C. F. McKENNA.

PROCESS AND APPARATUS FOR THE MANUFACTURE OF PORTLAND CEMENT.

APPLICATION FILED JAN. 2, 1907. RENEWED MAR. 19, 1909.

936,555. Patented Oct. 12, 1909.

4 SHEETS—SHEET 1.

Fig. 1.

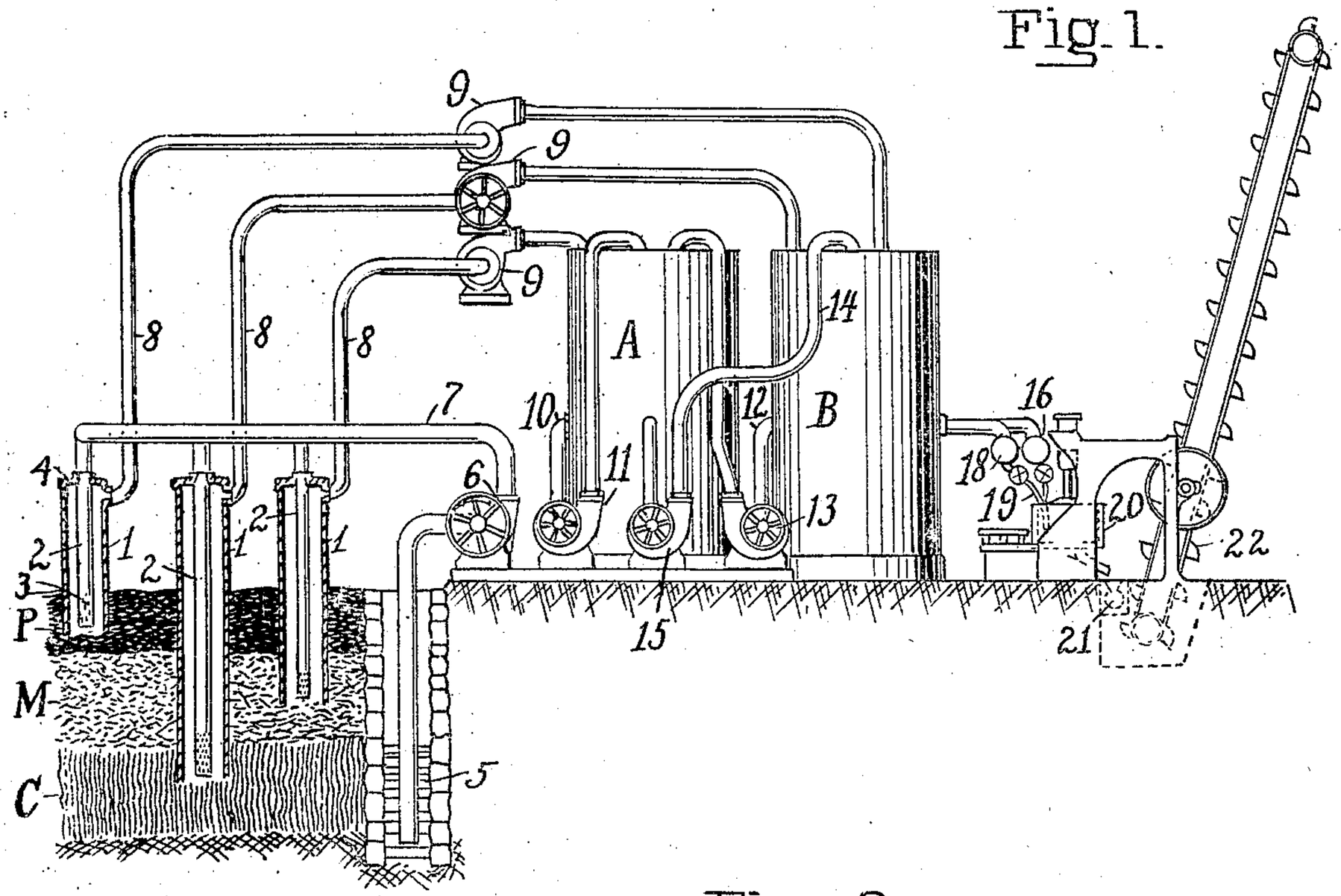
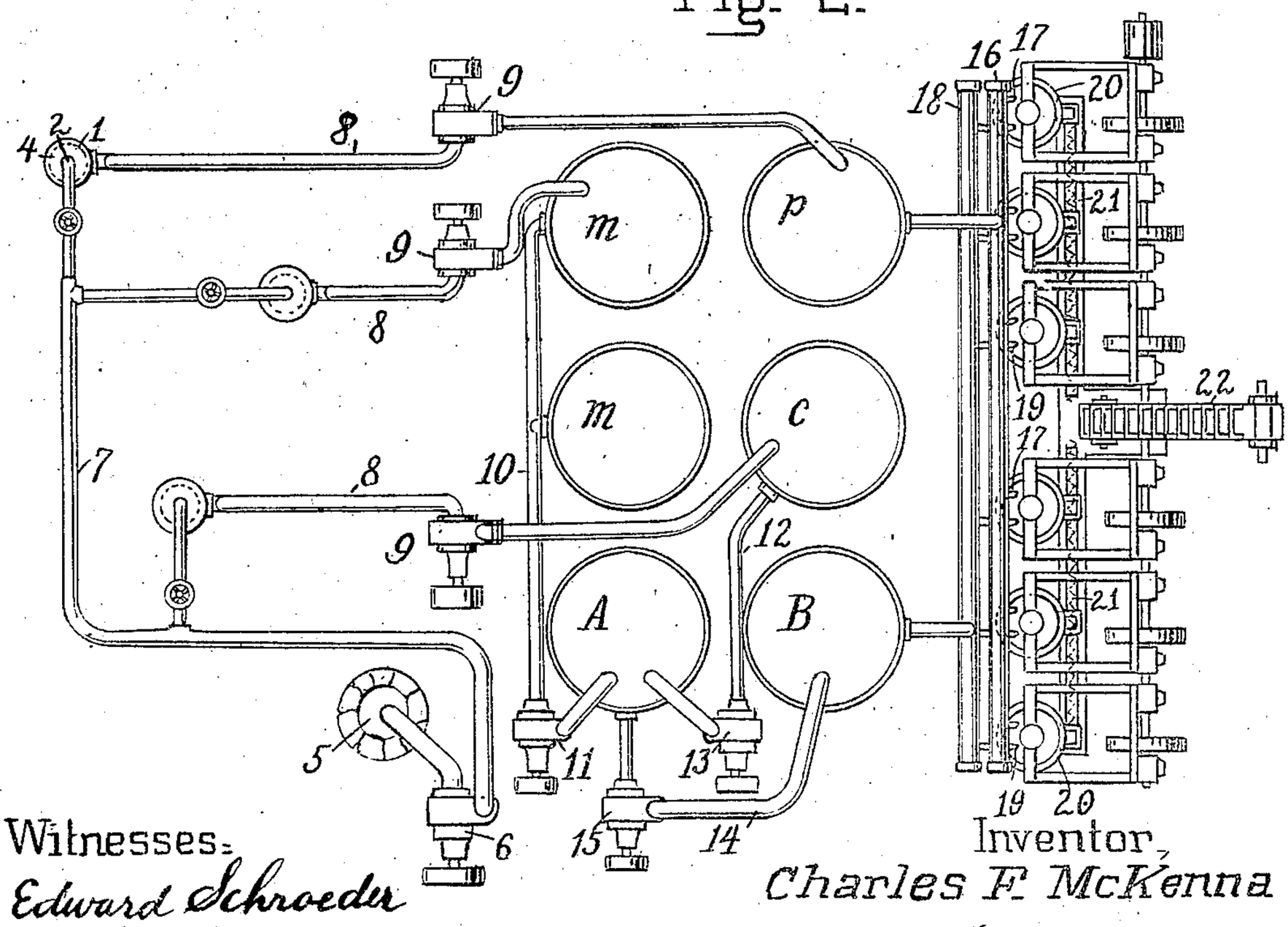


Fig. 2.



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4 SHEETS—SHEET 2.

