No. 815,680. PATENTED MAR. 20, 1906.

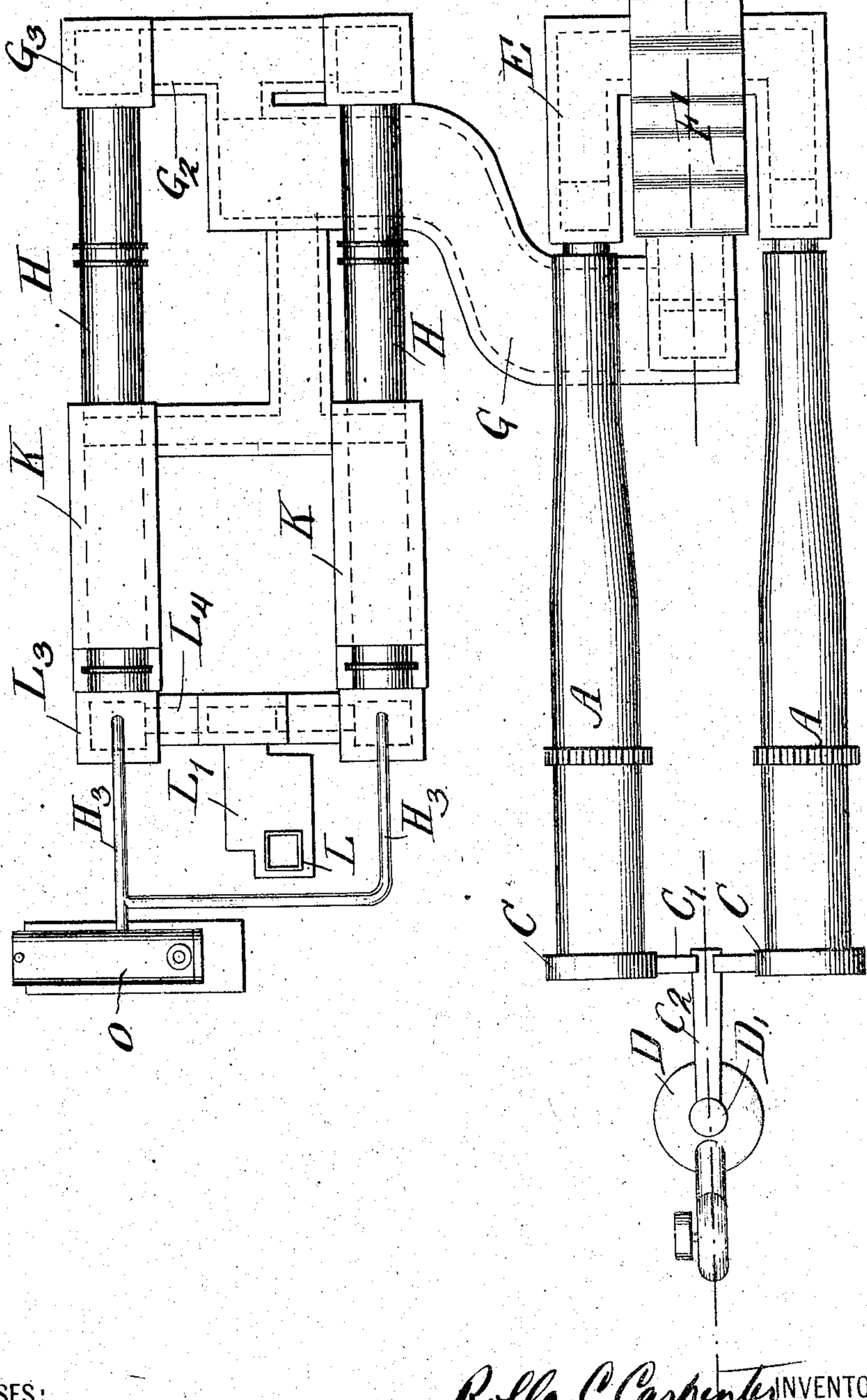
R. C. CARPENTER.

APPARATUS FOR MAKING CEMENT.

APPLICATION FILED OCT. 17, 1902.

