

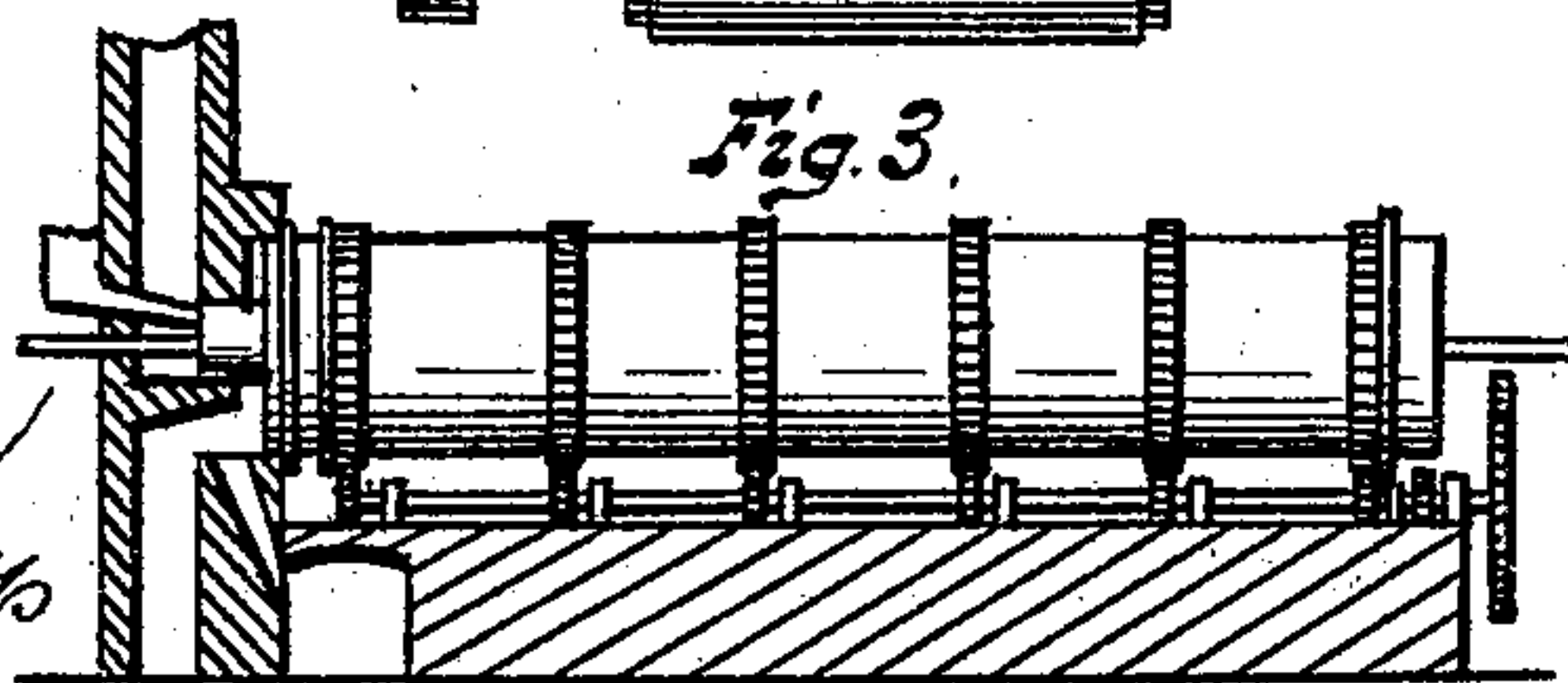
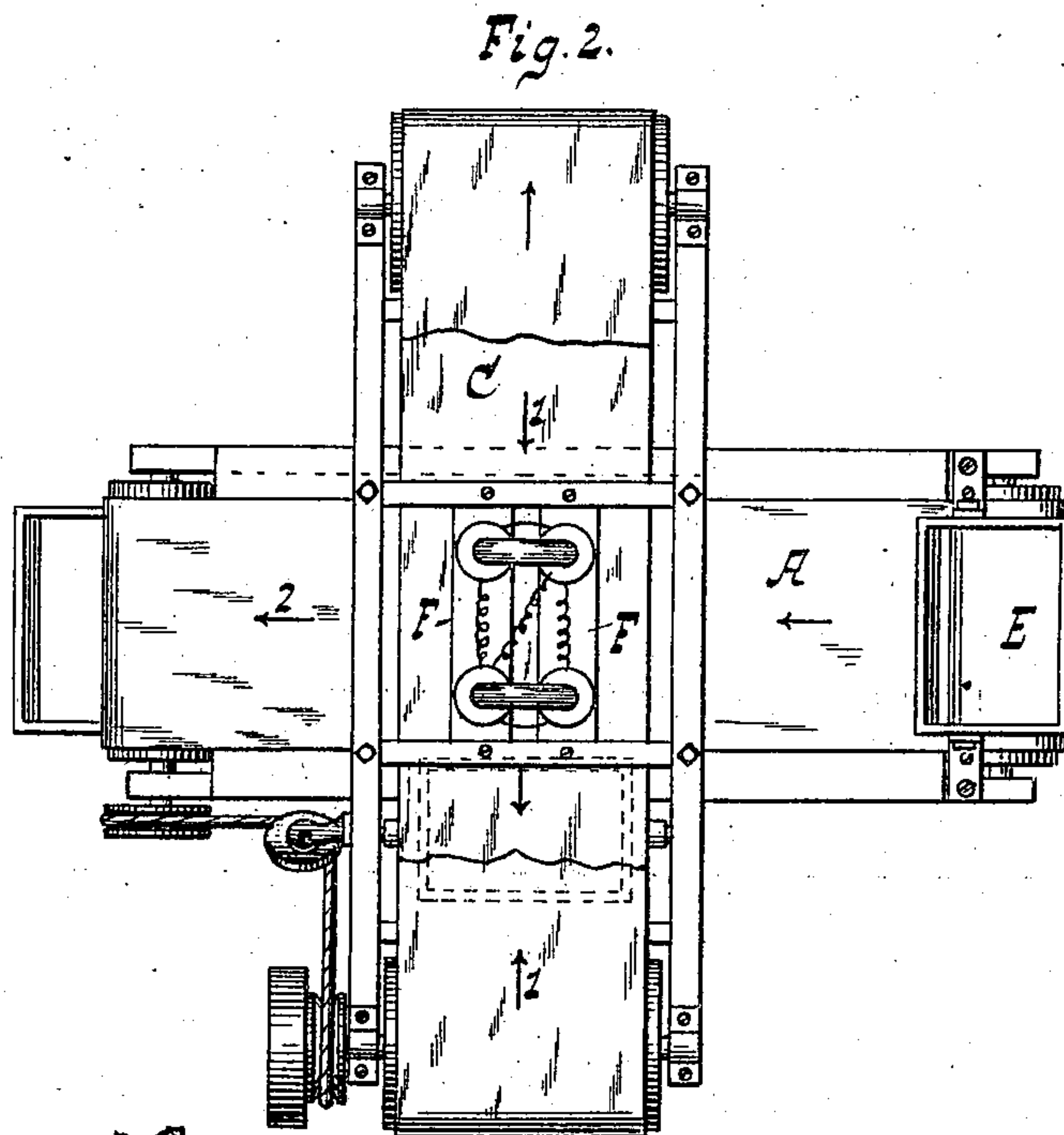