Fig. 3.

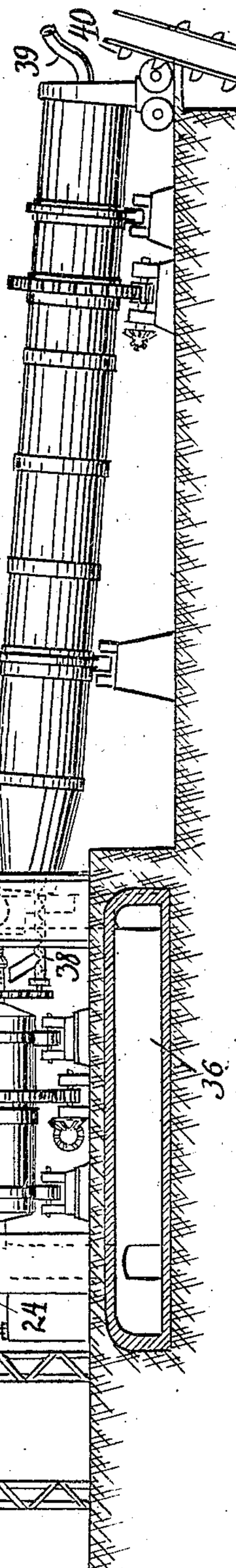
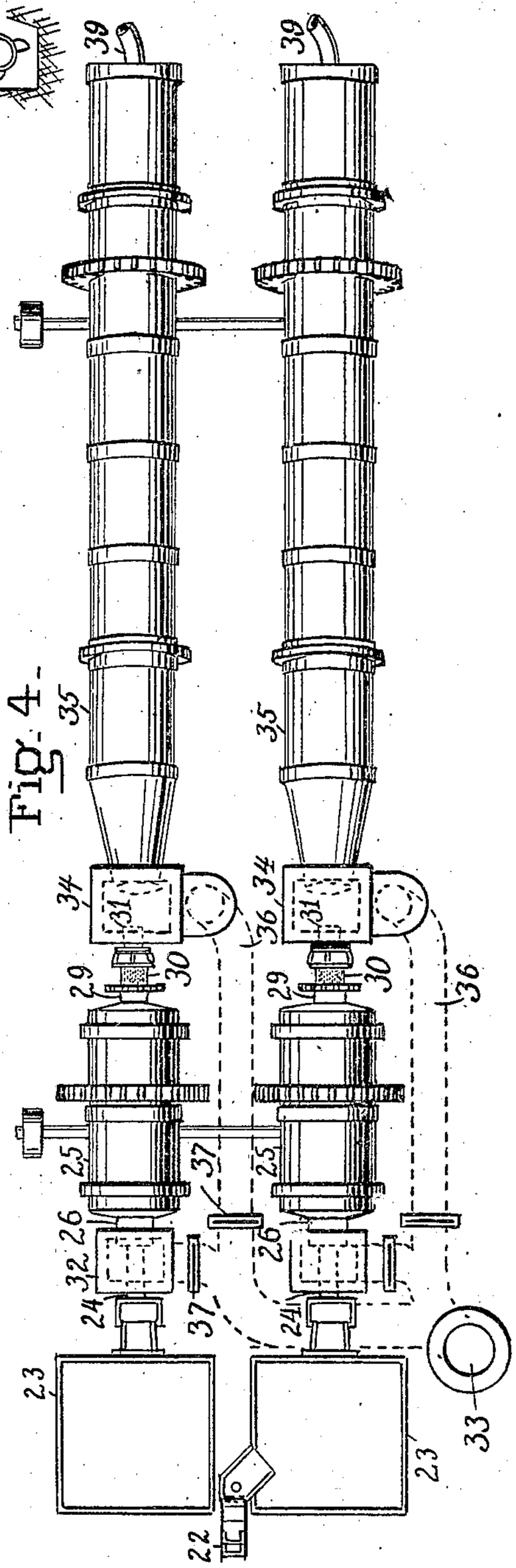


Fig. 4.



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4 SHEETS—SHEET 3.

