E. SCHMATOLLA.

SHAFT KILN WITH GENERATOR GAS FIRING.

APPLICATION FILED FEB. 25, 1907.

**917,667.**

Patented Apr. 6, 1909.

5 SHEETS—SHEET 1.

*Fig. 1.*

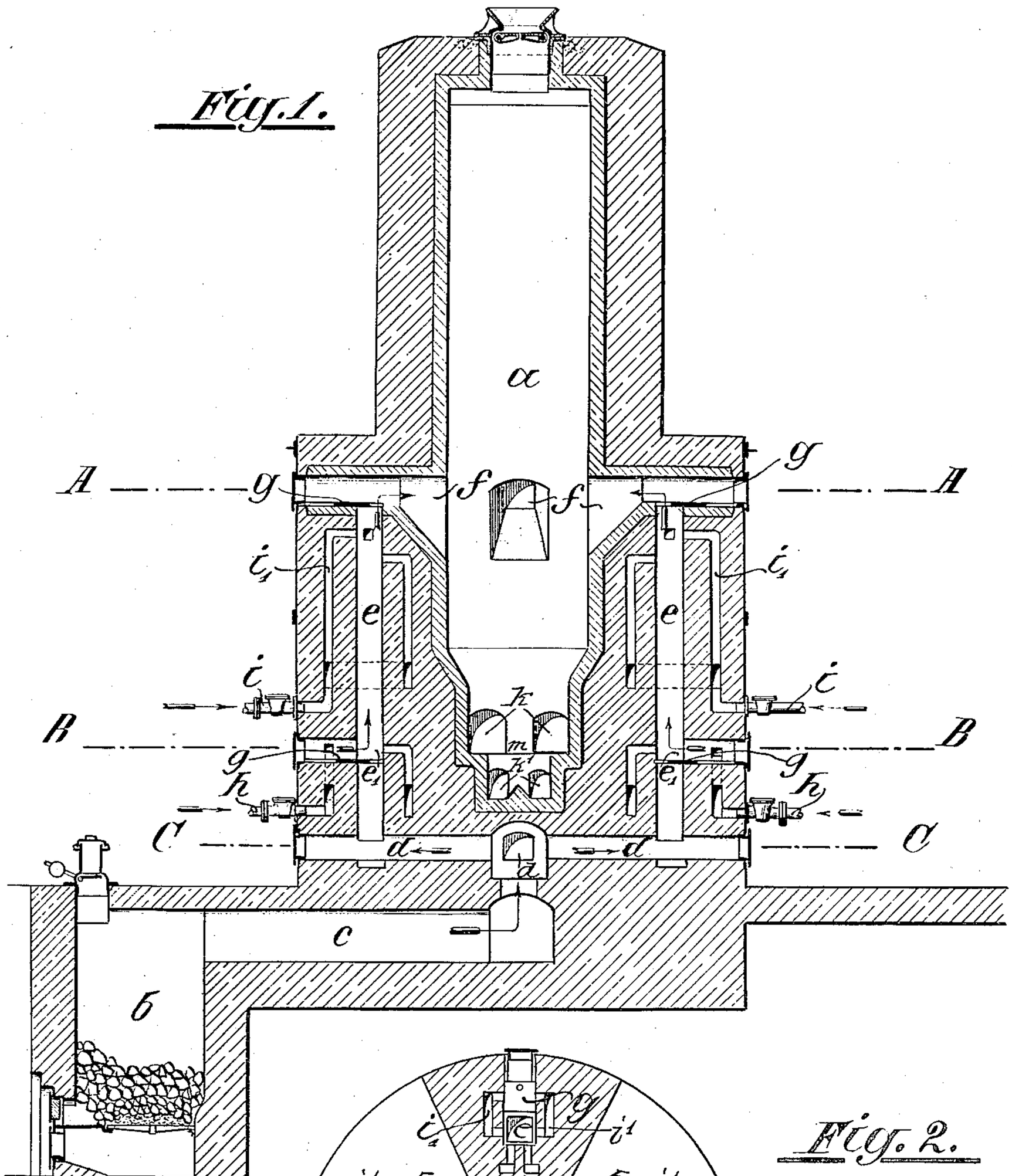


*Fig. 2.*

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5 SHEETS—SHEET 2.

