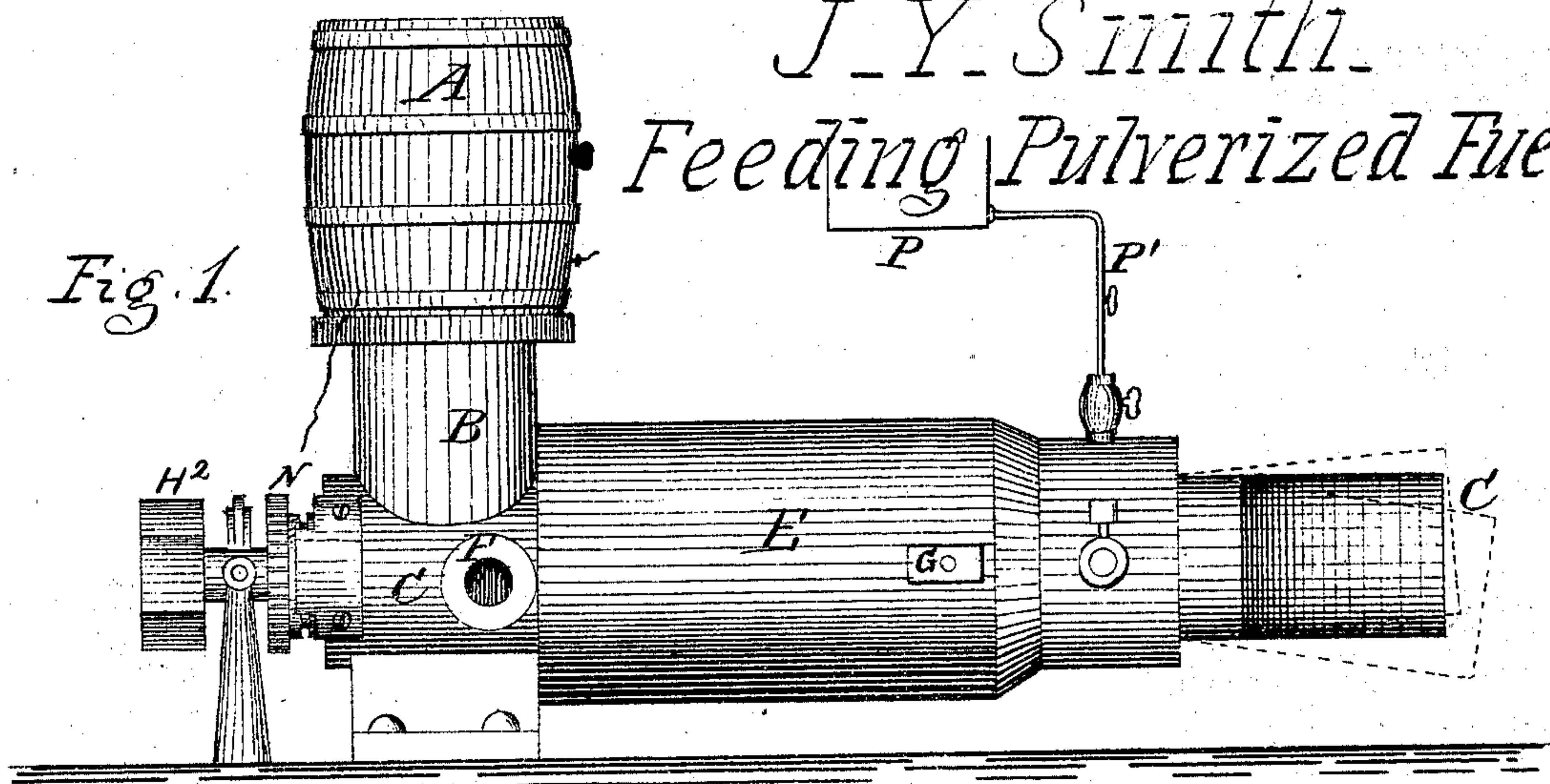


# J. Y. Smith Feeding Pulverized Fuel.

Fig. 1.



No. 120,680.

