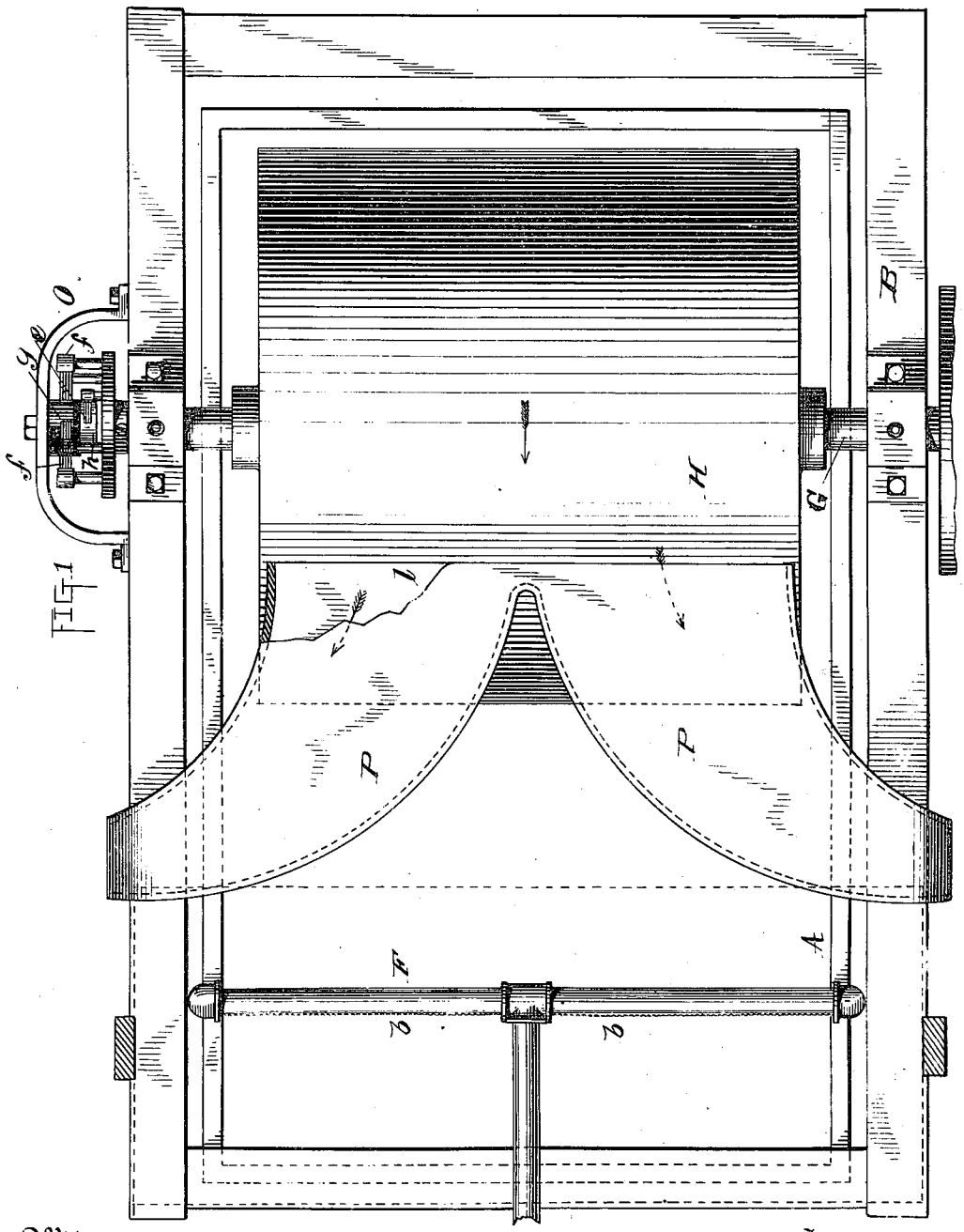
(No Model.) 4 Sheets—Sheet 1.

T. A. EDISON.

MAGNETIC SEPARATOR.

No. 430,280. Patented June 17, 1890.