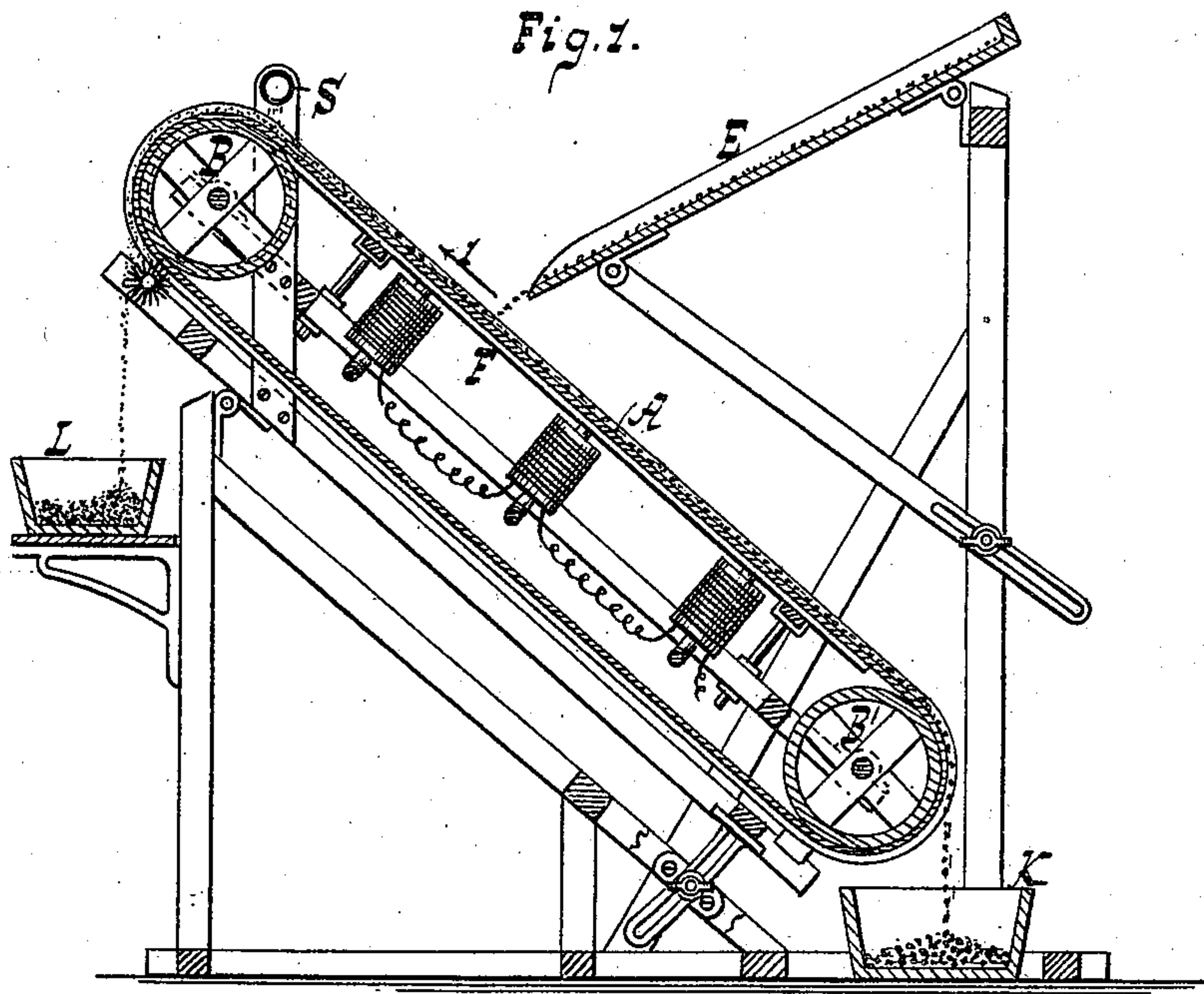
(No Model.)