3 SHEETS—SHEET 1.

Fig. 1



WITNESSES:

Jessie B Kay

Alexander Mitchell

Rolla C Carpenter INVENTOR

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3 SHEETS—SHEET 2.

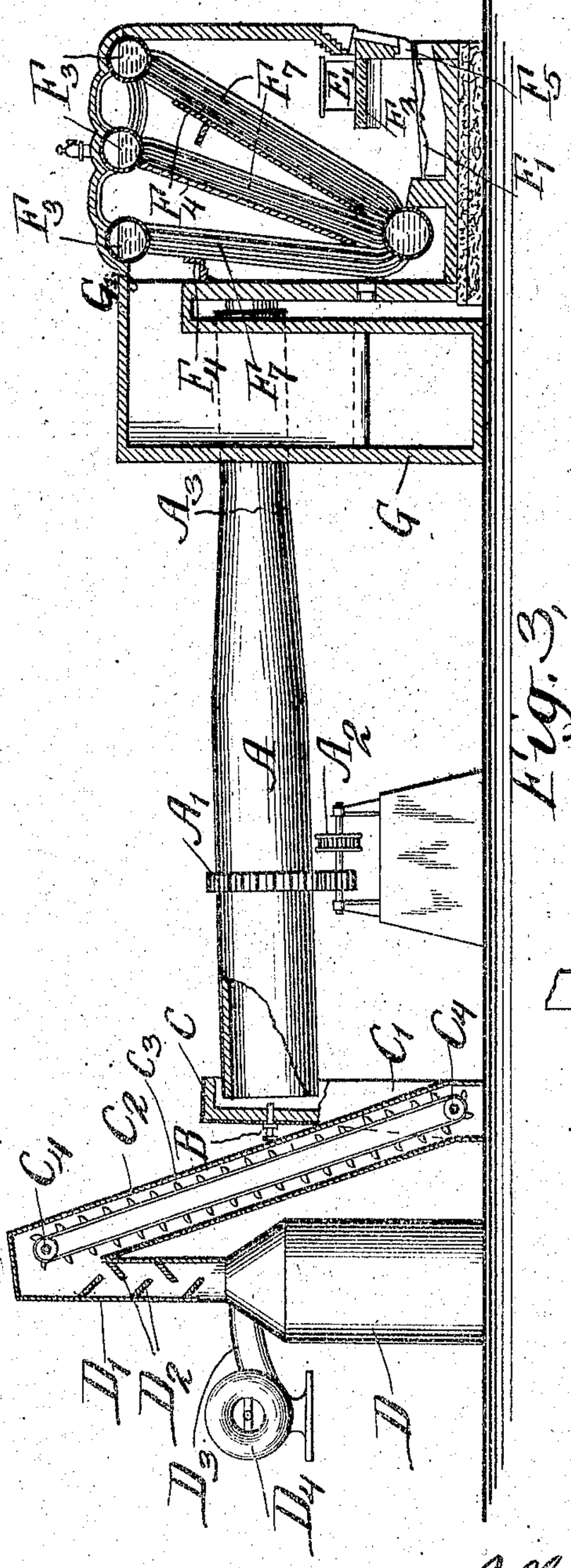

Fig. 2.