Patented Nov. 7, 1871.

Fig. 2

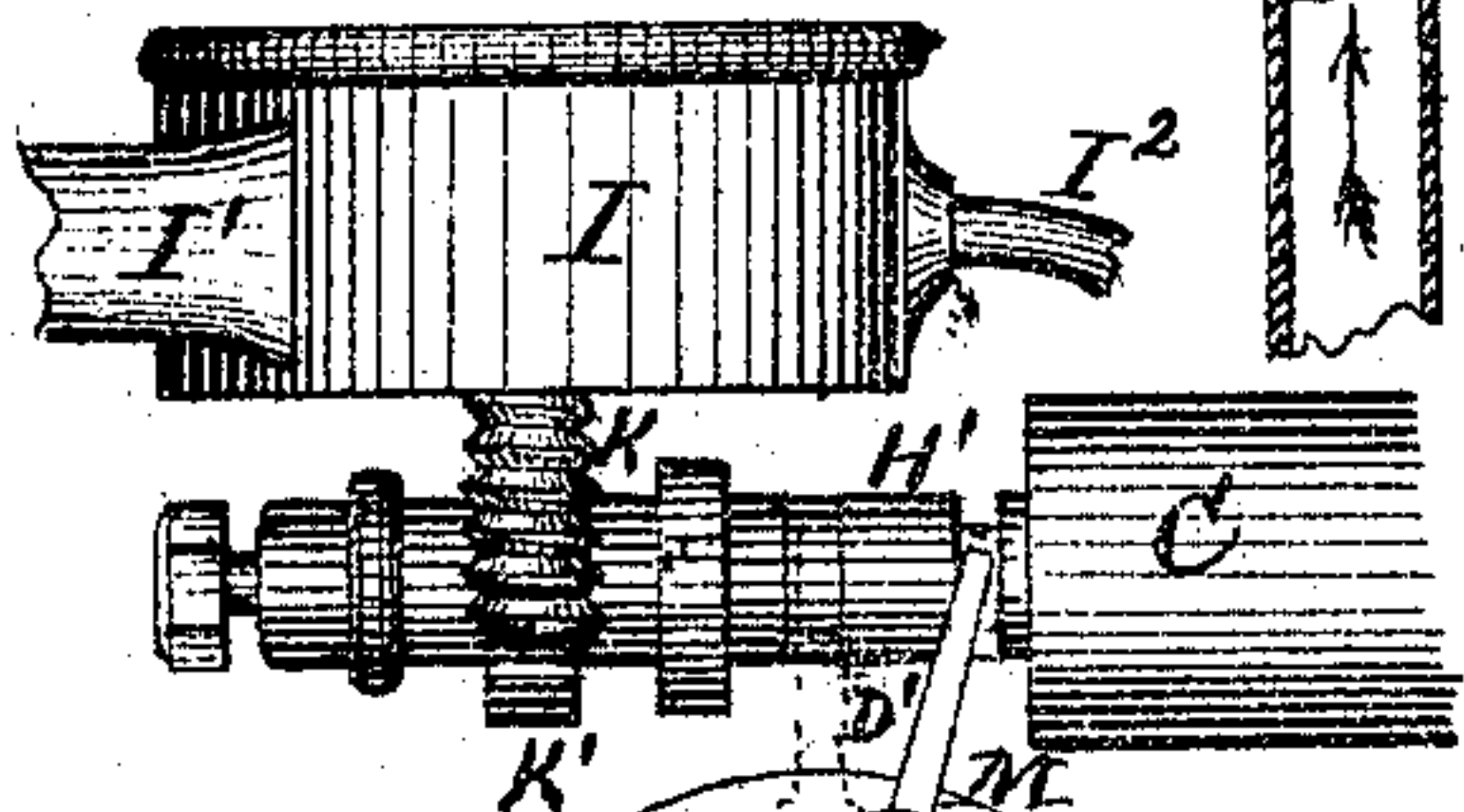