*Fig. 4.*

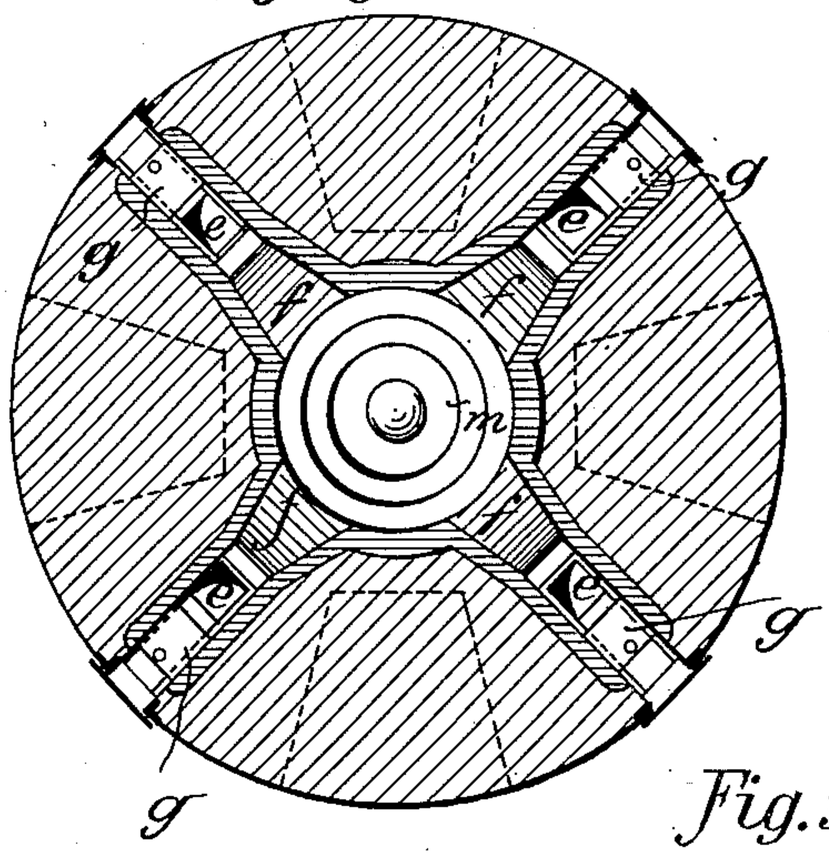



*Fig. 5.*

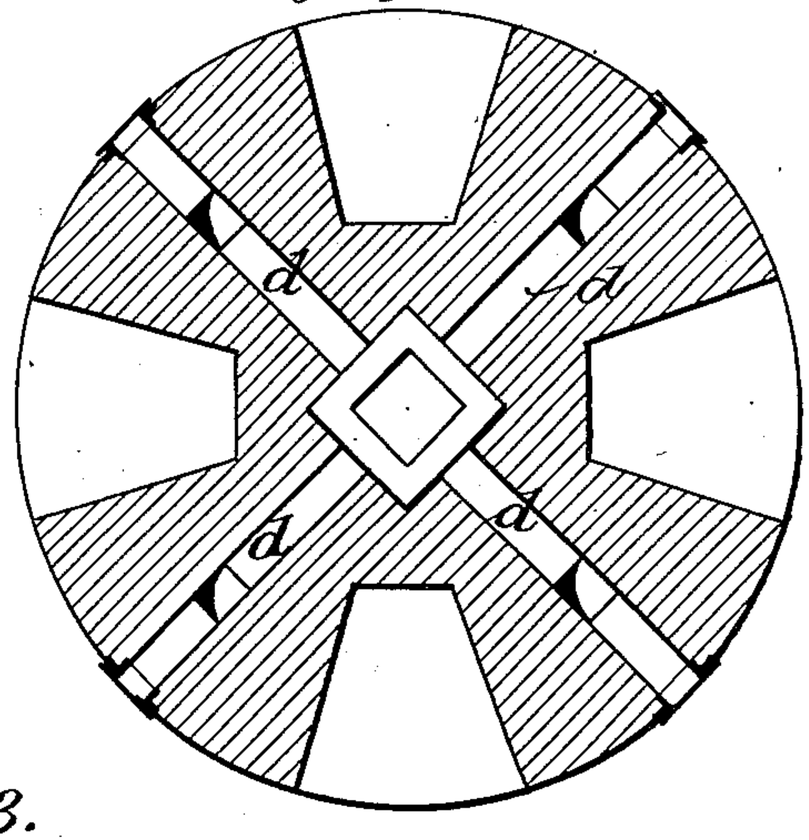
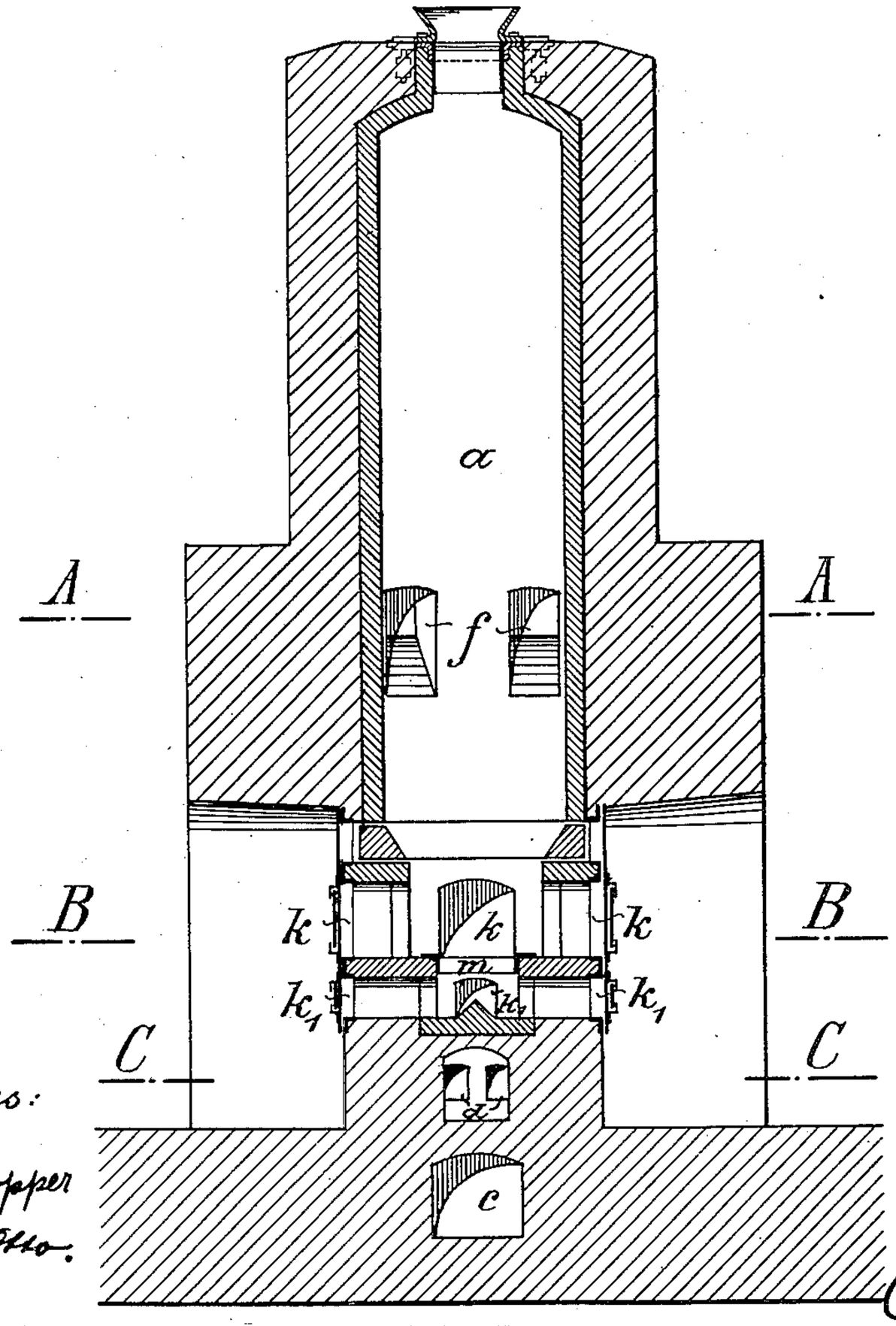



*Fig. 3.*




Witnesses:

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5 SHEETS—SHEET 3.