G. CONKLING.

ART OF CONCENTRATING MAGNETIC IRON ORE.

No. 504,201.

Patented Aug. 29, 1893.



WITNESSES:
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UNITED STATES PATENT OFFICE.

GURDON CONKLING, OF GLENS FALLS, NEW YORK.

ART OF CONCENTRATING MAGNETIC IRON ORE.

SPECIFICATION forming part of Letters Patent No. 504,201, dated August 29, 1893.

Application filed January 16, 1893. Serial No. 458,546. (No model.)

To all whom it may concern:

Be it known that I, GURDON CONKLING, a citizen of the United States, residing at Glens Falls, in the county of Warren and State of New York, have invented new and useful Improvements in the Art of Concentrating Magnetic Iron Ore, of which the following is a specification.

The object of this invention is an improvement in the art of concentrating magnetic iron ore whereby a concentrate is obtained which is practically free from phosphorus or other impurities, the presence of which when exceeding one tenth of one per cent. would render the concentrate unfit for the manufacture of steel.

The apparatus which may be used in carrying out my invention, is illustrated in the accompanying drawings in which—

Figure 1, represents a longitudinal vertical section of a magnetic separator to be used when the comminuted ore is in a wet state. Fig. 2, is a plan or top view of a magnetic separator which may be used when the comminuted ore is in a dry state. Fig. 3 is a side elevation of an ore roasting furnace which can be used in carrying out one step of my new process.

After a very large number of experiments in concentrating iron ore which I have carried on during the last fifteen years, I have found that in order to obtain a high grade concentrate containing from sixty to seventy-two per cent. of metallic iron, it is necessary to crush the ore into a very fine state and then to expose the same to the action of magnets in a perfectly dry state. If the finely crushed mass is exposed to the action of magnets in a wet state, fine particles of gangue adhere to the iron particles which are attracted by the magnets and in the majority of cases the concentrate is rendered unfit for the manufacture of steel. I have also found that the entire bulk of the ore coming either out of the mines or from the dump or waste piles, contains from two to ten per cent. of moisture varying at times largely from atmospheric causes. To be concentrated under the ordinary process of dry concentration the usual course is either to crush the mass to the required fineness in a wet state and then to dry the finely crushed mass and expose it to the

action of magnets or the raw mass is dried first, then crushed to the required fineness and finally exposed to the action of magnets. In either case the entire bulk of the mass under treatment has to be dried which involves considerable expense in labor and fuel. In treating low grade ores this expense in many cases is so great that it exceeds the profit derived from the concentrate and many mines have been left idle on account of the great expense involved in concentrating the ore.