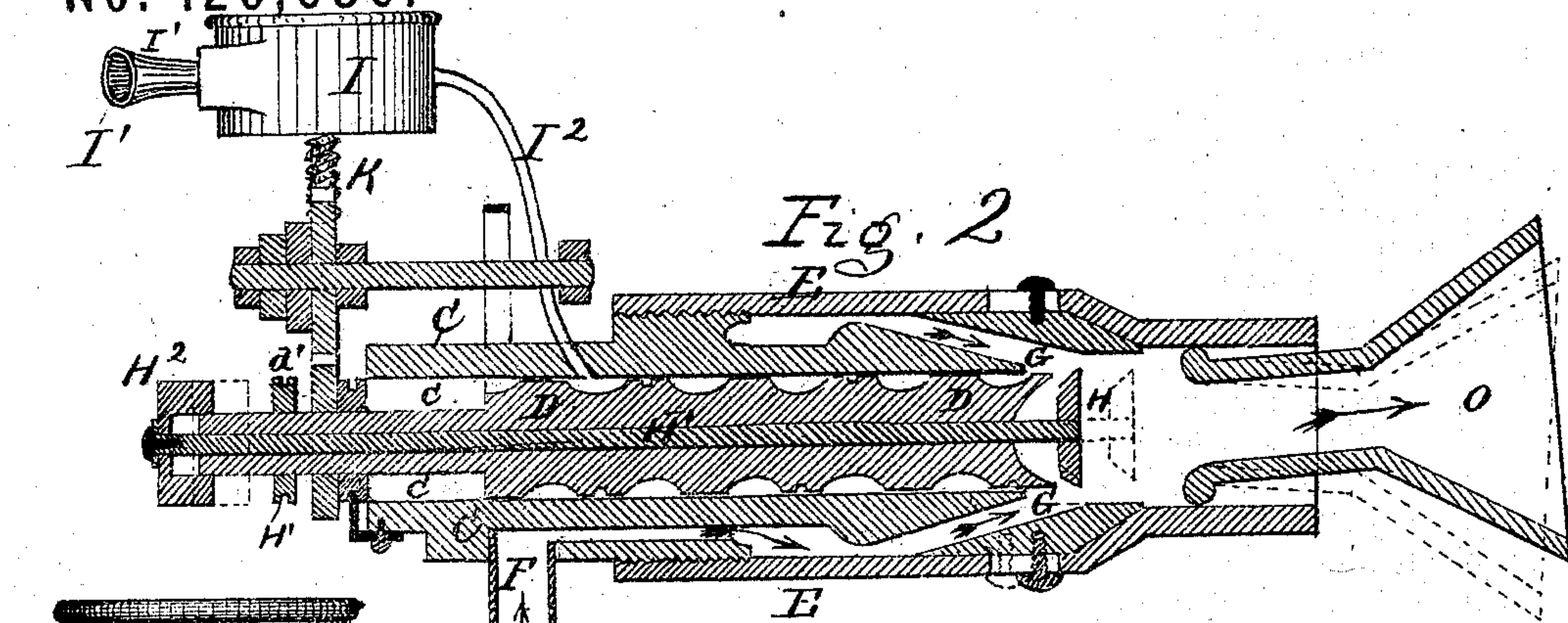


