2 Sheets—Sheet 1.

J. M. HARTMAN.

Blast Furnace.

No. 229,883. Patented July 13, 1880.

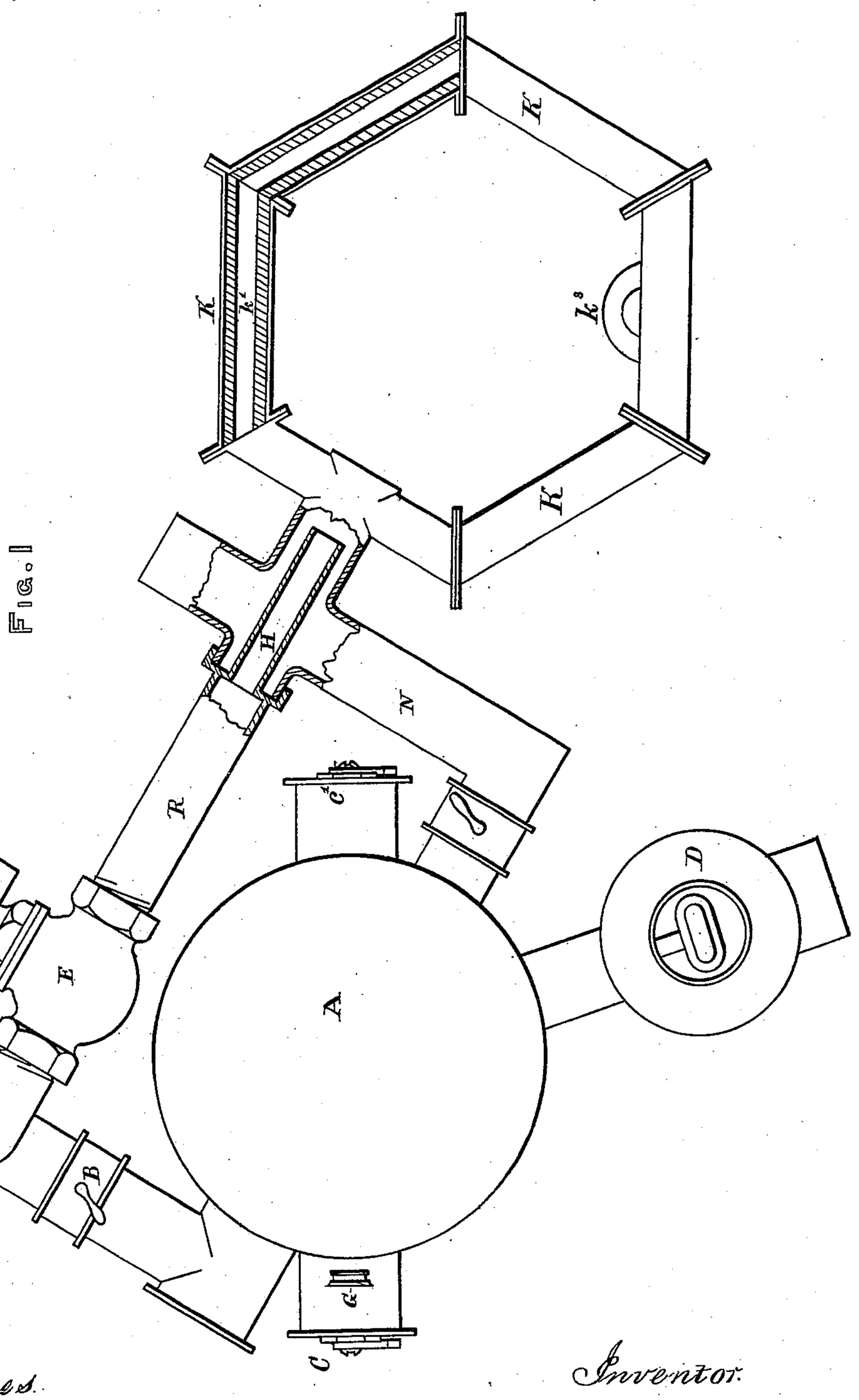

FIG. 1

Witnesses.

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2 Sheets—Sheet 2.