*Fig. 6.*

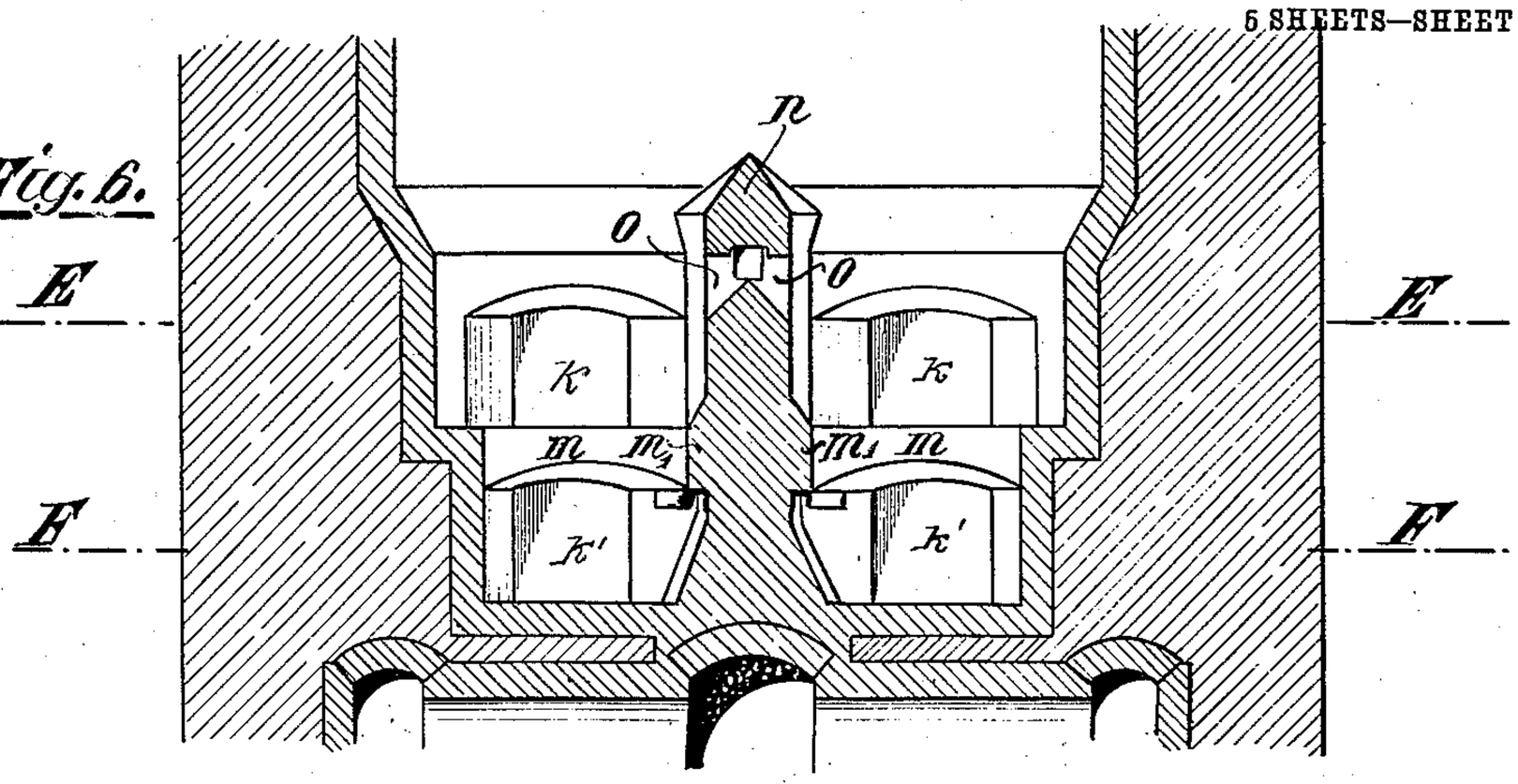



*Fig. 7.*

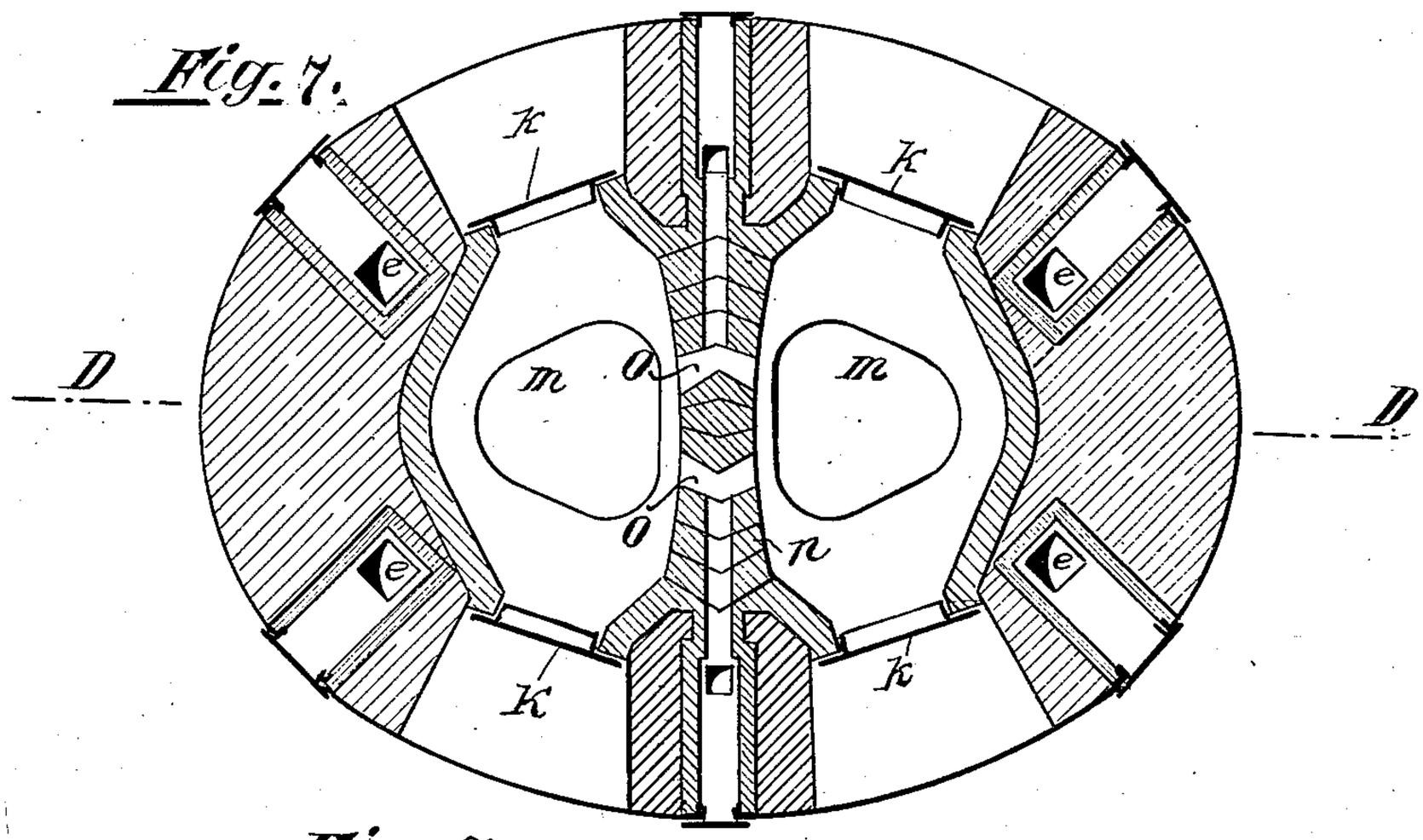
