

J. T. FUHRMANN.

FLUE CUTTER.

APPLICATION FILED JUNE 30, 1908.

922,127.

Patented May 18, 1909.

2 SHEETS—SHEET 1.

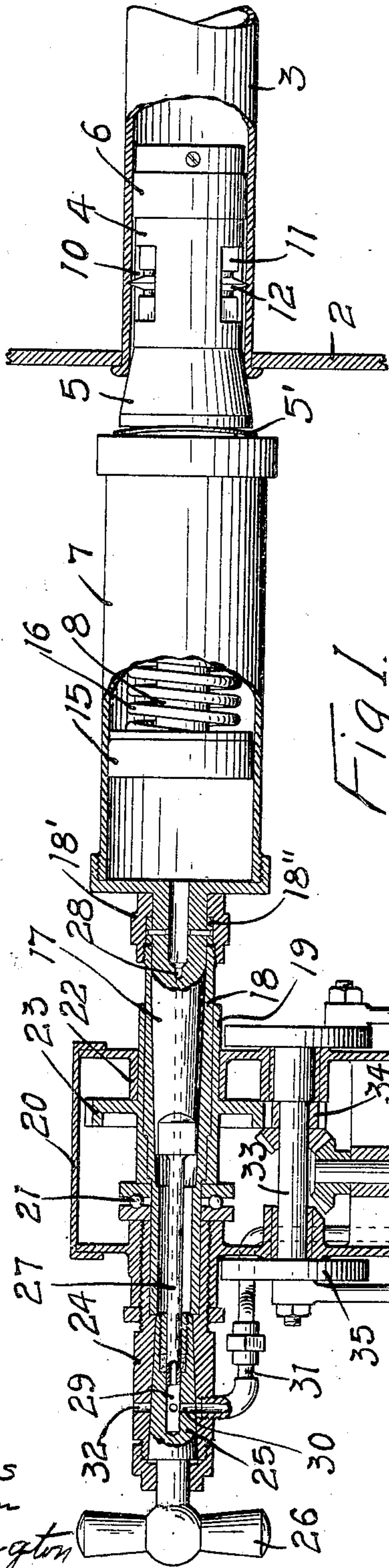


Fig. 1.