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FIG. 2

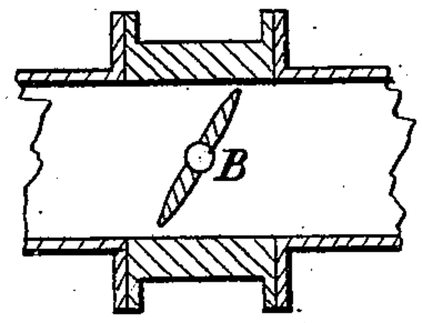


FIG. 3

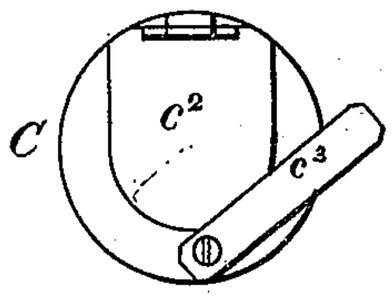


FIG. 4

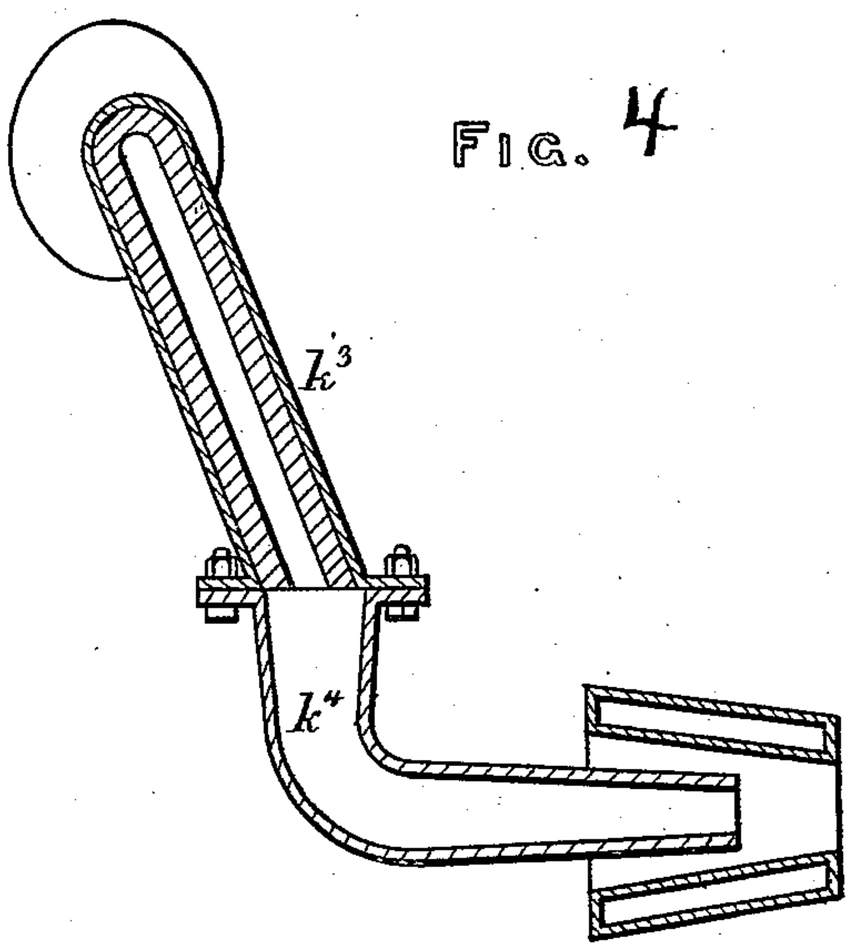
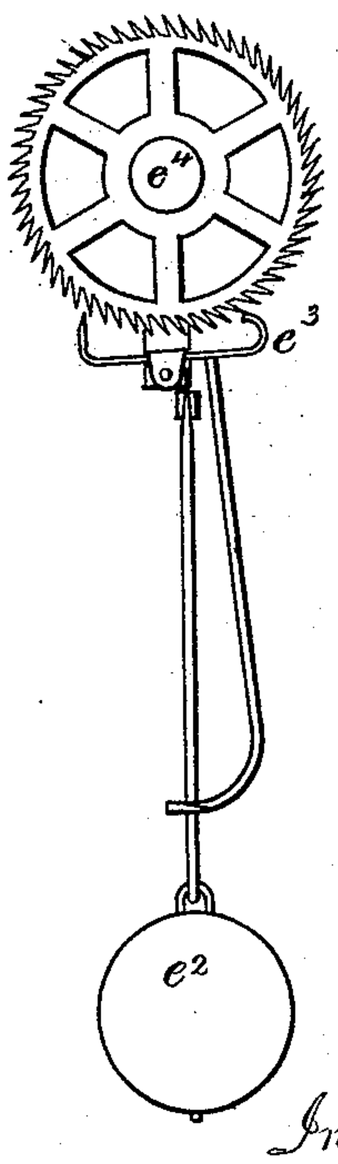


FIG. 5



Witnesses.