Fig. 5

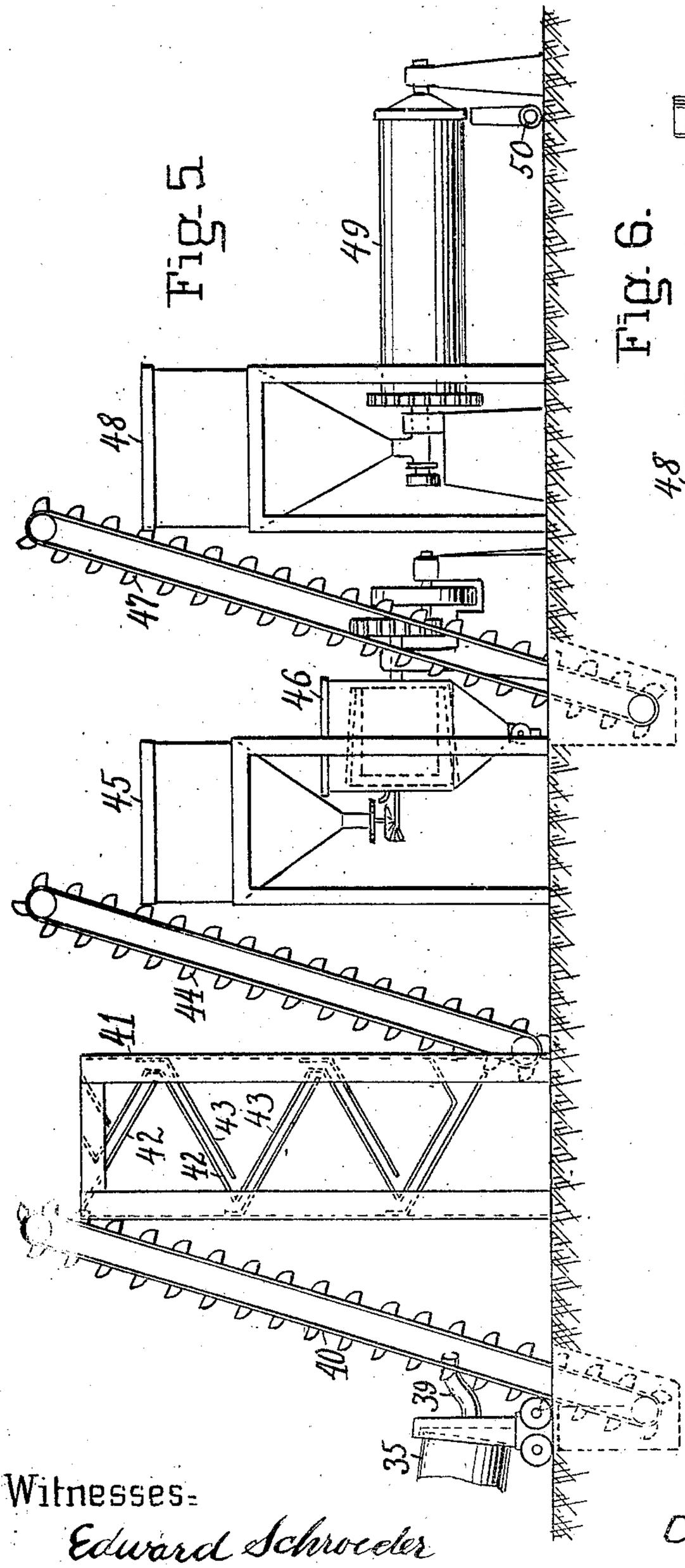
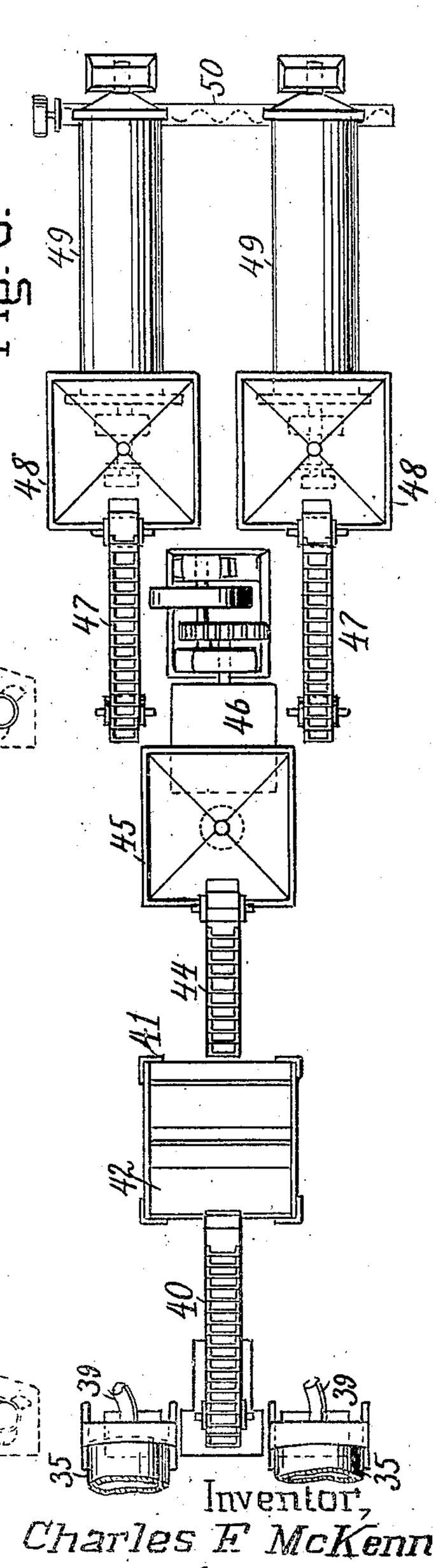