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(No Model.) 4 Sheets—Sheet 2.

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MAGNETIC SEPARATOR.

No. 430,280. Patented June 17, 1890.

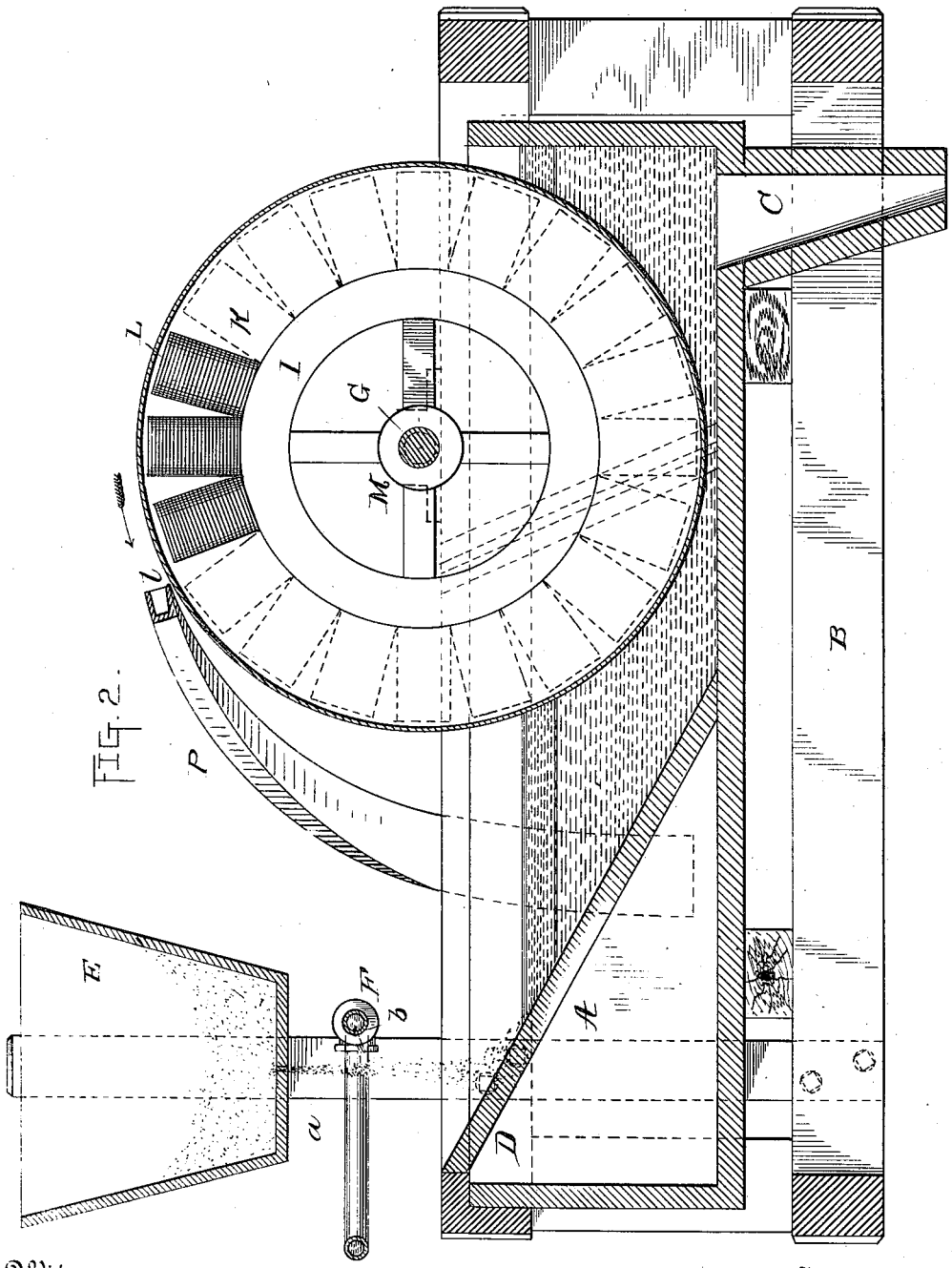

FIG. 2.