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UNITED STATES PATENT OFFICE.

JOHN M. HARTMAN, OF PHILADELPHIA, PENNSYLVANIA.

BLAST-FURNACE.

SPECIFICATION forming part of Letters Patent No. 229,883, dated July 13, 1880.

Application filed December 10, 1878.

To all whom it may concern:

Be it known that I, JOHN M. HARTMAN, of Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented a new and useful Improvement in Blast-Furnaces, which improvement is fully set forth in the following specification and accompanying drawings, in which—

Figure 1 is a general plan of the works. Fig. 2 shows the interior of the pivot-valve. Fig. 3 shows the construction of the air-surging valve. Fig. 4 shows mode of connecting the bustle and tuyere pipes. Fig. 5 shows the automatic operation of the equalizing-valve.

The nature of my invention consists in an improved combination of appliances to prevent the accumulation of dust upon the walls of the fire-brick regenerator; also, in combining with the regenerator a valve which may be suddenly opened to discharge dust with a surging pressure of the air; also, in an apparatus by which the heat is retained in the stove at the commencement of the blow, and utilized at the end of the blow, by an automatic valve; also, in the construction of the pipe where the hot and cold blast commingle; also, in the construction of the bustle-pipe in straight segments lined with fire-brick, which are bolted together by bevel-flanges; also, in connecting the bustle-pipe to the belly-pipe of the tuyere by means of a fixed depending branch lined with fire-brick.

In operating regenerative fire-brick stoves, one of which is shown at A, the gases from the blast-furnace deposit dust on the walls of the stove, which destroys their efficiency and requires the walls to be frequently cleaned. When the stoves are heated to a high temperature this dust fuses on the walls and destroys them.

A gas-washing apparatus does not remove all the dust. The bulk of the powder passing the washer collects on the cold side of the stove near valve C.

The stoves are changed every four hours, and after a stove is cut off from the furnace it is left full of compressed air, which must be got rid of. At the extreme bottom of the stove, on the cold side, I place a surging dust-valve, C, which, by means of a bolt or trip, is caused to fly open suddenly. The air in the stove expands, rushes out through this valve, and carries off part of the fine powder. This valve relieves the pressure, carries off part of the powder, and, to the extent the powder is carried off, the stoves are rendered more efficient.

The construction of the air-surging valve is shown in Fig. 3.

The valve consists of a hinged door, c^2, closed by a lever-bolt, c^3. By withdrawing this lever or bolt the valve opens instantly. To remove this powder I blow through the stoves about every two days a large volume of blast from the furnace-blowing engine, which sweeps it out of the stove. For this purpose the stove is provided with a pivot-valve, B, (shown in Fig. 2,) or any similar valve which can be suddenly opened, by which the air can be surged through the stove intermittingly. On the opposite side of the stove from the said pivot-valve there is a surging dust-door, c', similar to C, which is thrown open when surging the air through the stove for the escape of the air and dust. By means of the conjoined operation of a gas-washing apparatus, the air-surging pivot-valve B, and the dust-surging valve C, I keep the stoves clean.

To regulate the amount of gas in a stove has been heretofore difficult, as no pyrometer has been found to stand the heat in the combustion-chamber of the stove.

When the gas has been burned and passed through the stove its heat is lowered, so that a pyrometer can be used in its escaping gas without being destroyed.

By inserting a pyrometer, G, in this escaping gas a proportion can soon be established that will enable the operator to govern the stove completely. For instance, I find that with escaping gas going off at 400° the blast when turned on will give 1,100° on the hot side of the stove, and if I wish to run 1,200°, then the escaping gas must be raised in temperature to correspond by adding more gas.