Fig. 6

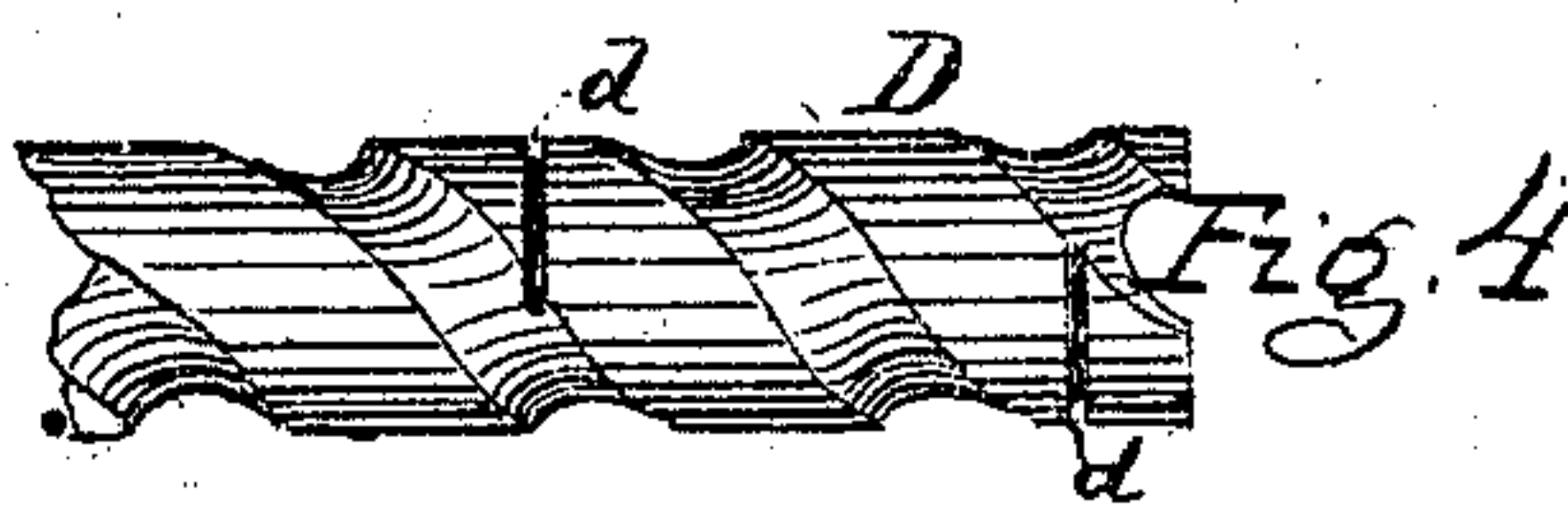


Fig. 4

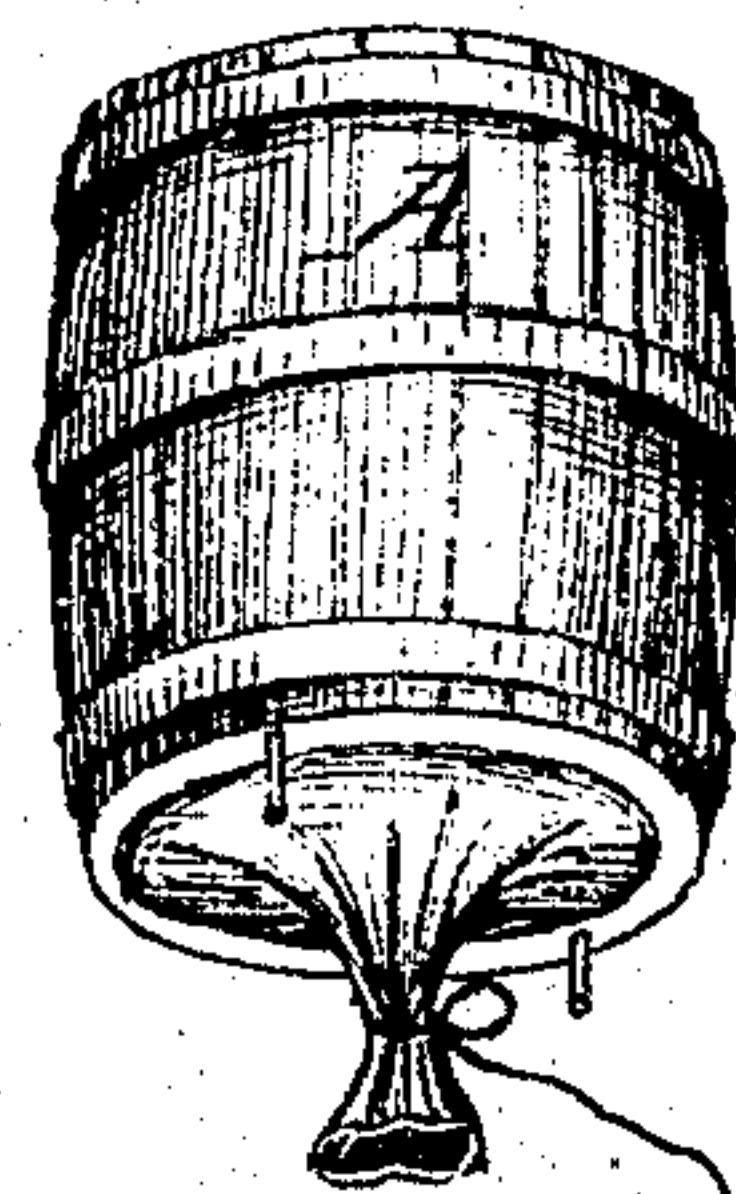
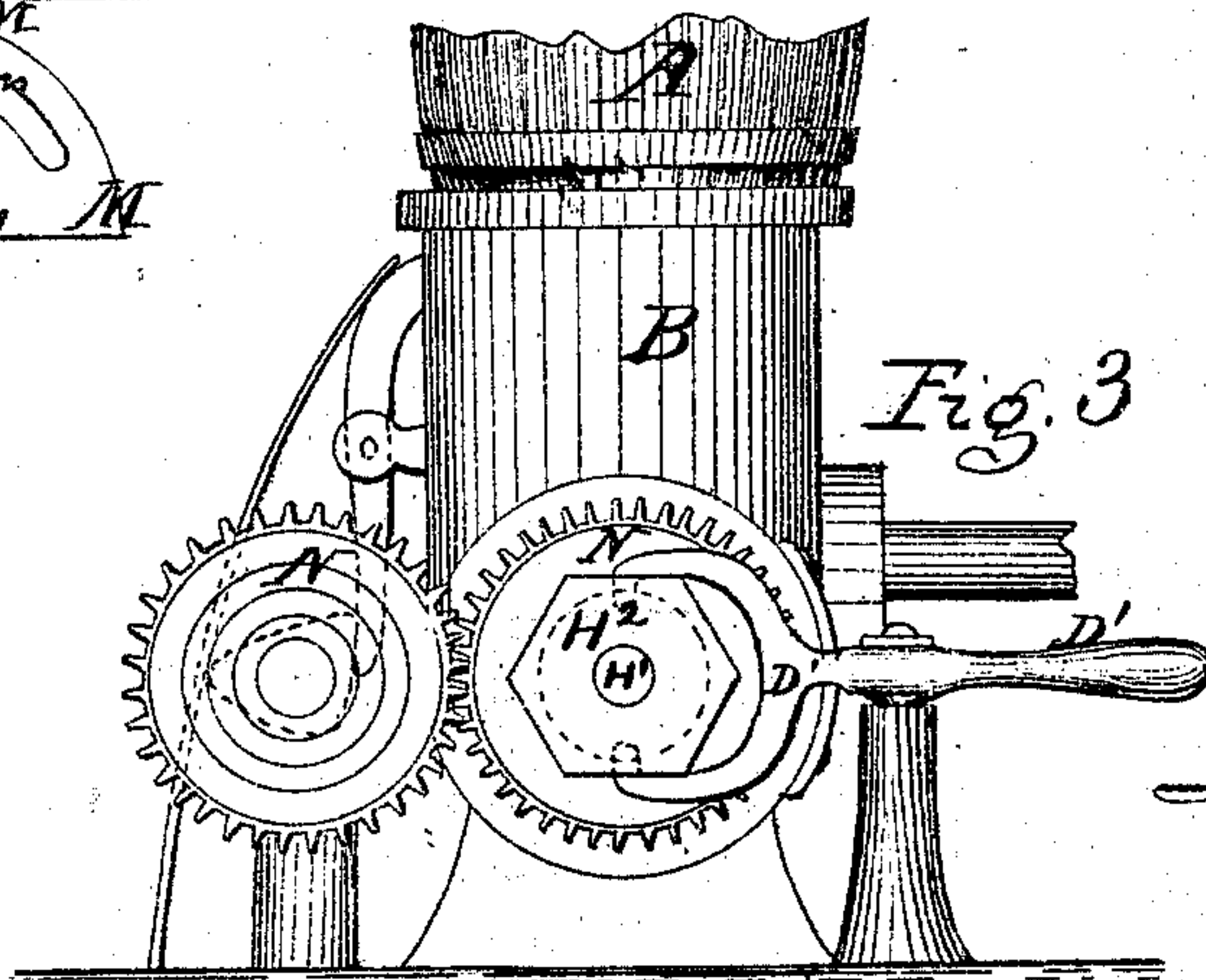


Fig. 5

Fig. 3



Attest  
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# UNITED STATES PATENT OFFICE.