Fig. 6.



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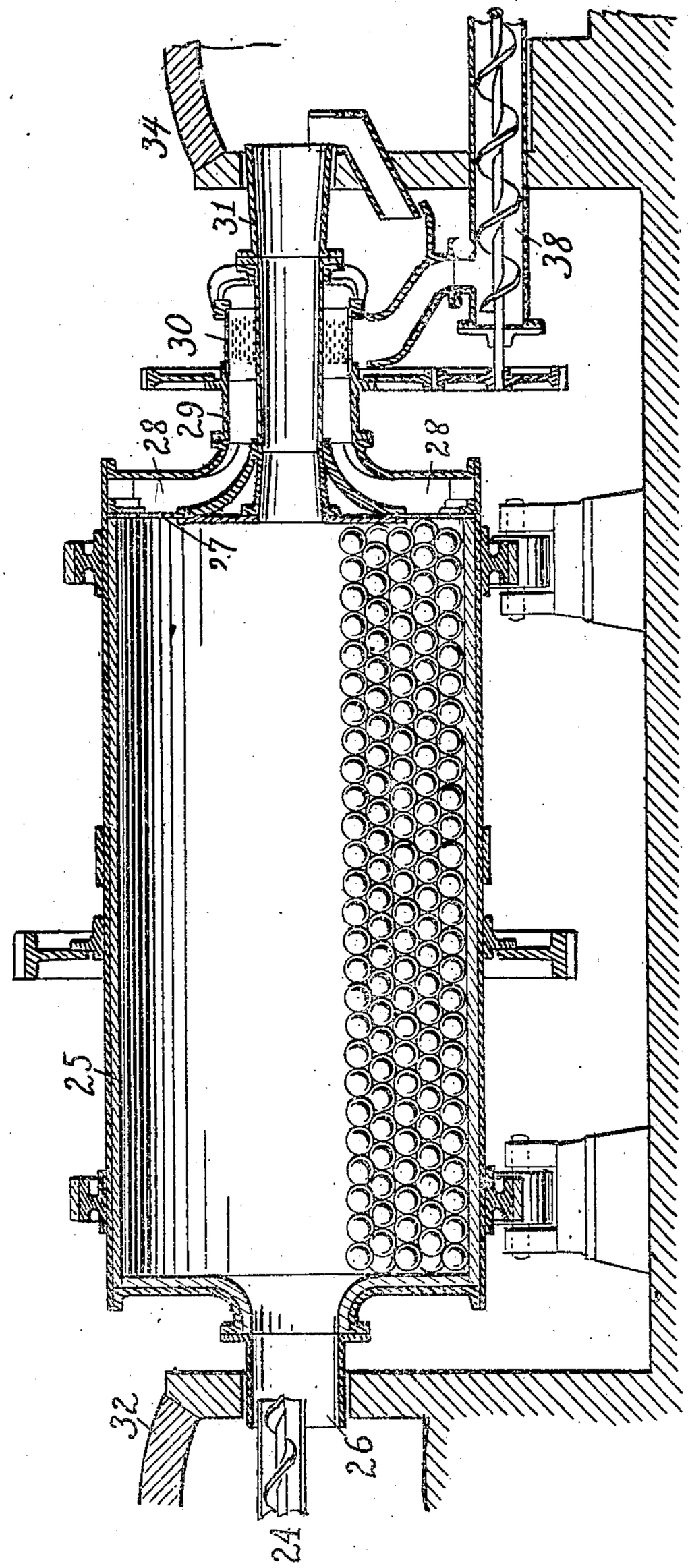
4 SHEETS—SHEET 4.