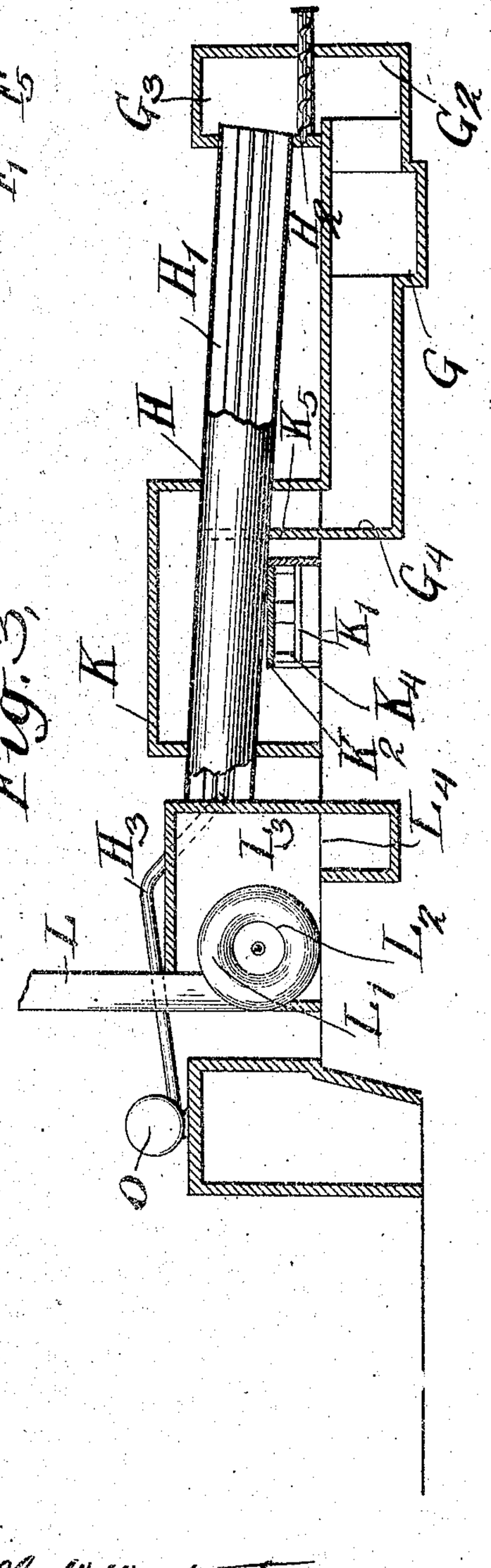

Fig. 3.

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3 SHEETS—SHEET 3.

Fig. 1.

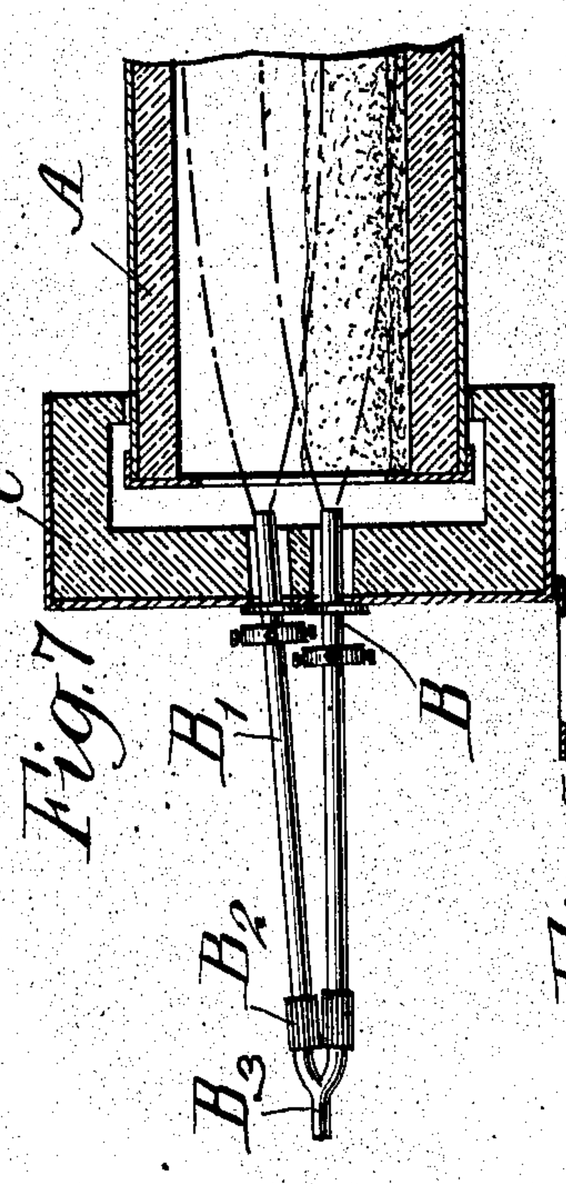


Fig. 2.