JOHN Y. SMITH, OF PITTSBURG, PENNSYLVANIA.

## IMPROVEMENT IN APPARATUS FOR FEEDING PULVERIZED FUEL TO FURNACES.

Specification forming part of Letters Patent No. 120,680, dated November 7, 1871; antedated November 4, 1871.

*To all whom it may concern:*

Be it known that I, JOHN Y. SMITH, of Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improved Apparatus for Feeding Finely-pulverized Fuel; and I do hereby declare that the following is a full, clear, and exact description of the same, reference being had to the annexed drawing making part of this specification, in which—

Figure 1 is an elevation of the apparatus. Fig. 2 is a longitudinal section. Fig. 3 is an end elevation. Fig. 4 is a detached view of the spiral feeder. Fig. 5 is a perspective view of the cask from which the pulverized fuel is fed, and Fig. 6 is a perspective view of a part of the apparatus.

In all the figures the same letters are employed in the designation of parts which are identical.

This improvement relates to that class of apparatus in which provision is made for feeding finely-comminuted fuel, to be burned while floating in the atmosphere. The apparatus may be applied to any kind of furnace or combustion-chamber. The special points of novelty will be specifically indicated in the following description and specification of claims:

Either steam or a hot or cold blast or a current of gas may be employed as the means of carrying the finely-pulverized fuel into the combustion-chamber. I prefer to use finely-powdered coal for the fuel, reduced by grinding in any suitable mill to a fine powder. The fuel, when ground, is passed into a box or cask having one close head and a flexible sack at the other end. When the cask has been filled a string should be tied around the sack and so fastened by a loop that, when passed through a small hole in the chine of the cask, the loop may be disengaged by drawing this string, and thus the contents of the cask be discharged into the hopper.

In the annexed drawing the cask is indicated by A. B is the hopper, into which the fine powder is discharged, and from which it is fed into the barrel C of the injector. This is a tube of a uniform diameter of bore, closed at one end by a head, which may be conveniently removed so as to permit the spiral feed to be withdrawn when necessary. Within the barrel C is a spiral conveyer, D, revolving in the chamber of the barrel C. This may be actuated by

gearing, as shown at N in Fig. 3, or by other means to be explained. In order to assist in dislodging the powder and to prevent its choking the feeder I cut grooves *d* around the spiral feeder D; these, cutting through the spiral flange, will tend to dislodge the pulverulent material discharged from the hopper. The spiral feeder passes through the head of barrel C, and is so constructed that a longitudinal motion may be imparted to it independently of its rotary motion by means of the bifurcated lever. In case the coal should lodge in the barrel C the feeder D may be moved longitudinally in both directions by means of the lever D'. The barrel D is surrounded by a jacket, E, both being so constructed as to leave an annular chamber between them, into which the air, steam, or gas is discharged through either the pipe F or I<sup>2</sup>. The point of the barrel C should be beveled, as shown in Fig. 2. A ring, G, is placed in the chamber, and is to be similarly beveled. This ring is operated by a stud projecting through slots in the jacket E, so that by moving it toward or from the end of the barrel C the force and quantity of the blast may be regulated at the will of the operator. While the entering blast is thus susceptible of regulation, the quantity of pulverulent matter may also be controlled by means of the valve H, which, being actuated by the rod H', may be so arranged in relation to the mouth of the barrel C as to regulate the supply of the pulverulent material carried forward by means of the spiral feeder. The rod H, passed through a hole bored through the spiral feeder, is regulated by means of the head H<sup>2</sup>, screwed into the end of the feeder. I have already indicated the mode of revolving the feeder by means of the spur-wheels N N; but I have shown in Figs. 2 and 6 another mode, which in most cases I would prefer to use, as it may be employed where it is not convenient to apply independent power to the actuation of the feeder. I is a case inclosing a fan or other wheel, to be revolved by the force of the current of air, steam, or gas entering at I<sup>1</sup> and escaping at I<sup>2</sup>, to be discharged into the injector or into the furnace. The wheel will be caused to rotate rapidly by the force of this current, and its shaft, passing through a suitable stuffing-box in the head of the fan-case, carries, or, by means of intermediate gearing, communicates motion to the worm K, which engages cor-