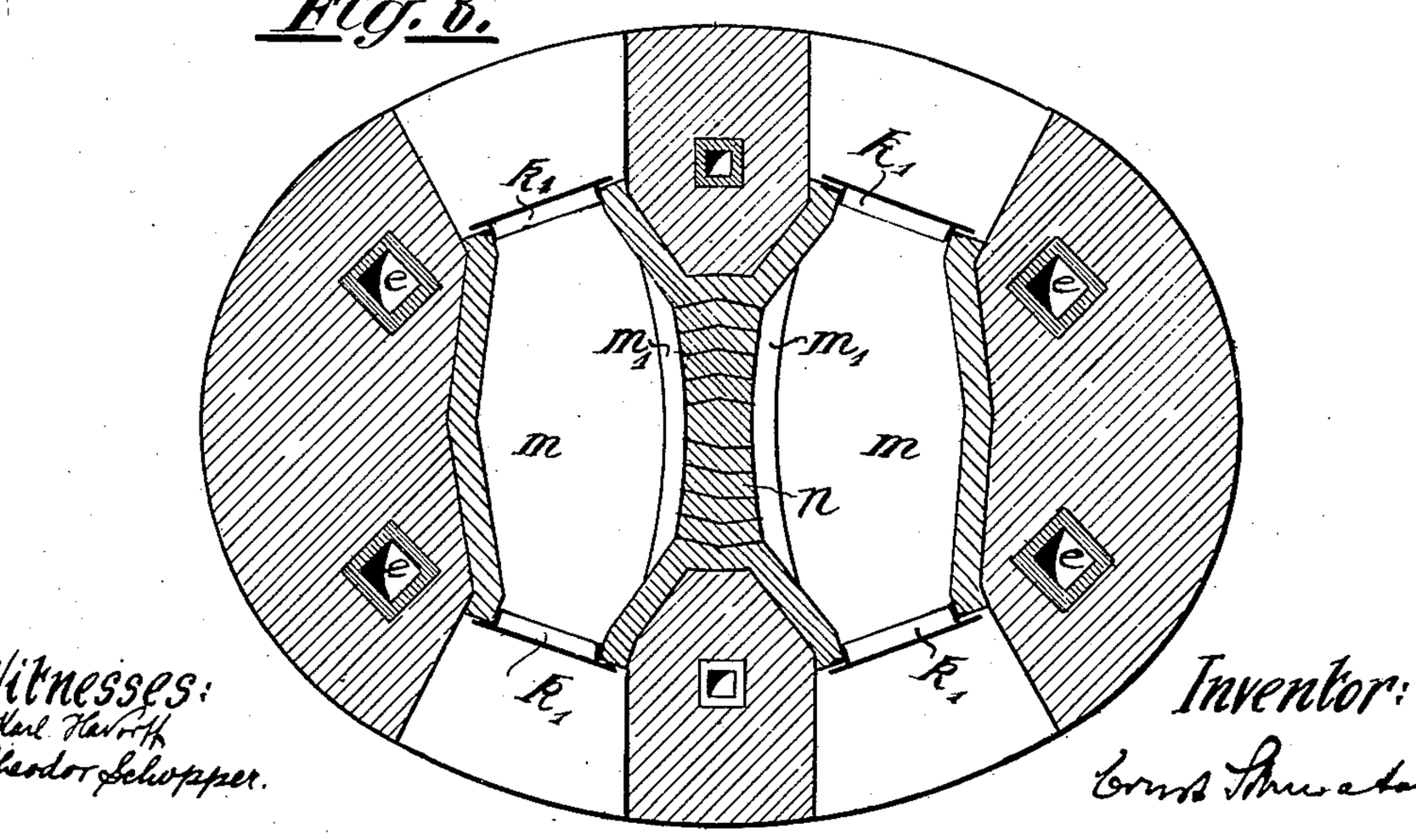



*Fig. 8.*

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5 SHEETS—SHEET 4.