Fig. 7.



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UNITED STATES PATENT OFFICE.

CHARLES F. McKENNA, OF NEW YORK, N. Y.

PROCESS AND APPARATUS FOR THE MANUFACTURE OF PORTLAND CEMENT.

936,555. Specification of Letters Patent. Patented Oct. 12, 1909.

Application filed January 2, 1907, Serial No. 350,438. Renewed March 19, 1909. Serial No. 484,538.

To all whom it may concern:

Be it known that I, CHARLES F. McKENNA, a citizen of the United States of America, and a resident of the borough of Manhattan, in the city of New York, county of New York, and State of New York, have invented certain new and useful Improvements in Processes and Apparatus for the Manufacture of Portland Cement, of which the following is a specification.

This invention relates to a process of mining cement raw materials and their preliminary treatment by hydraulic methods, and to a process of converting the raw materials into cement which is especially suited to economic practice in conjunction with their hydraulic mining and initial treatment.

One of the objects of the invention is the economical utilization of calciferous material in the form of deposits of marl and argillaceous material in the form of deposits of clay, which are usually found together, as raw materials for Portland cement manufacture, particularly where beds of these materials are overlain by or are convenient to beds of peat.

Further objects of the invention relate to the practical mining of such deposits for suitable raw materials without stripping, without suspension of the work in cold weather and without the removal of other than the finely divided constituents of the deposits which are most useful in cement manufacture, thus effecting a material reduction or elimination of grinding preliminary to incorporating and burning.

Further objects of the invention relate to affording opportunities for examining and correcting composition of the mixed material before its transfer to the kilns.

Further objects of the invention relate to the rapid elimination of water by screening and consequent saving in fuel consumption for final evaporation or drying, and the heating of the material during incorporation and preliminary to its introduction into the kilns whereby further fuel saving is effected, and the utilization of the incorporating mill to arrest and save material which is carried from the kiln with escaping gases.

In the accompanying four sheets of drawings which form a part of this application is illustrated apparatus embodying my invention and for carrying out the process embodying my invention, in which—

Figures 1 and 2 show respectively elevation and plan views of the parts of the apparatus for the hydraulic mining, elutriation and transportation of the cement raw materials and fuel material, tanks for mixing the elutriated materials, and centrifugals for screening. Figs. 3 and 4 show respectively elevation and plan views of the parts of the apparatus comprising bins for screened material, incorporating mills, and rotary kilns for producing cement clinker. Figs. 5 and 6 show respectively elevation and plan views of the parts of the apparatus comprising a clinker cooler, bins for clinker, and ball mills and tube mills for final grinding. Fig. 7 shows in vertical section drawn to a larger scale one of the incorporating mills.

The three sheets of drawings containing Figs. 1 to 6 inclusive, read from left to right and in order, show in sequence apparatus for carrying out the successive steps of the complete process from the mining of the raw materials to the delivery of the cement.