respondingly-spiral cogs on the face of a pinion, K', on the shaft of the feeder D, which will be rotated by the motion of the wind-wheel. The lever D' is attached to a plate, M, having two slots, one in the arc of a circle and the other radial, in which the bifurcated lever is secured by means of set-nuts. The one on the segmental slot being loosened, the feeder D may be operated longitudinally for the purpose already explained. By loosening the set-nut at the radial slot the points of the lever may be disengaged from the groove *d'*, and the spiral feeder drawn out of the barrel C to admit a rod to be passed through the injector. The inclined face of the ring G will cause the blast, when passing the mouth of the barrel C, to have the form of a cone, into the center of which the pulverulent material will be discharged, thereby insuring the thorough intermingling of the fuel with the air, steam, or gas before entering the combustion-chamber. The blast is discharged through the mouth-piece O, which is attached to the inside of the mouth of the jacket E by a ball-joint, so as to permit the mouth-piece to be directed toward different parts of the furnace or combustion-chamber, as may be preferred.

Great difficulty has been experienced in the application of fuel-injectors to practical use by reason of the inability of metallic mouth-pieces to withstand the very high temperature to which they are exposed. To meet this difficulty I propose to construct or line the mouth-piece with a refractory substance formed of pulverized quartz, prepared in the manner set forth fully in a specification filed in an application made at the same time as this. In many metallurgic operations it is desirable to mingle various gaseous or liquid inflammable substances with the coal for the purpose of modifying the flame according to the requirement of the art or operation. I have indicated at P a receiver, connected by a pipe, P', with the chamber where the pulverized fuel is mingled with the blast, by means of which the desired modification may be produced, other gases or inflammable liquids being introduced at that point.

I am aware that spiral conveyors have heretofore been used for the purpose of feeding pulverulent fuel; and in a former application of my own I have set forth an apparatus for feeding pulverized fuel in a blast of air, steam, or gas;

and I do not, therefore, claim either of these features broadly.

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

1. In combination with the injector-hopper B, the cask A provided with the flexible sack-mouth, and arranged to operate substantially as set forth.

2. The barrel C when constructed with a uniform bore and used in combination with the removable spiral feeder D, substantially as set forth.

3. The spiral feeder D when constructed with the transverse grooves *d*, substantially as set forth.

4. In combination with the spiral feeder D, the lever D' for giving a longitudinal motion to the former while rotating on its axis, substantially as set forth.

5. In combination with the lever D', the plate M, constructed with the segmental and radial slots, substantially as and for the purpose set forth.

6. The spiral feeder D, in combination with the endless screw K, communicating to the feeder a rotary motion derived from the action of the blast on the fan-wheel in the case I, substantially as set forth.

7. In combination with the barrel C and jacket E, the adjustable ring G for regulating the blast, substantially in the manner set forth.

8. In combination with the barrel C and spiral feeder D, the adjustable valve H, arranged to operate substantially as set forth.

9. In combination with a feed-injector, an adjustable mouth-piece, O, arranged to operate substantially as set forth.

10. A mouth-piece, O, made of silex, substantially as described.

11. In combination with the feeding device D C and the jacket E, the pipes P', arranged to discharge gases or combustible liquids into the pulverized fuel when mingled with the air or other blast, substantially in the manner set forth.

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

JOHN Y. SMITH.

Witnesses:

B. EDW. J. EILS,  
A. RUPPERT.

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