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MAGNETIC SEPARATOR.

No. 430,280. Patented June 17, 1890.

FIG. 3.

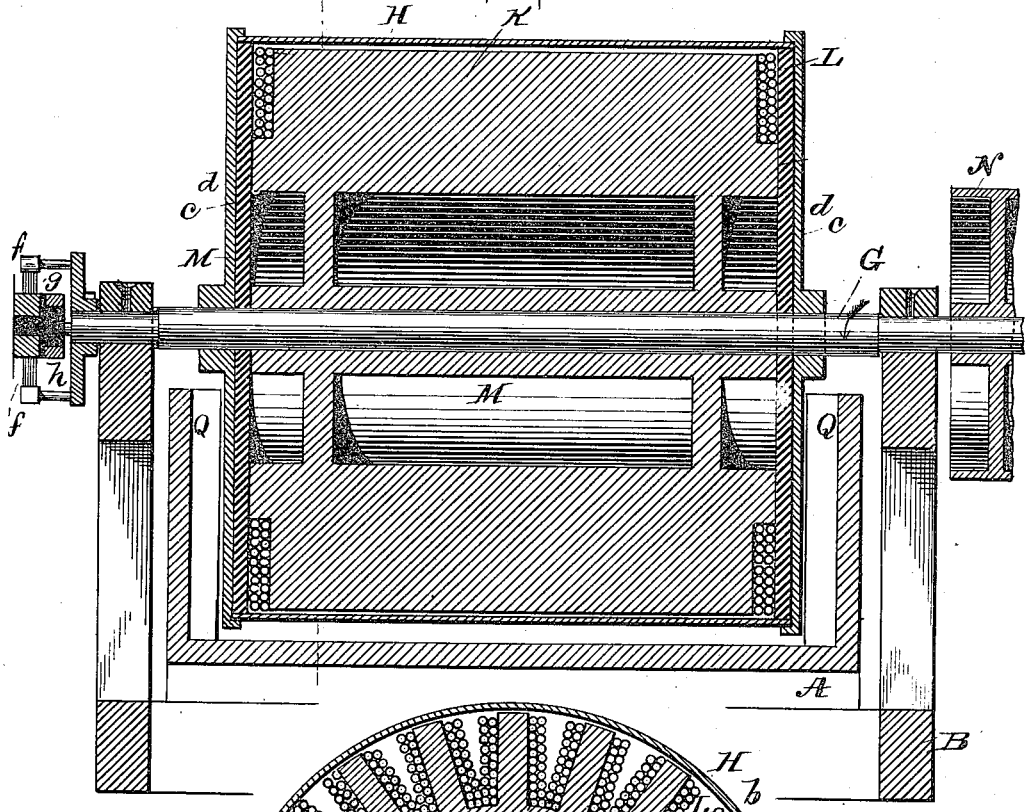
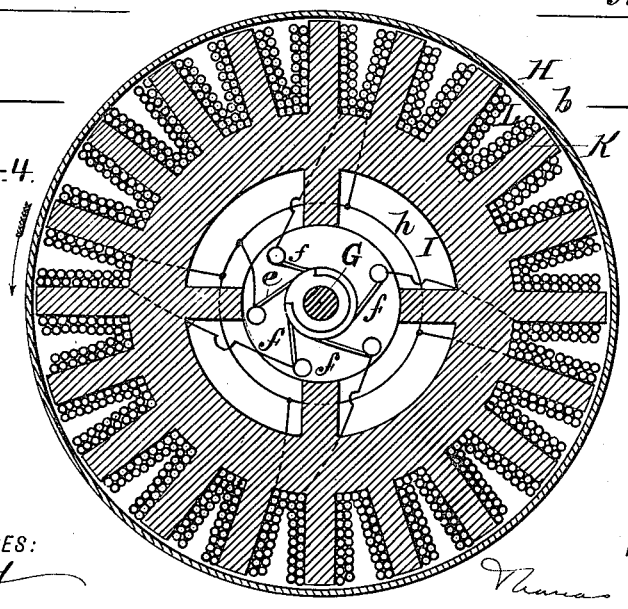


FIG. 4.