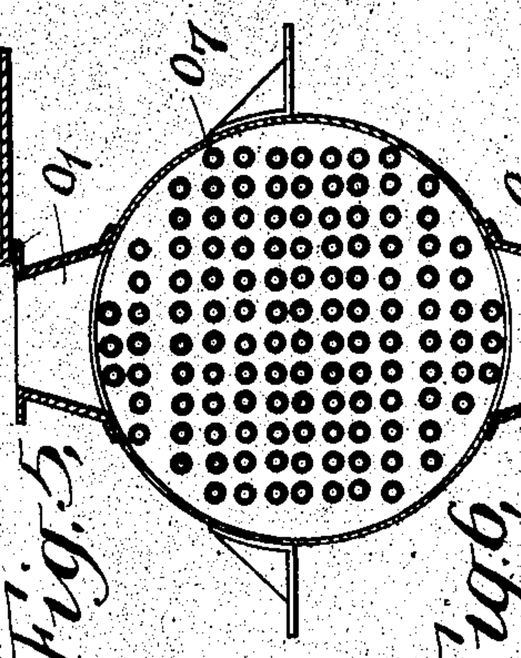


Fig. 3.

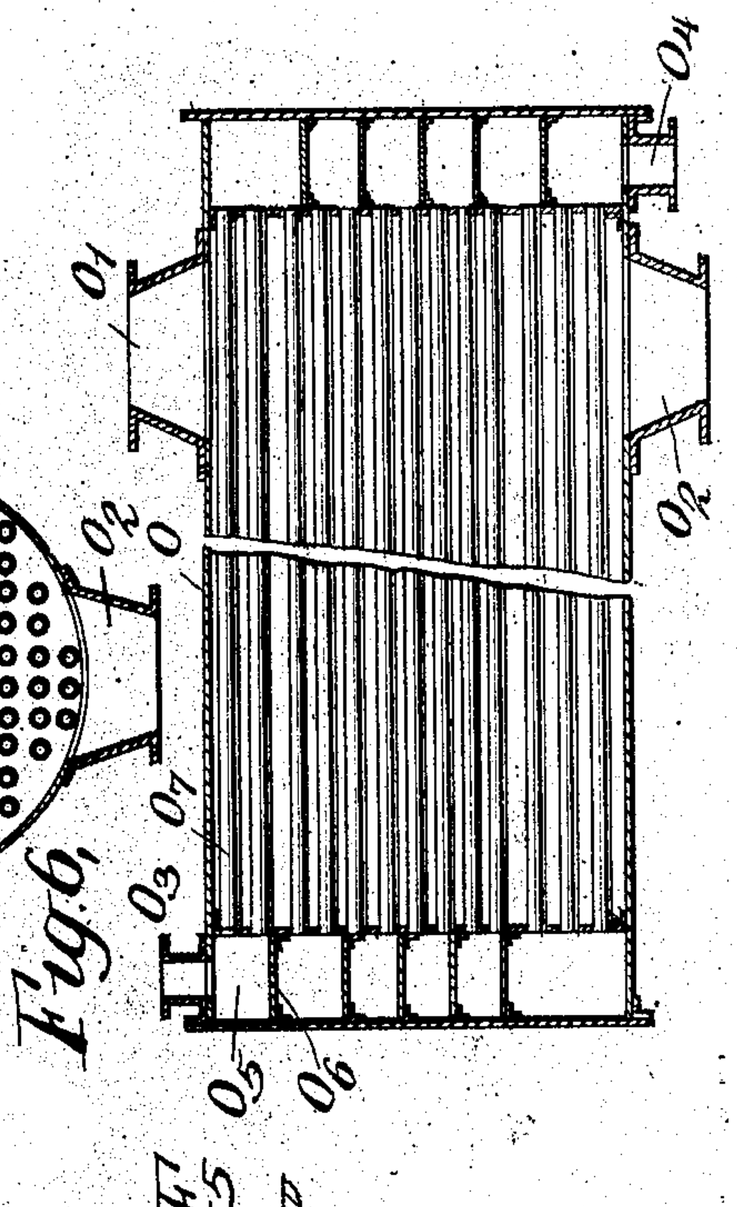
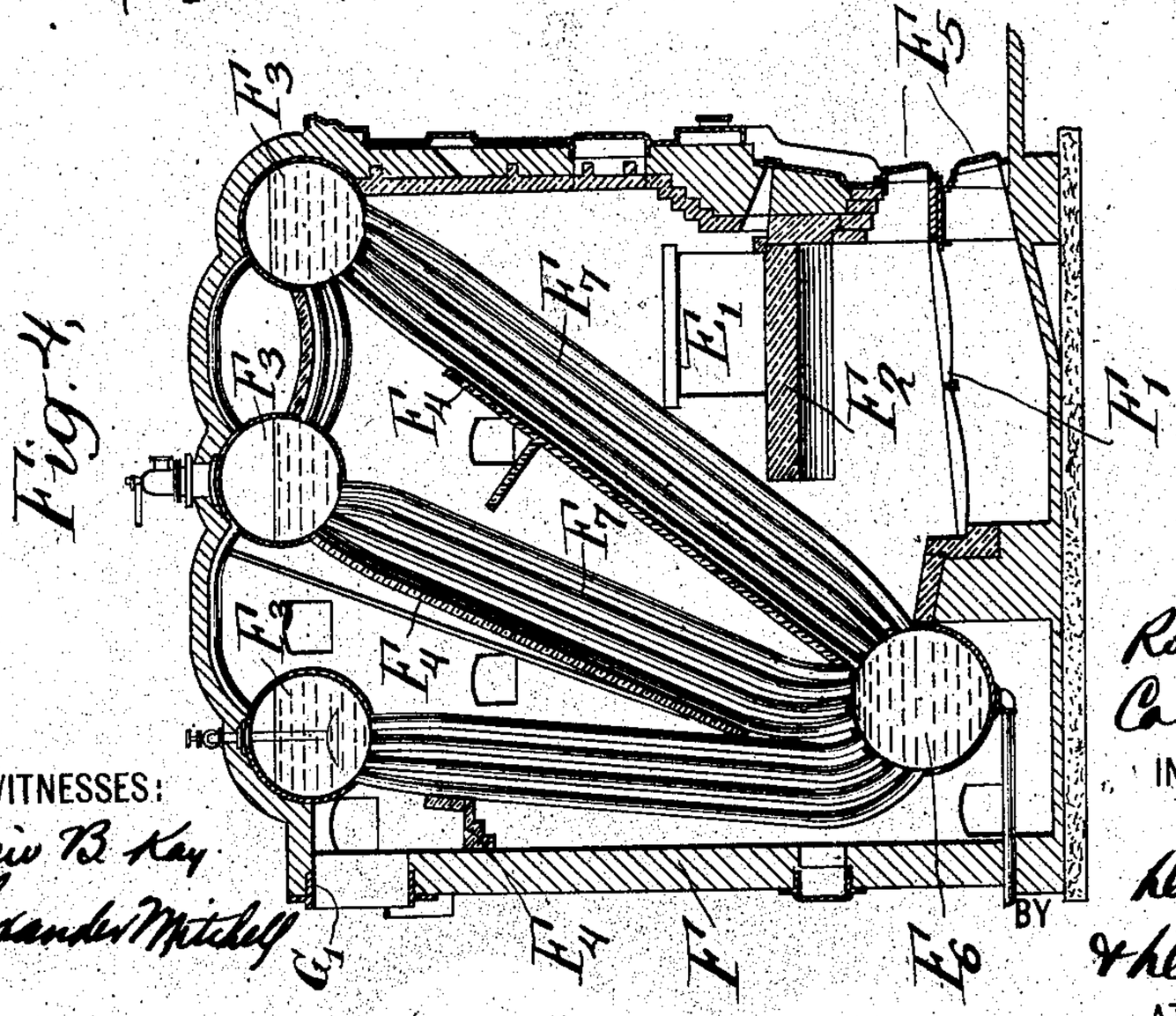


Fig. 4.



WITNESSES:

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APPARATUS FOR MAKING CEMENT.

No. 815,680. Specification of Letters Patent. Patented March 20, 1906.

Application filed October 17, 1902. Serial No. 127,647.

To all whom it may concern:

Be it known that I, ROLLA C. CARPENTER, a citizen of the United States, and a resident of Ithaca, in the county of Tompkins, State of New York, have invented certain new and useful Apparatus for Making Cement, of which the following is a specification, taken in connection with the accompanying drawings, forming part of the same.

