) or those which are attached to the fixed central shaft, D, are corrugated radially upon the under or convex side, while the larger, (see Fig. 7,) or those which are attached to the cylinder E and revolve around the fixed shaft, have a central hole and are corrugated radially on the upper or concave side. The diameter of the smaller (or upper) amalgamating-disk and the diameter of the central hole in the under or larger disk should be such as to permit the free passage of the ore between the edges of the disks and the side of the cylinder, and between the central shaft and disk, and for this purpose I have found three-eighths ($\frac{3}{8}$) of an inch sufficient, though I do not state the distance as a matter of limitation, as it may be increased or diminished to suit circumstances.

The construction of the feed-blades and amalgamating-disks being of the general character specified, they are arranged as follows: Beginning at the top is a pair of feed-blades, such as shown in Figs. 4 and 5, the first one, Fig. 5, being attached to the center upright shaft, and the second, Fig. 4, or its companion, being fastened or attached to the revolving cylinder E, and arranged to feed ore, &c., downward. The second device, No. 2, is the saucer-shaped amalgamating-disk, corrugated on its under or convex surface (shown in Fig. 6) and attached to the fixed shaft. The third device, or No. 3, is the saucer-shaped amalgamating-disk corrugated on its upper or concave surface, (shown in Fig. 7,) which is secured to the revolving cylinder or shell E. These four sets of devices constitute a series which is repeated until the bottom of the cylinder E is reached.

As a matter of convenient construction, it will be found desirable to form the plates with recesses to receive the skeleton frame, and straps by which the disks, &c., are secured, so that a smooth interior finish will be obtained.

As the central fixed shaft, D, can be raised or lowered and secured at any desired point by means of the set-screw or clamp *c*, it is evident that the distance between the corrugated amalgamating-disks can be adjusted and varied to suit the condition of the ore.

I indicates a water-pipe terminating in a perforated spray-ring, *i*, which encircles the revolving cylinder E and is arranged in the tank or well A, just above the mercury-level. From this spray-pipe jets of water are projected on the floating refuse to separate the mercury therefrom and prevent waste.

K indicates a conveyer of any desired character, arranged in the tank at one side thereof, supported by suitable brackets, *k*, attached to the tank, and the buckets of which dip below the water-line, so as to elevate the concentrated ore and deliver it into a spout, L, which conducts it from the machine. This conveyer, as well as the pump-shaft c^3, is driven from the main power-shaft G, through suitable belts and pulleys.

The devices being of substantially the character hereinbefore specified, will operate as follows: The mercury-well is first supplied with mercury, water is admitted to the annular spray-pipe *i*, the ore properly crushed or comminuted is fed to the hopper F and power applied to rotate the cylinder E actuates the pump-plunger c^2 and the conveyer K. The mercury is elevated from the well and projected through spouts c^4 upon the ore in the

hopper F. The ore is fed downward by the feed-blades No. 1, and passes over the concave surface of stationary amalgamating-disk No. 2 to the periphery thereof, where it falls upon the outer part of rotating amalgamating-disk No. 3, and is carried upward between the concave and convex radially-corrugated surfaces, being thoroughly triturated, intermingled, and amalgamated; passes thence through the eye of rotating amalgamating-disk No. 3, falling upon the fixed feed-blades No. 4, which deliver it to the rotating feed-blades No. 1 of the second series, and thus on through the machine, the fresh ore in the hopper being regularly supplied with mercury pumped up from the well, while the ore or matrix and amalgam are discharged at the lower end of the cylinder upon the convex surface of the false bottom C. The mercury and precious metal contained sink through the annular opening at the periphery of the false bottom into the well, whence the free mercury is drawn by the pump and delivered to the fresh ore, dirt, or sand in the hopper, as before specified, while the refuse rises past the flanges e^3 at the sides of the tank or well, where it is met by the jets of water from spray-pipe *i*, which free it of any mercury, the mercury thus saved settling down into the well. The refuse is carried out of the tank with the overflow of water, while the concentrates or coarser particles of ore, which still contain valuable matter, are removed by the conveyer and deposited in a suitable receptacle outside, to be worked over again. The amalgam can be withdrawn from the well from time to time, as becomes necessary, and, being deprived of the precious metal it contains, the mercury may be returned to the well.