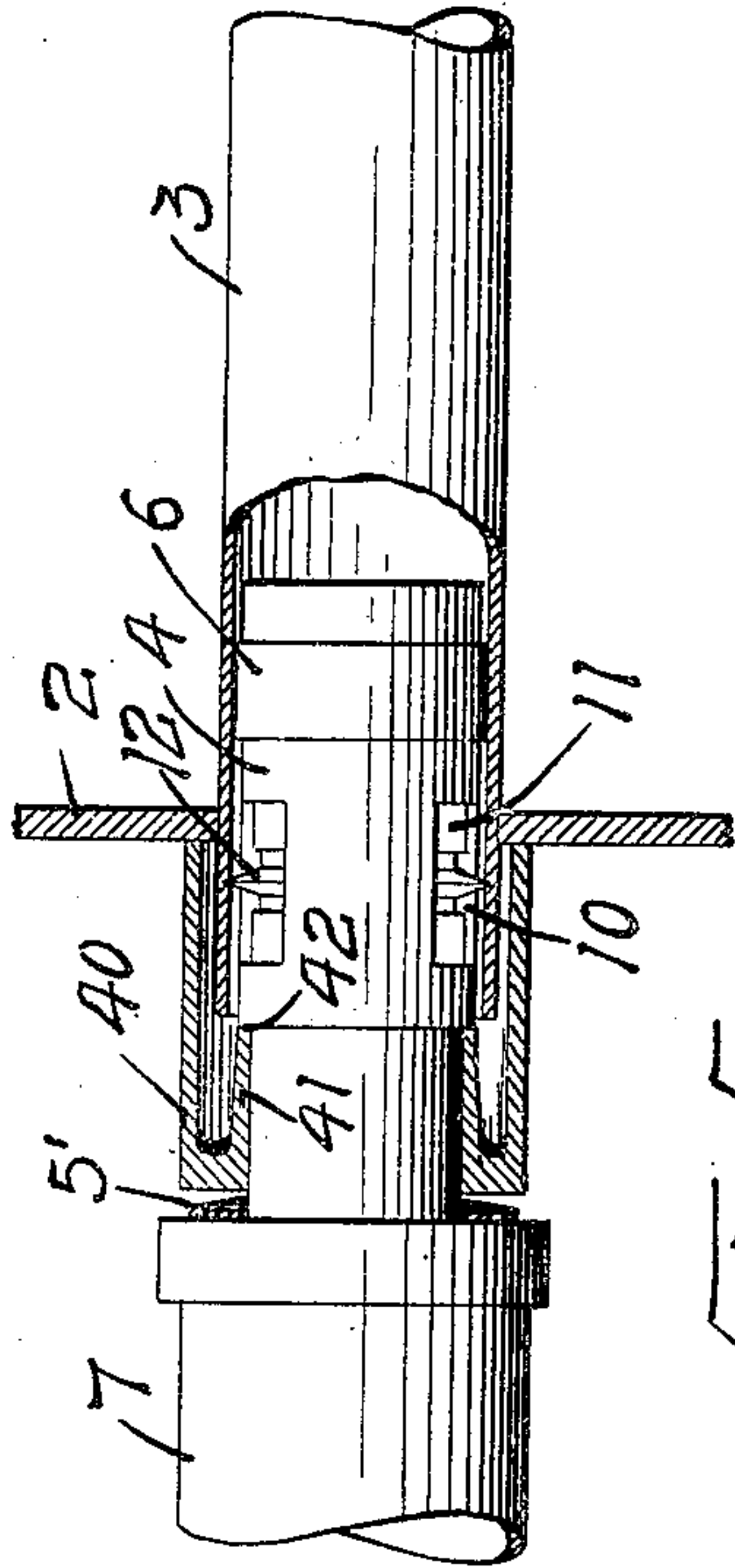


Fig. 5.

WITNESSES