This invention relates to apparatus for making cement, and is especially applicable to the making of cement by the rotary process.

In the accompanying drawings, in which the same reference character refers to similar parts in the several figures, Figure 1 is a plan view showing an embodiment of this invention. Fig. 2 is a partial vertical sectional view of the same. Fig. 3 is a similar sectional view showing another portion of the apparatus. Fig. 4 is a sectional view of the boiler and mountings. Fig. 5 is a transverse sectional view of the cement-heater. Fig. 6 is a longitudinal sectional view of the same. Fig. 7 is a detail showing the method of heating the kilns.

In this apparatus two rotary kilns A are indicated, coöperating with suitable clinker-cooling apparatus, and in conjunction with these kilns two rotary driers H are employed, the gases from the kilns serving to heat these driers after passing through a suitable boiler F. It is understood, however, that any desired number of kilns may be employed coöperating with a corresponding equipment of driers and other auxiliary apparatus.

As indicated in Fig. 2, the rotary kiln A is mounted so as to be rotated as desired by suitable driving mechanism A^2, which coöperates with the gear A′, secured to the kiln. As is indicated, this kiln is formed with a constricted upper portion A^3, although it may be made cylindrical, if desired. This kiln is mounted in any suitable way so that its lower end makes a substantially tight joint with the casing C, while its upper end fits within a similar casing, so as to make a substantially tight joint therewith. The casing C, in which the burners B B′ are mounted, terminates in the chute C′, which leads the clinker from the lower end of the kiln into the lower end of this chute, where it is engaged by the endless conveyer C^3, preferably consisting of an endless chain running over suitable pulleys C^4 and provided with buckets to carry this clinker up through the inclosed conveyer-casing C^2. The clinker, as is indicated in Fig. 2, drops from the conveyer upon the staggered slides D^2, arranged, as indicated, in the cooling-tower D′ of the clinker-cooler D. This clinker-cooler is supplied with air from the fan D^4, which forces air into the cooler through the pipe D^3 and causes it to circulate in proximity to the hot clinker, so as to be heated thereby. The temperature of this air for supplying combustion in the kiln increases as it passes down the casing C^2 and up the clinker-chute C′, so that it is highly heated as it enters the kiln A. It is of course understood that this particular means of heating the air need not be employed under all conditions, although it is desirable that the air for combustion be supplied to the kiln in a heated condition and under forced draft.

The means for heating the kiln is indicated in detail in Fig. 7, which is a partial axial section through the kiln and adjacent parts. The fuel, which is preferably powdered coal or similar material fed forward in a blast of air, is supplied through the pipe B^3, and this pipe communicates, by means of the flexible joints B^2, with the two burner-tubes B B′, which enter the casing C, as indicated. These burners are through suitable mechanism adjustably mounted in the casing, so that the position of the flame within the kiln may be adjusted as desired to supply heat to any part of the kiln, although it is understood that other means of supplying the fuel and of heating the kiln may be used in some cases.

The highly-heated gases which issue from the upper end of each of the kilns are directed into the passages E, which communicate at the point E′ with a boiler, as indicated, the heat of these gases being utilized in this way. As is shown in the drawings, this boiler may be constructed with the water-drum F^6, communicating with the steam-drums F^3 by means of the water-tubes F^7. Suitable bridge-walls or partitions of refractory material F^4 are formed within the boiler-housing F, so as to direct the heated gases in a zigzag manner through the tubes to thoroughly heat the same. This boiler is also preferably provided with an auxiliary furnace. As indicated, the grate F′ is formed directly under the combustion-arch F^2, so that a substantially inclosed combustion-chamber is formed, within which the complete combustion of fuel upon the grate may take place without interference from the spent kiln-gases entering through the aper-

ture E′ above the combustion-arch. Suitable doors F^5 are formed in the housing for firing the furnace, and cleaning-apertures are provided as desired throughout the boiler-housing to thoroughly clean the boiler from time to time as necessary.