*Fig. 10.*

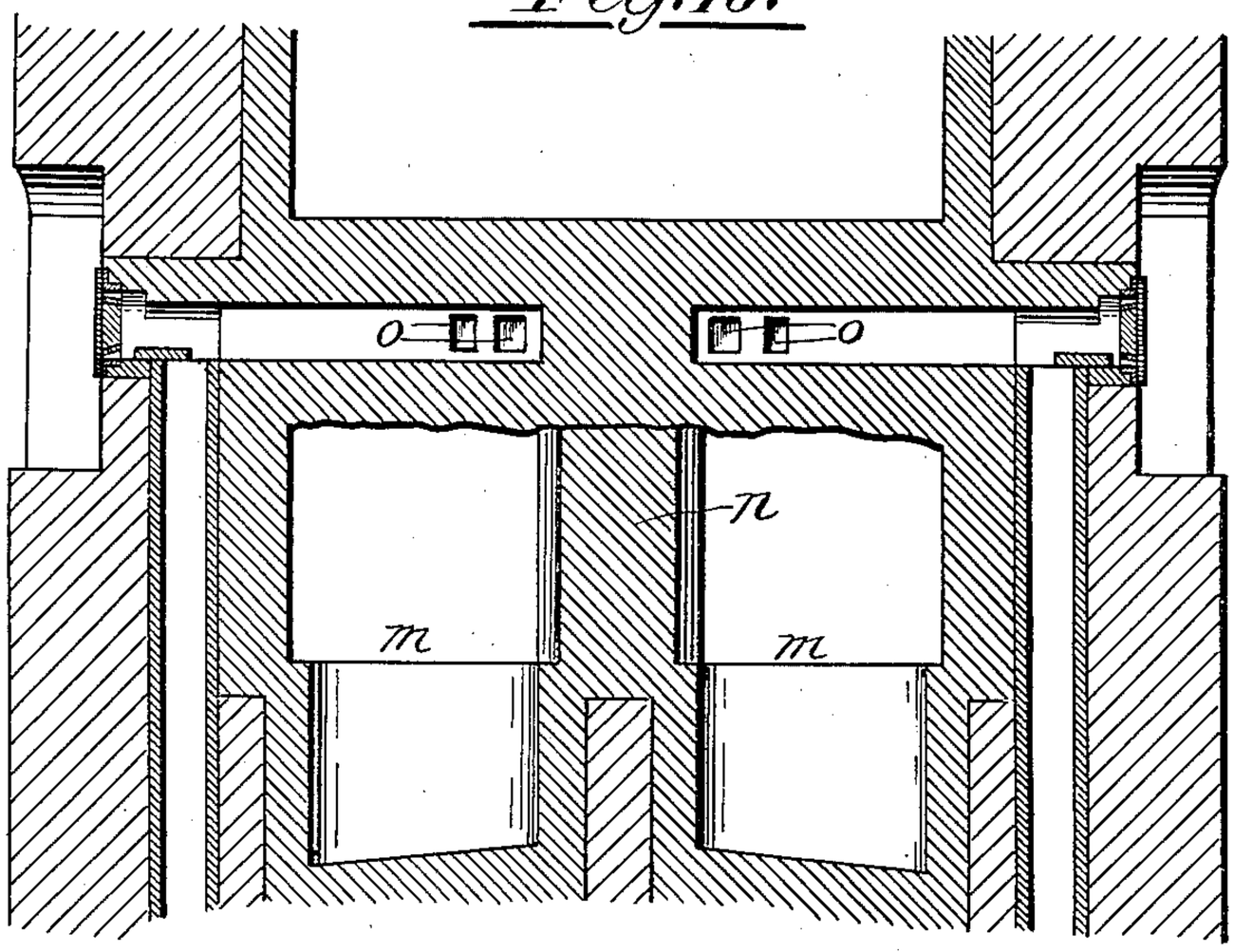
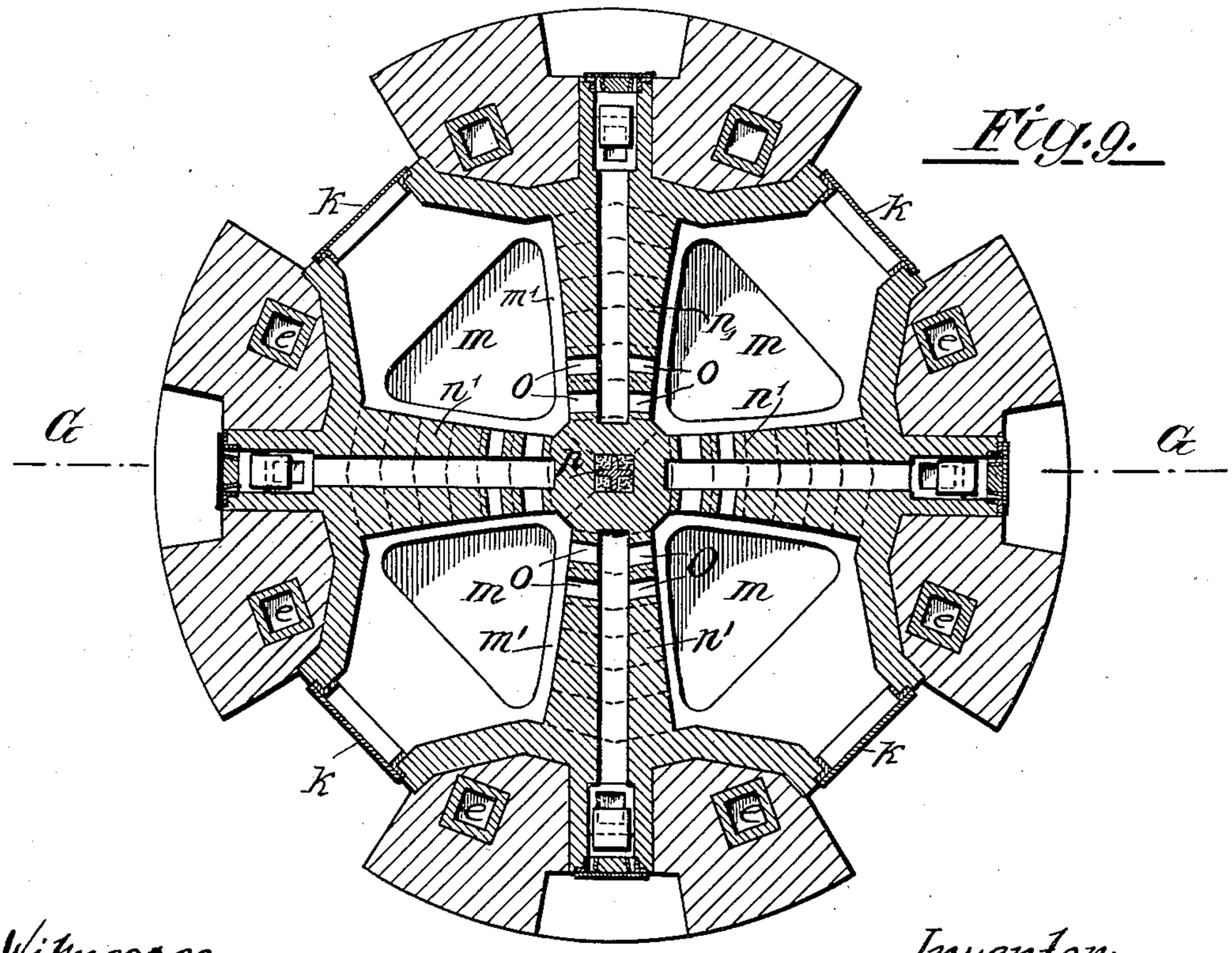