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(No Model.) 4 Sheets—Sheet 4.

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MAGNETIC SEPARATOR.

No. 430,280. Patented June 17, 1890.

FIG. 5

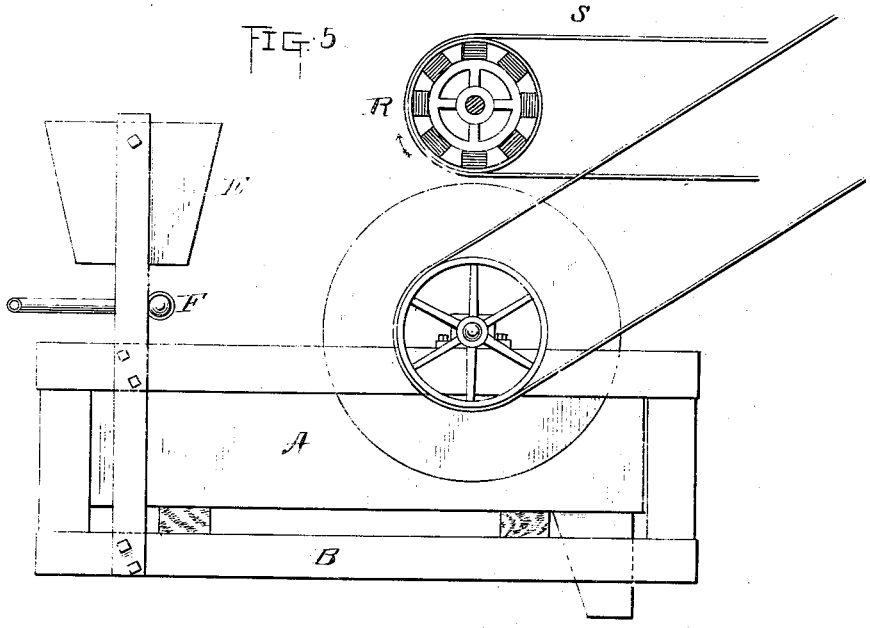
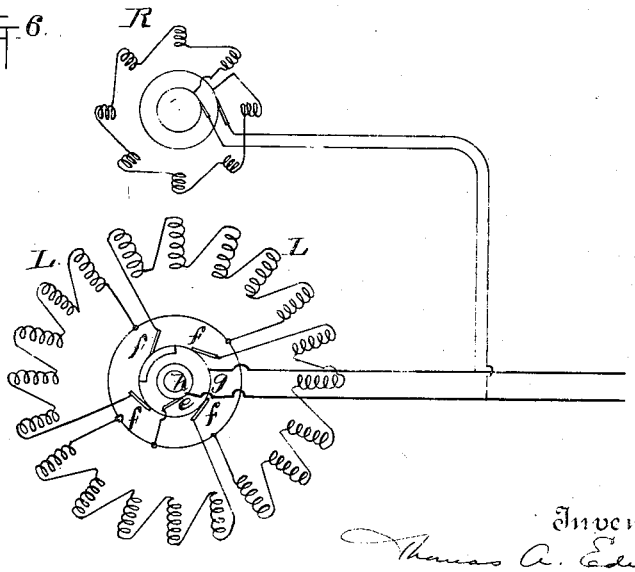


FIG. 6



Witnesses
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Inventor:
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By his Attorneys

UNITED STATES PATENT OFFICE.

THOMAS A. EDISON, OF LLEWELLYN PARK, NEW JERSEY.

MAGNETIC SEPARATOR.

SPECIFICATION forming part of Letters Patent No. 430,280, dated June 17, 1890.

Application filed July 29, 1889. Serial No. 319,102. (No model.)

To all whom it may concern:

Be it known that I, THOMAS A. EDISON, a citizen of the United States, residing at Llewellyn Park, in the county of Essex and State of New Jersey, have invented a certain new and useful Improvement in Magnetic Separators, (Case No. 843,) of which the following is a specification.