For the hydraulic mining I provide for each of the raw materials individually deposited, as the peat P, marl M, and clay C, a hydraulic extractor consisting of a shield pipe 1 and a water pipe or nozzle 2 within the shield pipe, which is sunk vertically through overlying strata into the material which it is desired to mine and to a sufficient depth to bring the end below frost in cold weather. The shield pipe is open at the lower end and the water pipe or nozzle opens through perforations 3 forming a spray adjacent to the lower end of the shield pipe. The two pipes are mechanically held in proper relation to each other by a cap 4 at the upper end of the shield pipe, the water pipe passing through the cap.

In operation water is drawn from any suitable source, as a well 5, and forced, as by a pump 6, through pipe connections 7 to the nozzle within the shield pipe. The spray from the nozzle on striking the raw material in which the lower part of the shield pipe is embedded washes out and brings the finer particles into suspension, leaving behind the larger and heavier constituents, and carries the finer part of the material, thus brought into an elutriated condition

up through the annular space between the pipes and through pipe connections 8 and a suction pump 9 into storage tanks, several of which are provided as *m m* for the marl, *c* for the clay, and *p* for the peat. From these tanks the washing or slurry of calciferous material is drawn through pipe connections 10 and a pump 11, and the washing or slurry of argillaceous material is drawn through pipe connections 12 and a pump 13, both washings into a tank A and mixed, the composition tested and corrected, and then through pipe connections 14 and a pump 15 transferred to a tank B. Where natural grades can be availed of for pressure, it is obvious that the pumping may be more or less dispensed with. The slurry of fuel material, which may be also made with powdered coal when peat is not available, is drawn through a main 16 and nozzles 17 17, and the slurry of mixed cement materials is drawn through a main 18 and nozzles 19 19 into centrifugals 20 20. A small quantity of fuel material is first charged, this having the property of packing against the centrifugal screen and serving as a suitable support and filtering medium for the elutriated cement material as it is screened, this cement material being so finely divided that it would pass through the centrifugal screen if allowed to come in direct contact therewith. Additional fuel material is charged with the cement material as may be further needed for support or for providing porosity in the screening and useful in subsequent operations.

The screened mixed material is discharged from the centrifugals into screw conveyers 21 21, and thence passes to a bucket belt conveyer 22 by which it is elevated to bins 23 23. From either bin the screened material is delivered through a screw conveyer 24 into an incorporating mill 25, the conveyer projecting through a hollow trunnion 26 at one end of the cylinder of the mill. This mill effects preliminary drying and intimate mixing or incorporating of the cement materials. The finely divided particles after traversing the cylinder pass through screens 27 at the end into chambers 28 formed by radial partitions which elevate the incorporated material and discharge it through a sleeve 29 and screen 30. Any particles which are too large to pass through this second screen can pass across it and be discharged into a separate channel, and any particles which fail to pass the first screen can pass out through an interior concentric tube or trunnion 31. Both trunnions of the cylinder are hollow and run loosely in flue heads or chambers, one of which 32 communicates with a stack 33, and the other of which also receives one end of a rotary kiln 35. By-pass flues 36 are provided so that by means of dampers 37 as much or little as desired of the hot gases from the kiln may be made to pass through the incorporating mill. The mill is thus employed for preliminary drying and pulverizing so far as may be necessary as well as for incorporating before discharging the material into the kiln. The mill thus arranged and connected also serves to catch material which is carried out of the kiln by the escaping gases and would otherwise be lost through the stack. A screw conveyer 38 receives the fine screened material from the incorporating mill and discharges it into the rotary kiln. Opportunity is also afforded for withdrawing samples at this conveyer and testing correctness of composition of the material as it is about to pass into the kiln. The kiln is of usual construction and is heated by an ignited mixture of powdered fuel and air which is blown into the kiln from a pipe 39. The fuel mixed with the cement material also becomes ignited in the kiln and contributes to the heat generated by the fuel which is blown in. Upon the discharge from the kilns the clinker falls on a bucket conveyer 40 and is elevated to the top of a cooling tower 41 and discharged. The clinker descends in the tower by gravity over inclined plates 42 in zigzag arrangement which are air or air and water cooled. A parallel zigzag path is provided by a second set of plates 43 for use as a dryer for fuel material which may also be deposited at the top of the tower so as to descend over this set of plates which become heated by the clinker. The cooled clinker is elevated by a belt conveyer 44 to a bin 45 from which it is drawn into a Lindhard ball mill 46 such as is shown in United States Patent No. 737,750 dated Sept. 1, 1903. This mill effects the first of the grindings subsequent to the burning in the kilns. After this grinding the cement is again elevated by belt conveyers 47 47 to bins 48 48 and drawn therefrom for final grinding in Davidson tube mills 49 49 containing balls or pebbles and constructed and operating in a manner well known in cement practice. The discharge from these mills is collected by a screw conveyer 50.