The time a stove is on the furnace is usually two hours. It is called a "blow," and is the time the air is being blown through one of the stoves. When a fire-brick stove is heated up and the blast turned through it on the furnace the temperature will be, perhaps, 1,300°. In two hours this will lower to 1,100°. This variation deranges the working of the furnace and changes

the quality of the iron. To obviate this I place a pipe between the cold-air and hot-blast pipe, outside of the stove. In this pipe is placed an automatic equalizing-valve, E, which is opened wide at the beginning of the blow, allowing the cold air to pass direct to the hot-blast. This cold air mixing with the hot-blast reduces its temperature when working, as in the above-described case, to about 1,200°. Now the cold air that has passed direct has not robbed the stove of the heat that it would have received had it passed through the stove; consequently that heat is retained in the stove.

To the valve E above mentioned is attached any well-known movement, such as clock-work or a float and cataract. This latter is made in this way: A steam-cylinder placed upright has a piston sliding loosely within it. The piston-rod is attached to the stem of the equalizing-valve E. (See Fig. 1.) In the piston is a check-valve opening downward, and also a simple hole drilled through the piston. The cylinder is filled with glycerine. It operates this way: The piston is raised by hand, opening the valve E. As the piston descends by gravity the glycerine passes through the hole to the top side, the hole being of such a size as to allow it to escape in two hours. Either of these plans described herein will gradually close the valve toward the latter part of the blow, by which more air will pass by the stove at the commencement of the blow, and less pass direct to the hot-blast pipe N. By this means the heat held in reserve at the beginning of the blow will be given up toward the latter part of the blow and a more uniform temperature maintained.

When the difference in pressure between the hot and cold side of the stove is considerable, which pressure is due to friction through the stove, I use a puppet-valve which can be adjusted by weights, which will cause it to gradually close by the change of pressure.

To make the cold air enter the hot-blast and mix thoroughly with it, I continue the cold-blast-pipe nozzle H through the hot-blast pipe into the connection to the circular pipe. The hot-blast passing along outside of this pipe forms a suction which draws the cold air with it and mixes it thoroughly.

The fire-brick stoves are placed up close to the furnace and discharge immediately into the pipe running around the furnace. This pipe is usually called a "bustle-pipe." It forms a circle around the furnace and is lined with fire-brick of one or more thicknesses. This pipe is costly to make and extremely difficult to line with the brick. To obviate this I form it of straight segments K, with angle-flanges. These straight pipes I line with fire-brick, k', and after being lined I bolt them together in position.

Heretofore the tuyere-pipe leading from the bustle-pipe to the furnace has been attached to the bustle-pipe direct. This long exposed tuyere-pipe is heavy to handle and causes great loss of heat by radiation. I make one or more of the branches K of the bustle-pipe with a branch, k^3, as shown in Fig. 4, which is also lined with fire-brick. The tuyere-pipe k^4 can then be made quite short, can be easily handled, and causes only a small loss by radiation. This is an important feature in the connections of the hot-blast stoves where the temperature of blast is over red heat.

One of the automatic arrangements for closing the equalizing-valve E is shown in Fig. 5. It consists of a clock-work mechanism operating the pendulum e^2 and escapement e^3, and by means of a screw upon the spindle e^4 of the valve it is gradually closed.

What I claim as my invention is—

1. In combination with a regenerative fire-brick stove, the cold-blast main M, a pivot-valve, the hot-blast main N, and dust-discharge outlets, whereby a sudden discharge of blast is produced, as herein described.

2. The combination, with a regenerative fire-brick stove, of the cold-air main M and the valve C, with hinged door c^2 and bolt c^3, whereby is produced a sudden puff of blast and discharge of dust, as herein described.

3. The combination of the cold-blast main M, the connecting-pipe R, equalizing-valve E, and the nozzle H, projecting in within the hot-blast pipe, as described.

4. The bustle-pipe of a blast furnace, constructed in segments K, having beveled flanges and lined with fire-brick, as herein described.

5. In combination with the bustle-pipe of a blast-furnace, a depending branch, k^3, lined with fire-brick, for connecting to the tuyere-pipe, as herein described.

6. In combination with a fire-brick regenerative stove, a cold-air main leading into the stove, and a hot-air main, N, leading from the stove to the furnace, a cold-air pipe, R, connecting the cold-air main M with the hot-air pipe N, and a regulating-valve, E, in the pipe R, in combination with automatic mechanism for gradually closing said valve toward the end of the blow, whereby the volume of cold air is gradually cut off and forced through the stove and a steady temperature of the blast maintained, as herein specified.

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Witnesses:
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JOHN F. GRANT.