The gases issuing from the boiler pass out the aperture G′ and into the flue G, which conducts them by means of the transverse passages G^2, into the hood G^3 at the lower end of each of the rotary driers H, these driers of ordinary construction being provided with the usual longitudinal stirring-ribs H′. These driers are mounted in the inclined position (indicated in Fig. 3) and are suitably rotated by any desired means, the driers forming substantially tight joints with the various casings with which they communicate. The cement material may be fed into the driers in a substantially liquid condition by the pipes H^3, and the dried material falling from the lower end of the driers may be removed from the housings by the screw conveyers H^2. (Indicated.) An auxiliary drying-furnace is preferably provided to furnish additional heat to each of the rotary driers. This furnace, mounted in a suitable housing K, comprises the grate K′, there being suitable firing-doors K^4 to supply fuel for combustion upon the grate and below the combustion-arch K^2. The bridge-wall K^5 indicated directs the gases in a circuitous route about the rotary drier and into the passage G^4, which communicates with the housing G^3, as indicated, so that these gases after heating the drier by passing around the outside of the same, as described, pass together with the kiln-gases through this drier. The gases from the drier are preferably received in the hood L^3 and are led therefrom by the passage L^4 into the inlet L^2 of the fan L′, by which they are forced out through the stack L of any desired construction. It is of course understood that the passages and auxiliary apparatus through which the kiln-gases circulate are so proportioned that any dust that may be deposited from the kiln-gases may be readily removed from time to time and so that it does not interfere with the operation of the apparatus.

In order to warm the cement material and economize the fuel required to dry the same, it is desirable in some instances to employ the cement-heater O, which may be constructed as is indicated in detail in Figs. 5 and 6. This heater is substantially a surface condenser, in which the cement material, preferably in a substantially liquid condition, circulates through the tubes O^7 within the heater-shell O. The cement material, which is forced into the inlet O^3 within the head O^5, is directed across through the tubes by the transverse division-plates O^6 within the heads at either end of the heater, so as to circulate in a zigzag manner through the condenser, emerging at the outlet O^4, which communicates with the pipes H^3 to convey this material to the driers. The cement material is heated within this device by steam, which may be conveniently supplied from the exhaust of the engines operating the plant and which may be operated by steam from the boiler indicated. This steam enters the steam-inlet O′, and coming in contact with the outside of the tubes is condensed thereon, as in an ordinary surface condenser, the condensed water issuing from the outlet O^2. As is indicated in Fig. 5, the spacing of the tubes is such that substantially the same number of tubes is available for the cement material in each passage from head to head of the heater, so that the material circulates throughout the heater at substantially the same rate, preventing undue deposition of this material within the heater.

It is of course understood that many modifications may be made in this apparatus by those familiar with this art without departfrom the spirit of this invention.

Some of the parts of this apparatus may be omitted, if desired, and other parts may be substituted for parts described herein without losing the advantages derived from this invention. I do not, therefore, desire to be limited to the disclosure which has been made in this case; but

What I claim as new, and what I desire to secure by Letters Patent, is set forth in the appended claims.

1. In cement apparatus, a rotary kiln, a clinker-cooler adjacent said kiln, means to convey the clinker from said kiln to said cooler, a supply-fan to force air into said clinker-cooler to be heated therein and to force said air into said kiln, a boiler mounted adjacent said kiln, means to conduct the kiln-gases through said boiler, a rotary drier, a drier-furnace to heat said drier and means to conduct the gases from said furnace around said drier and then through the same and means to conduct kiln-gases from said boiler through said drier.

2. In cement apparatus, a rotary kiln, means to heat air from the clinker from said kiln and to force said heated air into said kiln to support combustion therein, means to heat said kiln, a boiler mounted adjacent said kiln to receive the kiln-gases therefrom, a rotary drier provided with a drier-furnace and means to conduct the kiln-gases from said boiler through said drier.

3. In cement apparatus, a rotary kiln, a clinker-cooler mounted adjacent said kiln, means to force air through said clinker-cooler and into said kiln, means to heat said kiln, a rotary drier mounted adjacent said kiln, a drier-furnace for said drier and means to conduct the kiln-gases from said kiln through said drier.