There are many forms of the detailed apparatus already in the art for effecting many of the steps herein set forth and which may be substituted without departing from the spirit of my invention, and I therefore do not limit myself to the precise apparatus herein illustrated except so far as it is specifically recited in the claims.

As is well known the present practice in cement manufacture tends to an exceedingly fine subdivision of the cement materials. To illustrate this it may be stated that the best modern practice requires the material to be so fine that seventy-five per cent. thereof will pass through a screen of 40,000 meshes to the square inch. Fine subdivision is as essential in the wet process. By hy-

draulically mining the materials in the manner before described, I accomplish this in the process of mining and I secure by graduation the very finest particles that the mined bed contains.

What I claim as new, and desire to secure by Letters Patent of the United States, is—

1. The process of working peat, marl, and clay deposits which consists in removing the individual deposits with a hydraulic extractor, admixing the washings of the several deposits, and passing the same through a screen, whereby the washings of peat serve as a filter for the washings of the other deposits.

2. The process of working peat, marl, and clay deposits which consists in removing the individual deposits by a hydraulic extractor, admixing the washings of the marl and clay deposits, throwing the peat washings on a screen, and throwing the admixed washings of marl and clay upon the peat while in the process of screening, whereby the washings of peat serve as a filter for the washings of the other deposits.

3. The process of mining calciferous and argillaceous materials and manufacturing Portland cement therefrom which consists in separately hydraulically mining and elutriating the materials whereby particles unsuited for incorporating and burning without preliminary grinding are eliminated, jointly screening, drying, incorporating, burning, and subsequently grinding.

4. The process of mining calciferous and argillaceous materials and manufacturing Portland cement therefrom which consists in hydraulic mining and elutriation of the materials, the mixing therewith of fuel material, screening the mixed materials, drying, incorporating, burning, and subsequently grinding.

5. The process of manufacturing Portland cement which consists in the mixture of a slurry of finely divided calciferous and argillaceous material with fuel material, screening of the mixed materials, drying, incorporating, burning, and subsequently grinding.

6. The process of manufacturing Portland cement which consists in the mixture of a slurry of finely divided calciferous and argillaceous material with peat, screening of the mixed materials, drying, incorporating, burning, and subsequently grinding.

7. The process of manufacturing Portland cement which consists in the formation of a slurry of calciferous and argillaceous materials, filtering the slurry through fuel, burning the resultant residue, and subsequently grinding.

8. In a process of manufacturing Portland cement, the passage of mixed calciferous and argillaceous material through an incorporating mill and a kiln, and the concurrent passage of the gases from the kiln through the incorporating mill to a stack.

9. In an apparatus for working peat, marl, and clay deposits, the combination of a hydraulic extractor for each of said deposits, whereby particles unsuited for incorporating and burning without preliminary grinding are eliminated, means for admixing the washings from the several extractors, a screen for screening the admixed washings, means for drying, incorporating, burning, and subsequent grinding.

10. In an apparatus for manufacturing Portland cement, the combination of an incorporating mill, a kiln and a stack therefor, connections for the passage of gases from the kiln to the stack through the incorporating mill, and means for the passing of mixed calciferous and argillaceous materials into the incorporating mill and from the incorporating mill into the kiln.

Signed by me at New York, (borough of Manhattan), N. Y., this thirty-first day of December, 1906.

CHAS. F. McKENNA.

Witnesses:
SAMUEL W. BALCH,
EDWARD SCHROEDER.