The object of my invention is to reduce the expense in labor and fuel to such an extent that not only mines yielding low grade ores can be worked with profit but also very high grade ores can be treated with the least possible expense so as to yield a concentrate practically free from gangue. For this purpose I proceed as follows: I first crush the ore in the wet state to a fineness of from one-fourth to one-sixteenth of an inch according to the natural granular formation of the ore to be treated and then expose the coarsely crushed mass, while in a wet state, to the action of magnets.

In carrying out this process an apparatus may be used such as illustrated in Fig. 1 of the drawings in which the letter A designates an endless belt which extends over rollers B and B' and is placed in an inclined position.

F is a magnet which is situated in the interior of the belt A close to its upper branch.

E is a trough over which the crushed ore mixed with water is fed to the belt A and S is a spray pipe for washing the particles of ore which are attracted by the magnet. The belt moves in the direction of arrow 1 and the particles which are attracted by the magnet are carried by the belt over the pulley B and they are collected in the receiver L. The particles which are not attracted by the magnet run down over the pulley B' and are collected in the receiver K. The mass which has been collected in the receiver L is composed of particles from a quarter of an inch down and many of the particles are composed of iron ore and gangue still attached or adhering to the same and in order to eliminate this gangue from the mass I submit the same while wet to a second crushing operation reducing the particles into a very fine state and then I dry the mass by preference under constant agitation so as to detach the particles of gangue which adhere

to the particles of iron ore as long as they are moist. For the purpose of drying the ore I can use an ordinary ore roasting furnace of well known construction such as illustrated in Fig. 3. After the mass has been thoroughly dried, I expose the same to the action of magnets. For this purpose I can use with advantage a machine such as shown in Fig. 2 of the drawings. This machine consists of a main belt A and a secondary belt B which extends at right angles over the main belt A and in the interior of which close to its lower branch are situated the magnets F. The mass to be separated is fed to the main belt A through a hopper E and the magnetic particles which are attracted by the magnets F, are carried away by the belt B in the direction of arrow 1 while the gangue which remains on the belt A is carried away in the direction of arrow 2. From this description it will be seen that the crushing and recrushing of the ore is done in the wet state so that no dust is created and the bulk of the mass to be dried is reduced to such an extent that the operation of drying can be carried out at a sufficiently low cost to render it no obstacle from an economical point of view.

An actual test made by me has given the following result: A mass of two thousand two hundred and forty pounds of low grade magnetic iron ore was crushed in a wet state to one eighth of an inch, then exposed in a stream of liquid to the action of magnets with the minimum amount of loss, say two per cent. of magnetic particles; in the tailings I found fifteen hundred and seventy pounds of gangue or waste rock. In the mass of six hundred and seventy pounds saved I had a concentrated product of magnetic iron ore containing fifty per cent. of metallic iron. The six hundred and seventy pounds thus obtained were crushed to about one-fortieth of an inch, then dried and finally exposed to the action of magnets as above described. The concentrate obtained contains from seventy

to seventy-two per cent. of metallic iron and is practically free from gangue. In this case the bulk of the mass to be dried was reduced from two thousand two hundred and forty pounds to six hundred and seventy pounds.

From the foregoing explanation it will be seen, that my new process consists essentially of the following steps: one, coarsely crushing the ore in a wet state; two, exposing the crushed mass while wet, to the action of magnets; three, recrushing the concentrate thus obtained, while wet; four, drying the recrushed mass; five, exposing the dry mass to the action of magnets. By these means I am enabled to obtain a concentrate of a high grade in a comparatively cheap manner. By carrying out the first operation of crushing the ore in the wet state and also the third operation of recrushing the ore in the wet state I avoid the creation of dust which is unavoidable, if the mass is crushed in a dry state and which is injurious to the health of the operatives and to the machinery, and by the second operation, viz., "exposing the crushed mass while wet, to the action of magnets" I reduce the bulk of the mass which is afterward recrushed and then dried, so that the expense of recrushing and drying is materially reduced.

What I claim as new, and desire to secure by Letters Patent, is—

The process of concentrating iron ore which consists in first coarsely crushing the ore in a wet state; then exposing the crushed mass while wet to the action of magnets, then recrushing the concentrate thus obtained while wet, then drying the recrushed mass and finally exposing the dry mass to the action of magnets, substantially as described.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

GURDON CONKLING.

Witnesses:

WM. C. HAUFF,
E. F. KASTENHUBER.