More especially my object is to provide for the effectual separation of unusually small and light particles of material. In the general process employed by me and set forth in my Patent No. 228,329, dated June 1, 1880, in which the mingled material is allowed to fall past the poles of a magnet, which alters the direction of falling of the magnetic particles, effectual separation is sometimes prevented when the particles are very small and light by such particles becoming massed together, so that magnetic particles become surrounded by non-magnetic ones and cannot be withdrawn by the magnet. In the same patent I have shown and described the use of a body of water through which the material falls, the water acting to separate the particles and prevent their clinging together, so that the magnetic ones are readily influenced by the magnet. In my present invention I make use of water for causing the dispersion of the particles, and I so arrange the magnets that they act by their attraction not only to separate the magnetic material from the rest, but also to remove it from the water-chamber. I accomplish this by the use of magnets moving in and out of the water, which draw the magnetic material to their poles and then carry it out of the water. I prefer to employ a revolving wheel at whose periphery are many radial magnetic poles. This wheel is placed, partially submerged, in a water-tank, into which the pulverized magnetic and non-magnetic particles are introduced. Since they become disassociated from one another by the action of the water, the magnetic particles are attracted by the revolving magnets and separated from the rest and carried out of the water, where they are removed from the magnets by suitable means. To provide for the ready removal of the material from the revolving magnets, I employ a commutator for breaking the circuit of the magnets when they reach the points at which the material is to be removed. I may then accomplish such removal by means of a scraper or other mechanical device or by magnetic attraction.

My invention is illustrated in the accompanying drawings.

Figure 1 is a top view of apparatus embodying my invention with the elevated hopper omitted; Fig. 2, a longitudinal vertical section of the same with the magnets in elevation; Fig. 3, a transverse vertical section through the magnet-wheel; Fig. 4, a cross-section of the magnet-wheel with a diagram of the commutators. Fig. 5 illustrates a modification of my invention in which magnetic attraction is employed to remove the particles from the magnet-wheel, and Fig. 6 a complete diagram of the electrical connections of the apparatus.

The apparatus consists of a tank A, supported in a suitable frame B and having an outlet C at one end. At the other end is an inclined board or chute D, and above this is situated the hopper E, having an opening *a* in its bottom, through which the material falls. Below the hopper is a water-pipe F, extending transversely across the tank and provided with a number of orifices at *b*, by means of which a stream of water is directed upon the whole width of the falling stream of the particles. Within the tank and supported on the shaft G, which has bearings in the sides of the frame B, is the revolving magnet-wheel, which consists of a cylindrical drum H, preferably of brass or other non-magnetic material, and provided with end disks *c* and *d*. Within the drum is the iron ring I, having a series of radial projections K, each of which projections is wound with coils of wire L, so as to form electro-magnetic poles. The hub M of the ring I is secured to the end plates of the wheel, so that the whole wheel is turned by the shaft G, power being applied to it by means of the pulley N or by any other suitable means. Supported upon a bracket O outside the frame B are two stationary commutator-cylinders *g h*. The commutator *g* consists of an insulating body surrounded by a metal ring for three-fourths of its circumference, and upon this commuta-

tor bear four brushes or current-collectors *f*, which are carried by the shaft F, so as to revolve with the magnet-wheel. The commutator *h* is a continuous metal ring, and upon it bears a single brush or current-collector *e*. The magnets of the wheel are electrically divided into four sets, each containing five magnets in series. It is evident that a greater or less number of magnets than that shown may be employed, and that they may be divided into a greater or less number of sets, the number of brushes *f* on the commutator *g* of course corresponding with the number of sets of magnets. Each set of magnets is connected between the brush *e* on the commutator *h* and one of the brushes *f* on the commutator *g*, as is clearly shown by the diagrams in Figs. 4 and 6, and it will therefore be seen that as the magnet-wheel revolves the circuit of each set of magnets is closed for three-fourths of the revolution—that is, while brush *f* is on the metal part of its commutator—and broken for the remaining one-fourth of the revolution, when the brush *f* is on the insulating part. The commutator is so arranged that the circuit of each set of magnets is broken when it reaches the highest position on the wheel, or thereabout.