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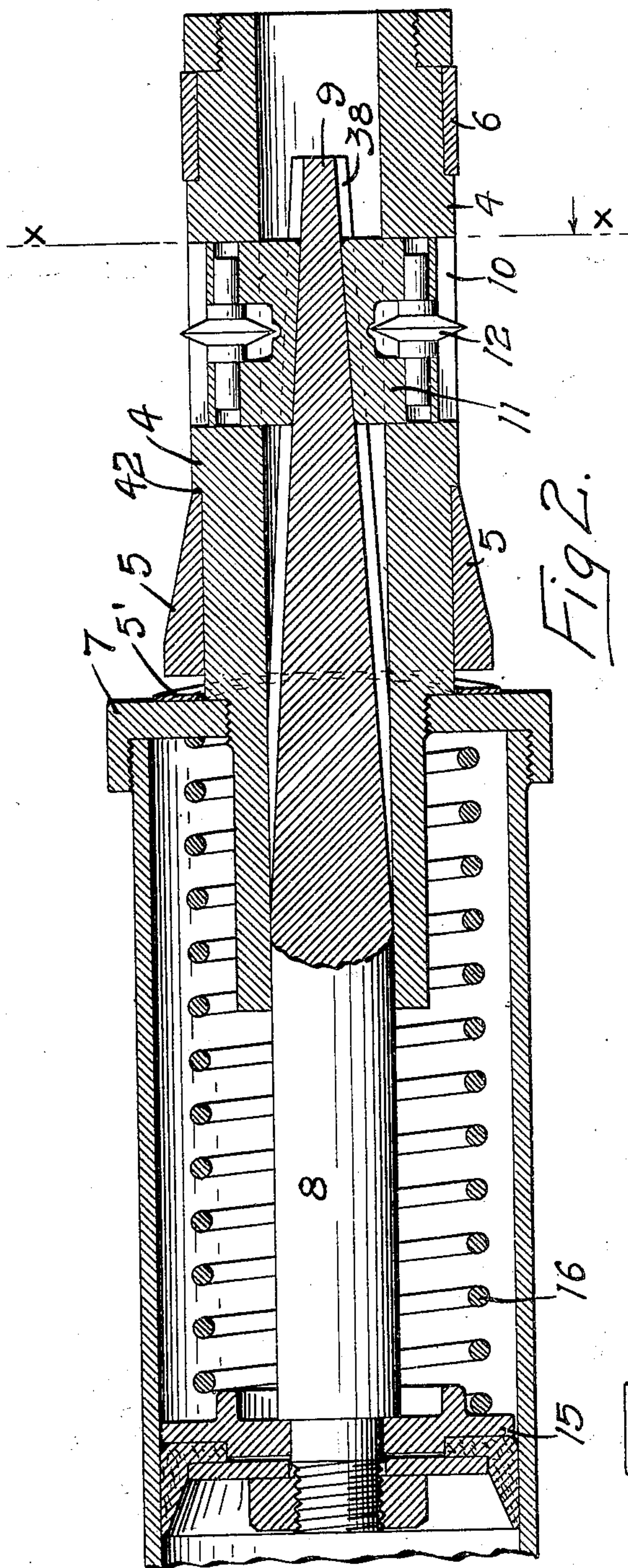