4. In cement apparatus, a rotary kiln, a

clinker-cooler adjacent said kiln to receive clinker therefrom, means to force air through said clinker-cooler and into said kiln, means to heat said kiln, a boiler adjacent said kiln to receive kiln-gases therefrom, a drier adjacent said boiler, a drier-furnace for said drier, means to direct gases from said drier-furnace through said drier and means to conduct the kiln-gases from said boiler through said drier.

5. In cement apparatus, a rotary kiln a clinker-cooler adjacent said kiln, means to force air through said clinker-cooler and into said kiln, means to heat said kiln, a boiler and a drier adjacent said kiln and means to direct kiln-gases through said boiler and drier.

6. In cement apparatus, a rotary kiln, means to heat said kiln, a rotary drier, a drier-furnace, means to direct the heated gases from said drier-furnace around said drier and then through the same, means to direct the kiln-gases through said drier and means to regulate the movement of said gases.

7. In cement apparatus, a rotary kiln, a rotary drier provided with a drier-furnace adjacent said kiln, means to direct the gases from said drier-furnace through said drier, means to direct the kiln-gases through said drier and means to regulate the movement of said gases.

8. In cement apparatus, a rotary kiln, means to heat said kiln, a drier, a drier-furnace, means to direct the gases from said drier-furnace through said drier, means to direct the kiln-gases through said drier and means to regulate the movement of said gases.

9. In cement apparatus, a rotary kiln, means to heat said kiln, a drier, a drier-furnace, means to direct the gases from said drier-furnace through said drier, and means to direct the kiln-gases through said drier.

10. In cement apparatus, a kiln, a rotary drier, a drier-furnace, means to direct the gases from said drier-furnace around and through said drier and passages connected with said kiln to direct kiln-gases through said drier.

11. In cement apparatus, a cement-heater to heat substantially liquid cement by heated vapors, a drier to receive said cement from said heater, a drier-furnace and means to direct the gases from said drier-furnace through said drier.

12. In cement apparatus, a cement-heater having heating-tubes to heat by means of heated vapors substantially liquid cement passing through said tubes, and a drier to receive said cement from said heater.

13. In cement apparatus, a rotary kiln, a multiple burner to supply fuel to said kiln, a clinker-cooler adjacent said kiln, an inclosed chain conveyer to supply clinker to said cooler from said kiln and a fan to force air through said cooler and conveyer into said kiln.

14. In cement apparatus, a rotary kiln, a casing inclosing the mouth of said kiln, a burner to heat said kiln, a clinker-chute connected to said casing, a clinker-cooler mounted adjacent said chute, a conveyer working in a closed casing to convey clinker from said clinker-chute to the top of said clinker-cooler, and a supply-fan connected to said cooler to force heated air into said kiln to supply combustion therein.

15. In cement apparatus, a cement-kiln, a burner to heat said kiln, a clinker-cooler, inclosed means to convey cement-clinker from said kiln to said cooler, means to force air for combustion into said cooler and thence into said kiln, a water-tube boiler mounted adjacent said kiln, an auxiliary furnace for said boiler and means to convey the kiln-gases through said boiler.

16. In cement apparatus, a rotary kiln, a burner to heat said kiln, inclosed means to receive the clinker from the mouth of said kiln and to cool the same, a fan to force air into said means to heat said air before it enters said kiln, a boiler mounted adjacent said kiln and means to pass the kiln-gases through said boiler.

17. In cement apparatus, a kiln, means to heat said kiln, a casing inclosing the mouth of said kiln, a clinker-chute connected to said casing, a clinker-cooler mounted adjacent said kiln, a tower connected to said clinker-cooler provided with staggered slides, means to admit air to said clinker-cooler adjacent said tower and and inclosed conveyer to carry clinker from said clinker-chute to the top of said tower.

18. In cement apparatus, a rotary kiln, means to heat said kiln, a clinker-cooler adjacent said kiln, an inclosed chain conveyer to supply clinker to said cooler from said kiln and means to cause a circulation of air through said cooler and conveyer into said kiln.

19. In cement apparatus, a cement-heater having heating-tubes to heat by means of heated vapors substantially liquid cement passing through said tubes and a rotary cylinder to receive said cement from said heater.

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