*Fig. 9.*

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5 SHEETS—SHEET 5.

*Fig. 11.*

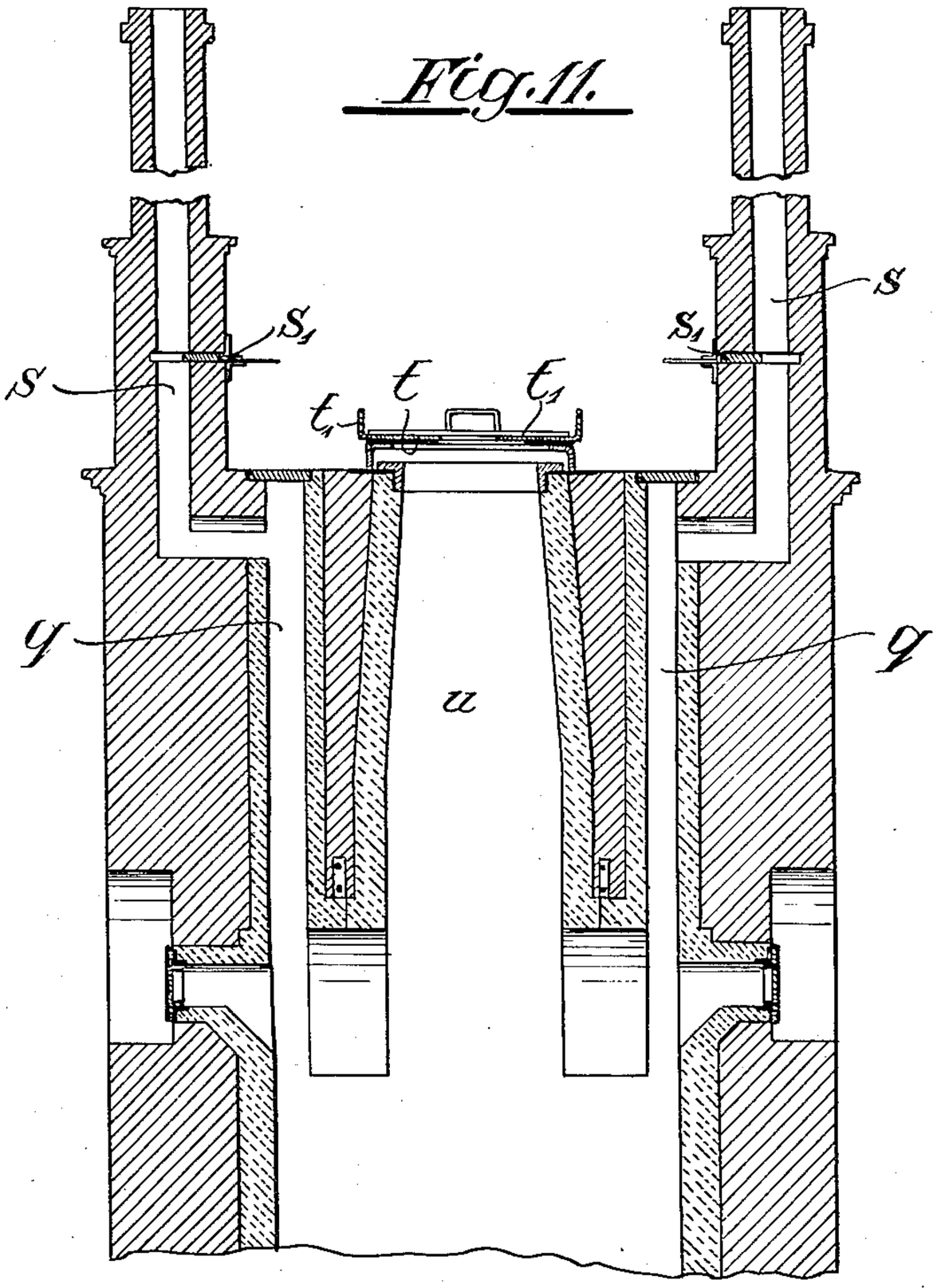
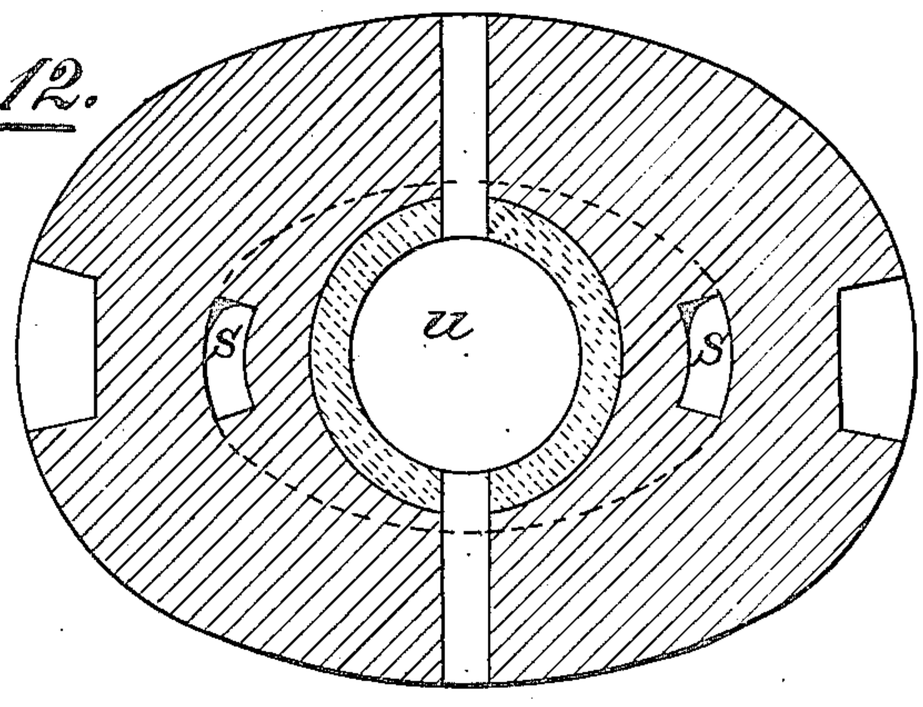