As is illustrated in Figs. 1 and 2, I place close to the upper portion of the magnet-wheel a double hollow chute P, whose lower surface forms at *l* a scraping-edge, and which branches, as shown, into two parts, each extending down on one side outside the frame B and terminating in a suitable receptacle, as will be readily understood.

The operation of the apparatus is as follows: The hopper E being filled with the mingled mass of particles of magnetic and non-magnetic material, such material is made to fall in a wide thin stream through the bottom of the hopper into the tank, which is partly filled with water, as shown, and on falling the material meets the stream of water from the pipe F, which assists in separating the particles one from another. Water being constantly introduced at one end of the tank and running out through the outlet C at the other end, there is a sufficient current in the tank to carry the particles toward the magnet-wheel, and in the water the magnetic and non-magnetic particles become completely separated from one another, so that as such particles come within the field of the magnets in the tank the magnetic particles are attracted to the drum H and held there, while the non-magnetic particles are carried on by the current and leave the tank through the outlet C. The ribs Q are provided at the sides of the tank to prevent the material from getting past the wheel at the sides instead of passing under it. As the wheel revolves in the direction indicated by the arrows in the drawings, the magnetic particles are carried up out of the water until they reach the mouth of the chutes P, and since at this point the circuit of each set of magnets is broken the material is readily scraped off the wheel by the edge of the chute and is fed away through such chute. Instead of this, however, I may employ the device shown in Fig. 5, in which a smaller magnet-wheel R revolves above the wheel in the tank A, the magnets of the wheel R being constantly energized and the wheel being provided with a conveying-belt S and placed over the point on the large wheel at which the circuit of the magnets is broken, so that it takes up the magnetic material from the large wheel and carries it around upon the belt S, by which it is conveyed away to a desired point. The magnets of the wheel R may be energized by brushes resting on continuous rings on its shaft, as will be readily understood, and as indicated in the diagram Fig. 6.

What I claim is—

1. In a magnetic separator, the combination of a water-chamber into which the material to be separated is introduced and magnets inclosed in a drum moving in and out of said water-chamber, whereby the magnetic material is removed therefrom, substantially as set forth.

2. In a magnetic separator, the combination of the water-chamber into which the material to be separated is introduced and the revolving wheel comprising a drum and inclosed magnets partially submerged in said chamber, substantially as set forth.

3. In a magnetic separator, the combination, with the water-chamber and the revolving magnet-wheel, of the commutator for breaking the circuit of the magnets at intervals, substantially as set forth.

4. In a magnetic separator, the combination, with a water-chamber, of a magnetic wheel revolving therein and a circuit-controller for de-energizing the upper magnets, whereby the material may be readily removed, substantially as set forth.

5. In a magnetic separator, the combination, with the water-chamber, of the revolving magnet-wheel, a circuit-controller for the magnets, and a stationary scraper adjacent to the periphery of the wheel for removing the magnetic material from said wheel, substantially as set forth.

6. In a magnetic separator, the combination, with the water-chamber, of the revolving magnet-wheel having a continuous periphery, the scraper for removing the magnetic material from said wheel, and the conveying-chute, substantially as set forth.

7. In a magnetic separator, the combination, with the water-tank and the magnets therein, of an elevated hopper and the water-pipe for discharging water upon the material falling from said hopper, substantially as set forth.

8. In a magnetic separator, the combina-

tion of the water-chamber, the magnets moving in and out of such chamber, and the commutator for breaking circuit of magnets when outside the chamber, substantially as set forth.

9. In a magnetic separator, the combination of the water-chamber, the revolving magnet-wheel, a commutator for breaking circuit of magnets outside the chamber, and means for removing the magnetic material from the wheel, substantially as set forth.

This specification signed and witnessed this 20th day of July, 1889.

THOS. A. EDISON.

Witnesses:
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I. C. BENNETT.