I have throughout the specification referred to the central hollow shaft as fixed and the cylindrical shell as revolving around the same, and have so shown it in the drawings, as I prefer such a construction; but it is evident that no further invention is required to cause the central shaft to revolve with the propeller-blades and amalgamating-disks attached thereto while the cylinder and its adjuncts remain stationary. The construction is equivalent to what is shown, the result is the same, and I intend in the following claims to cover such mere colorable changes.

I desire to call especial attention to the value of the present invention to all free-milling ore and to placer-dirt. Placer-dirt being always free, all that is needed is to screen out the gravel which is too coarse to pass through the machine, and then put the remainder—water and all—through the machine. For placer-mining it saves building a flume, and may be worked, if necessary, with a comparatively small amount of water.

Further, the advantages of my invention are the thorough manner in which the amalgamation is effected, whereby none of the precious metal is lost or mercury wasted, the great distance through which the mercury and ore are compelled to travel in contact and under agitation, so that the process is rendered very effective, while the apparatus is at the same time kept within compact and reasonable limit as to size without practically limiting its capacity or destroying its utility.

Having thus described the nature, construction, and operation of my invention, what I claim, and desire to secure by Letters Patent, is—

1. In an ore-amalgamator, the combination of a mercury and amalgam well, a rotating amalgamating-cylinder, and a pump arranged within the amalgamating-cylinder for elevating the mercury from the well and delivering it into the ore at the feed end of the amalgamating-cylinder, substantially as and for the purposes specified.

2. In an ore amalgamator and separator, the combination of a mercury and amalgam well, a rotating amalgamating-cylinder stepped in the mercury-well, a mercury-pump arranged within the amalgamating-cylinder for elevating the mercury from the well and delivering it into the feed end of the amalgamating-cylinder, and a refuse-washer arranged over the mercury-well and delivering thereinto, substantially as and for the purposes specified.

3. In an ore amalgamator and separator, the combination of a mercury and amalgam well, a rotating amalgamator, a pump for raising the mercury from the well and delivering it into the feed end of the amalgamator, a refuse-washer arranged over the mercury-well, and a concentrate-conveyer arranged in the water-zone of the well, substantially as and for the purposes specified.

4. In an ore-amalgamator, the combination of a mercury-well, a perforated false bottom arranged therein, a central mercury-pump, and a rotating amalgamating-cylinder inclosing the mercury-pump and supported by the false bottom, substantially as and for the purposes specified.

5. In an amalgamator having a central stationary shaft and a rotating shell, the combination of the saucer-shaped amalgamating-disks, one corrugated radially on the convex and the other on the concave surface, substantially as and for the purposes specified.

6. In an amalgamator, the combination of a central adjustable pump-barrel having a series of corrugated amalgamating-disks, and an inclosing amalgamating-cylinder having a corresponding series of corrugated annular amalgamating-disks, substantially as and for the purposes specified.

7. In an amalgamator, the combination of a mercury-well, a false bottom arranged therein, a vertical rotatable amalgamator journaled on the false bottom, a bearing-ring in which the upper end of the amalgamator is journaled, and stays extending from the mercury-well to the bearing-ring, substantially as and for the purposes specified.

8. In an amalgamator, the combination of

a central pump-barrel provided with convex radially-corrugated amalgamating-disks, and an inclosing-shell provided with corresponding concave radially-corrugated amalgamating-disks, one of said devices being journaled to rotate, substantially as and for the purposes specified.

In testimony whereof I affix my signature, in presence of two witnesses, this 23d day of October, 1884.

DAVID S. RANDOLPH.

Witnesses:

JOHN A. CABLE,

C. D. GREENE, Jr.