Fig. 2.

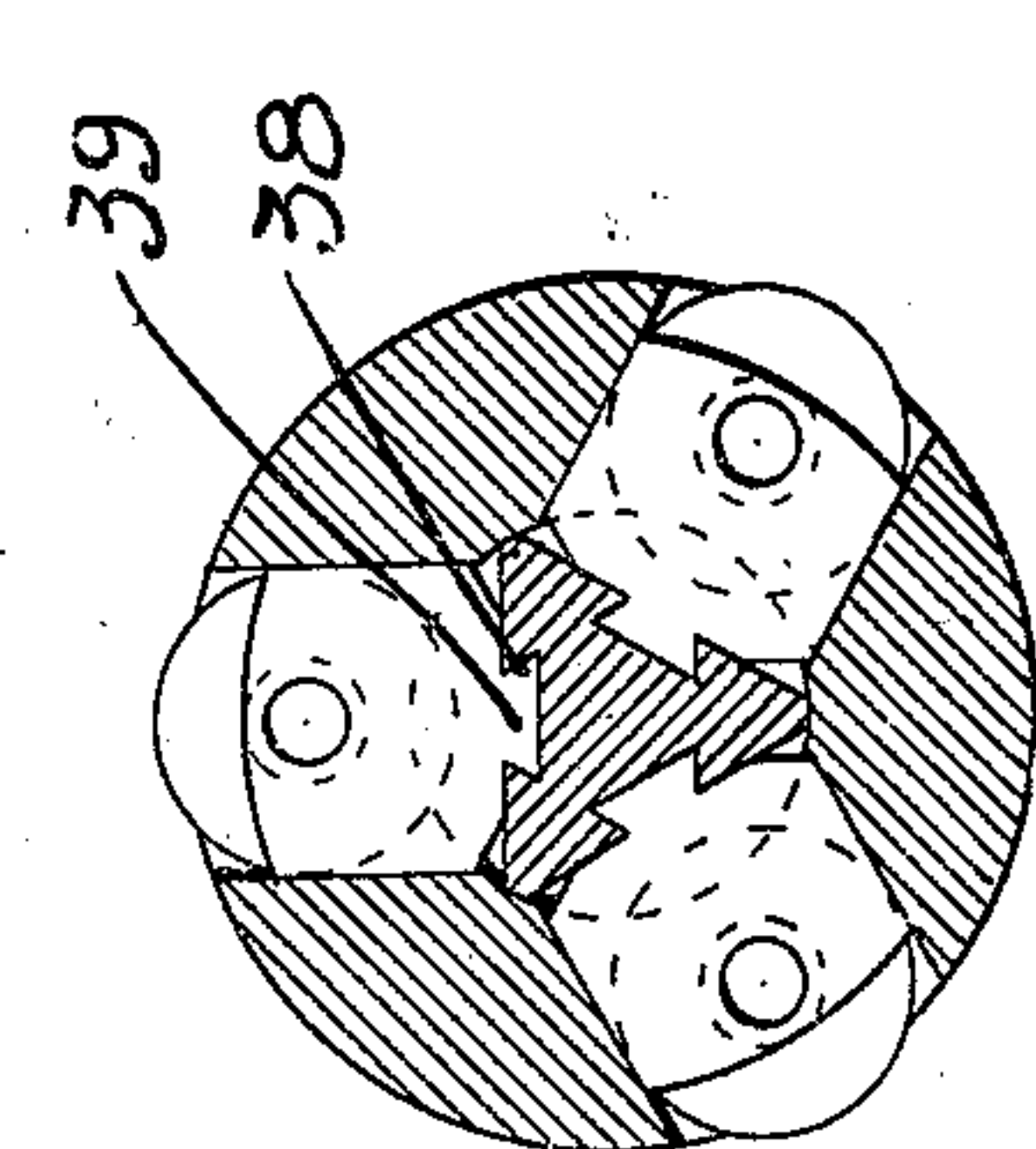


Fig. 4. x-x

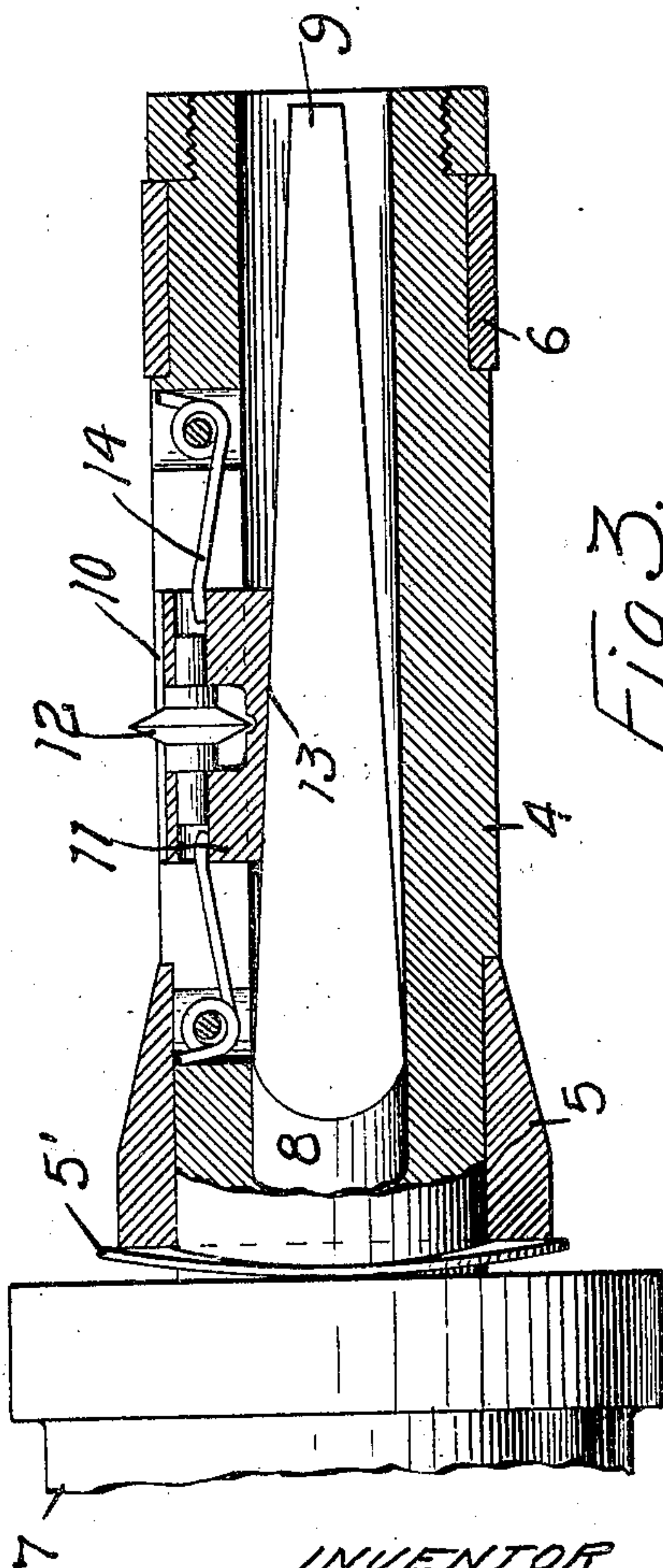


Fig. 3.

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# UNITED STATES PATENT OFFICE.

JOHN T. FUHRMANN, OF ST. PAUL, MINNESOTA.

## FLUE-CUTTER.

No. 922,127.

Specification of Letters Patent.

Patented May 18, 1909.

Application filed June 30, 1908. Serial No. 441,170.

*To all whom it may concern:*

Be it known that I, JOHN T. FUHRMANN, of St. Paul, Ramsey county, Minnesota, have invented certain new and useful Improve-  
5 ments in Flue-Cutters, of which the following is a specification.

The object of my invention is to provide a flue cutter of simple construction and one by means of which flues can be easily and rap-  
10 idly cut out of a boiler.

My invention consists generally, in various constructions and combinations, all as hereinafter described and particularly pointed out in the claims.

15 In the accompanying drawings, forming part of this specification, Figure 1 is a sectional view illustrating the application of my invention to a boiler flue and showing the mechanism for holding the flue cutters to the  
20 work. Fig. 2 is a longitudinal sectional view of the flue cutting portion of the tool. Fig. 3 is a detail sectional view illustrating the means for withdrawing the cutters from contact with the flue. Fig. 4 is a transverse  
25 sectional view on the line  $x-x$  of Fig. 2. Fig. 5 is a detail sectional view illustrating the application of the tool to the flue on the outside of the flue sheet.

In the drawing, 2 represents a portion of  
30 the flue sheet, 3 a flue and 4 a barrel adapted to fit into the end of a flue and having a tapered sleeve 5 at one end that fits snugly into the end of the flue and centers the tool therein. A loose collar 6 mounted on the inner  
35 end of the barrel is adapted to contact with the inner surface of the flue and allow the barrel to be freely revolved therein. One end of the barrel is tapped into a cylinder 7 and a pin 8 is provided within said barrel  
40 and has a tapered forward end 9 that is adapted to reciprocate within said barrel. Openings 10 are provided in the walls of the barrel and within these openings radially moving carriages 11 for the revolving cut-  
45 ters 12 are arranged. These carriages have inclined inner faces 13 to fit the tapered surfaces of the pin 8 and are held in yielding engagement with said tapered surfaces by means of springs 14. The tapered end 9 of  
50 the pin is preferably triangular in cross section having 3 flat surfaces with which a corresponding number of the flue cutter carriages contact. I prefer to provide three of these carriages as I have found that num-  
55 ber best suited for the purpose, but do not confine myself to this precise number.