*Fig. 12.*




Witnesses:
Karl Hasbach
Theodor Schlosser

Inventor:
Ernst Schmatolla

# UNITED STATES PATENT OFFICE.

ERNST SCHMATOLLA, OF BERLIN, GERMANY.

## SHAFT-KILN WITH GENERATOR-GAS FIRING.

No. 917,667. Specification of Letters Patent. Patented April 6, 1909.

Application filed February 25, 1907. Serial No. 359,217.

*To all whom it may concern:*

Be it known that I, ERNST SCHMATOLLA, mining engineer, a citizen of Germany, residing at 22 Halleschestrasse, Berlin, S. W., in the Kingdom of Prussia, have invented new and useful Improvements in Shaft-Kilns with Generator-Gas Firing for Burning Lime, Dolomite, Magnesite, Cement, and other Materials, of which the following is a specification.

The present invention relates to gas-kilns and an important object is to provide a gas-kiln in which producer-gas and air are supplied in a novel manner on the one hand, and in which the kiln-gases are conducted away in a special manner on the other hand, whereby complete combustion of the producer-gas in the kiln, equal distribution of the fire over the whole section of the shaft and complete utilization of the heat in the kiln are obtained.

In order that the invention may be clearly understood reference is made to the accompanying drawings in which several embodiments are represented by way of example and in which:

Figure 1 is a vertical sectional elevation showing the general construction of the kiln, the connection with the gas-producer being shown. Fig. 2 is a horizontal section on the line B—B of Fig. 1, through the discharge outlets of the shaft-kiln. Fig. 3 is a vertical section of the kiln in a plane at right angles to Fig. 1. Fig. 4 a horizontal section in the plane A—A in Fig. 1 and Fig. 5 a horizontal section in the plane C—C in Fig. 1. Figs. 6, 7, and 8 show a modification in which the section of the shaft is oval to allow of greater production. A device has been provided by means of which the producer gas may be introduced not only through the walls, but also through the center of the shaft. This modification is shown in Fig. 6 in vertical section in the plane D—D in Fig. 7, in Fig. 7 in horizontal section in the plane E—E in Fig. 6, and in Fig. 8 in horizontal section in the plane F—F in Fig. 6. Figs. 9 and 10 show another modification which is a further development of the modification shown in Figs. 6 to 8. This modification is also for a shaft-kiln with producer-gas firing for high production, but the section of the shaft is circular. Fig. 9 is a horizontal section of this modification corresponding to the horizontal section in Fig. 7, whereas Fig. 10 is a vertical section in the plane G—G in Fig. 9. Fig. 11 is another modification showing the upper part of a kiln of oval section providing means for conducting away the gases from the kiln in a modified manner, and Fig. 12 is a section in the plane H—H in Fig 11.

Referring to the drawing, the kiln shown in Figs. 1 to 5 principally consists of the shaft *a*, which will be continually full of the material to be burned, and the producer *b*. The producer-gas passes through the gas flue or channel *c* to below the center of the shaft and thence through branch flues *d* and vertical flues *e* and through the openings *f* into the interior of the shaft. Above the vertical flues or channels *e* there are arranged dampers *g* for accurately distributing the producer-gas and for regulating its admission to the burning shaft or chamber. The producer-gas has of course a strong tendency to rise in the vertical channels *e*. The peculiar arrangement of these vertical channels makes it possible to mix air with the producer-gas at two points one above the other within the vertical channels, in order to give the flame a temperature which is the most advantageous for the process employed. If, for example, the quantity of air necessary for the combustion of the producer-gas is first of all introduced at $e^1$ from the pipes *h*, the producer-gas will be completely burned in the vertical channel below the slides $g^1$. If air then is again admitted from pipes *i* below the slides *g*, or even above the latter, it is impossible to lower the temperature of the fire to a certain degree of temperature and this is very important, when burning plaster or stones which only stand a somewhat low temperature. Moreover, losses of heat by radiation from the vertical channels *e* may be avoided by surrounding the latter with the air channels *i'*. It will generally be possible, for example, when white-lime is to be burned, to do away with the admission of air through the vertical gas-flues *i'*, since it is preferable in such cases to burn the producer-gas within the shaft in the spaces between the pieces of material to be burned.

The air necessary for the combustion of the producer-gas is supplied to the kiln in a peculiar and novel manner. It is supplied through the cooling shaft *i. e.* that part of

the shaft which is situated below the gas-inlets. At the lowest end of the cooling shaft there are discharge-doors *k* arranged provided with slides for regulating the admission of air. Above these discharge-doors the shaft is contracted as may be seen from the drawing. Air is not admitted through the discharge-doors *k* however, but through discharge-doors *k'* which are situated below the discharge-doors *k*. The discharge-doors *k* lead to a lower continuation *m* of the cooling-shaft. The diameter of this continuation is, however, considerably smaller than the diameter of the cooling shaft above the upper discharge-doors. In this manner the air introduced through the lower doors *k'* is admitted near the innermost or central part of the shaft on the one hand, and it is possible to withdraw the lime or other material from the center and to avoid the formation of cones of cinders on the other hand. By this means it is possible to bring about an equal distribution of air over the cross-section of the shaft, and to introduce more air in the center and less near the walls of the shaft as desired, in order to prevent these walls being too much affected by the fire. In connection with this it may be remarked that one of the drawbacks of the older shaft-kilns for producer-gas firing is that the fire-brick lining is too quickly destroyed in the burning-zone, because combustion takes place chiefly close to the walls, whereas the fire is more or less prevented from reaching the center of the shaft. This necessitates the cross-section of the kiln being made relatively small, whereas the present invention makes it possible to construct shaft-kilns for producer-gas firing with a considerably greater cross-section and to thereby increase production.

Means for raising the production to a still higher degree are shown in Figs. 6, 7, 8, 9, and 10.

In the modification shown in Figs. 6, 7 and 8 the lower part of the cooling-shaft is divided into two parts by means of a bridge *n* which is sloped like a roof. The lower continuation *m* of the cooling-shaft is accordingly divided into two parts *m*—*m*. The latter are accessible through the lower discharge-door *k'*. The bridge *n* is provided with gas-supply channels or flues *o*. The air necessary for the combustion of the producer-gas flowing in through said flues *o* is chiefly admitted either through the lower discharge-doors *k'* or the lower continuation of the cooling-shaft, a shoulder *m'* of the wall preventing the air from rising directly along the walls of the bridge *n*. The material burned by the producer-gas supplied at the center of the shaft is chiefly withdrawn in a cooled condition through the pit *m* and the lower discharge-doors *k*. One feature of the invention therefore not only consists in the arrangements of the channels in the bridge, but also in the combination of the bridge containing the gas-supply flues with the lower continuations *m* of the cooling-shaft, whereby, as will be readily understood, peculiar effects are produced. As may be seen from Figs. 7 and 8, the bridge is built of specially shaped pieces forming vaults, whereby the bridge *n* is prevented from collapsing.

The modification of the invention shown in Figs. 9 and 10 only substantially differs from that shown in Figs. 6—8 in that, instead of one bridge serving for admitting gas, two bridges *n* are arranged crossing each other, whereby instead of two lower continuations *m* of the cooling-shaft, four are formed. The core *p* being common to the four bridges may serve for receiving an outer stiffening.

Figs. 11 and 12 show one constructional form of the charging device for use in connection with shaft-kilns with producer-gas firing according to the present invention. The charging device is particularly for use in such cases where materials are to be burned that burst or fall to pieces when suddenly heated, as *e. g.* some cement-stones and clay-lumps. The improvement consists substantially in the arrangement of a preliminary heating-shaft in connection with a peculiar device for carrying off the kiln gases. By this means it is attained that, after a fresh charge has been supplied the kiln-gases only partially pass through the fresh material or do not pass through it at all since they are led off through lateral channels *q* and chimney *s*. After the stones have become hot the dampers or slides *s'* of the chimneys are entirely or partly closed, and instead of them slides *t'* over the cover *t* are opened gradually, until finally all the kiln-gases go through preliminary heating-shaft *u*. The construction may also be such that the upper part of the shaft is divided into single sections serving alternately for charging fresh material and for carrying off the kiln-gases.

Having thus described my invention what I claim is:

1. In a shaft-kiln with producer-gas firing the combination of the shaft (*a*) with the upper discharging-doors (*k*) and a contracted part of the shaft lying above said upper discharging-doors and the lower discharging-doors (*k'*), and a second contracted part of the shaft arranged between said upper and lower discharging doors, as and for the purpose set forth and represented in the drawings.

2. In a shaft-kiln with producer-gas firing the combination of a shaft of oval cross-section with a cooling-shaft and a bridge dividing the lower part of said cooling-shaft and gas-supply flues arranged in said bridge,

and upper and lower discharge-doors supplying air to the gas streaming through the gas-flues of the bridge to the shaft and allowing to discharge the burned material through said lower discharge-doors, for the purpose set forth and represented in the accompanying drawings.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

ERNST SCHMATOLLA.

Witnesses:

WOLDEMAR HAUPT,

JOHN W. DYE.