The cutters which I prefer to employ consist of steel disks having sharpened edges arranged to revolve with the tool in a plane at right angles to the longitudinal axis of the  
60 flue. The cutters are normally withdrawn by the springs 14 within the barrel 4 to permit it to be thrust into the flue and are forced outwardly by the movement of the pin into engagement with the surface of the  
65 flue. A piston 15 is mounted on the outer end of the pin 8 and is held toward the outer end of the cylinder 7 by a spring 16. When the pin is forced in to project the flue cutter carriages, this spring is put under compres-  
70 sion to return the pin to its normal position when pressure on the piston is relieved. I prefer to feed the pin into the flue by the following described mechanism.

17 is a shank mounted on the end of the  
75 cylinder 7 and fitting within a tapered socket in a spindle 18 that fits within a sleeve 19 provided in a casing 20. This sleeve has a ball bearing 21 at its outer end and is adapted to turn freely thereon, being held  
80 against longitudinal movement by said bearing, and an annular flange 22 which engages a gear 23 on said sleeve. A union 18' is held on said shank by a ring 18'' and has a thread-  
85 ed connection with said spindle and whereby longitudinal movement may be imparted to said spindle to separate it from said shank. This union has therefore two functions. It  
90 holds the spindles and shank together during the operation of the tool and when revolved, withdraws the tapered shank from the spindle, and I am thus able to easily and quickly  
95 separate the cylinder from the operating mechanism. A valve casing 24 is tapped into the casing 20 and forms a continuation  
100 of the spindle 18 and has a tapered socket for a valve 25 that is provided with an operating handle 26. A tube 27 is connected at one end to the shank 17 and communicates  
105 through a port 28 in said shank with the interior of the cylinder 7. The outer end of the tube 27 is connected to the valve 25 and has a port 29 adapted to communicate with a  
port 30 in said valve and a fluid pressure supply pipe 31.

Fig. 1 illustrates the position of the ports when fluid pressure is admitted to the cylinder to force the pin forward. The casing 24 has an exhaust port 32 through which the  
110 fluid pressure in the cylinder is released when it is desired to withdraw the cutters from the flue. To admit fluid pressure the



valve 25 is rotated until its port registers with the fluid pressure supply pipe and the fluid rushing into the cylinder will force the piston inward and drive the tapered end of the pin in between the flue cutter carriages until they are forced out against the wall of the flue. Before this has been done, the tool is revolved by a suitable mechanism such as I will now describe in detail.

33, is a shaft mounted in the casing 20 and provided with a pinion 34 which meshes with the gear wheel 23. Crank disks 35 are mounted on the shaft 33 and provided with pitman rods 36 connected to pistons 37 of operating motors, not shown. When this shaft is revolved its movement will be transmitted to the tool and the flue cutters will be rapidly revolved in the flue to cut it out of the boiler. As the cutters work into the flue, they will be held and moved outwardly as the cut deepens by the movement of the tapered pin and the action of the fluid pressure on the piston 15, and thus the cutters will be held constantly and automatically to the work. As soon as the fluid pressure is relieved in the cylinder, the pin will be retracted and the cutters withdrawn within the periphery of the barrel out of engagement with the flue. It sometimes happens when the flue cutters are forced outwardly against the flue, that the cut will be inclined and if the barrel supporting the cutters is rigidly held against longitudinal movement, the edges of the cutters will be broken or damaged. This often happens when one end of the flue has been cut, and the tool is applied to the other end. To prevent this breakage, I provide a spring washer 5' located between the sleeve 5 and the end of the cylinder. This sleeve fits snugly in the open end of the flue, and when the cut made by the revolving cutters is slightly inclined or has an inward drawing action on the edges of the cutters which would tend to break them, the spring washer yields sufficiently to allow the barrel to move inward and the cutters to accommodate themselves to the position of the cut. I have found this spring washer an important adjunct to the tool.

Fig. 4 illustrates in cross section the manner of mounting the radially moving carriages on the tapered pin, dove tail grooves 38 being provided in the flat surfaces of the pin to receive correspondingly shaped tongues 39 on the carriages. Obviously the carriages will be forced in and out as the pin is reciprocated. I prefer however, to employ the spring device illustrated in Fig. 3 for withdrawing the carriage from its operative position.

In Fig. 5, I have shown a construction which consists in providing a gage collar 40 for the inner end of the cylinder adapted to receive the outer end of the flue and contact with the flue sheet. A flange 41 is provided

within said collar and adapted to contact with a shoulder 42 on the barrel 4, said collar taking the place of the tapered sleeve 5 and adapting the tool for cutting off the outer ends of the flues, it being necessary to merely place the collar over the end of the flue until it contacts with the flue sheet when the operator will know that the cutters are in position to cut off the flue at the proper point and leave sufficient stock for the formation of the bead on the end of the flue.

It will be noted that the cylinder and barrel operate continuously and it is unnecessary to stop the motor when it is desired to change the position of the cylinder and barrel.

I claim as my invention:

1. A flue cutter comprising a barrel, a cylinder in one end of which said barrel is mounted, a tapered pin arranged to slide in said barrel, a series of carriages mounted in said barrel and contacting with the tapered surfaces of said pin and having a radial movement in said barrel, a series of flue cutters carried by said carriages, a piston arranged in said cylinder and connected with said pin, a spring arranged within said cylinder and normally tending to hold said pin in its retracted position, means for applying fluid pressure to said piston to project said pin and move said cutters to an operating position, substantially as described, and means for revolving said cylinder and barrel continuously.

2. A flue cutter comprising a barrel, a pin arranged to slide lengthwise in said barrel and having a tapered forward end, carriages mounted in said barrel and having a radial movement and contacting with the tapered surfaces of said pin, a sleeve mounted on said barrel and having a tapered surface to fit the open end of a flue, a cylinder whereon said barrel is mounted, a piston therein, a spring arranged to normally hold said pin in a retracted or withdrawn position, means for applying a fluid pressure to said piston to project said pin and separate said flue cutter carriages, substantially as described, and means for revolving said cylinder and barrel continuously.

3. A flue cutter, comprising a barrel, a pin slidable therein and provided with a tapered end, carriages mounted in said barrel and contacting with said tapered end, flue cutters mounted in said carriages, a tapered sleeve carried by said barrel and adapted to fit into the open end of a flue, said sleeve being removable to adapt the device for cutting off the projecting ends of flues, a cylinder wherein said barrel is mounted, a piston in said cylinder and a spring arranged to hold said piston and pin in a retracted position and means for applying a fluid pressure to said piston to project said pin, substantially as described.



4. A flue cutter comprising a barrel, a pin having a tapered end that is triangular in cross section and provided with three flat surfaces, carriages fitting within openings in said barrels and contacting with said surfaces, springs provided within said openings on each side of said carriages and normally tending to withdraw said carriages within said openings, flue cutters mounted in said carriages and means for projecting said pin to support said carriages.

5. A flue cutter, comprising a cylinder closed at each end, a barrel tapped into one end of said cylinder, a pin slidable within said barrel and having a tapered end, carriages fitting within openings in said barrel, and contacting with said pin, flue cutters mounted in said carriages and adapted to be moved outwardly by the forward movement of said pin, a piston mounted on said pin within said cylinder, a spring for normally holding said piston and pin in a retracted position and means for applying fluid pressure to said piston to project said pin and means for revolving said barrel and said cylinder continuously.

6. A flue cutter comprising a barrel, carriages having a radial movement in said barrel, flue cutters mounted in said carriages, means for revolving said barrel and means for simultaneously imparting a radial movement to said carriages, substantially as described, the means for revolving said barrel operating independently of the means for imparting a radial movement to said carriages.

7. In a flue cutter, a cylinder having a piston, a tapered shank mounted on one end of said cylinder and having a fluid pressure passage leading into said cylinder, a spindle wherein said tapered shank is inserted, a union mounted on said shank and held against longitudinal movement thereon, and having a threaded connection with said spindle and normally holding said spindle and shank together, but adapted when revolved, to separate them, substantially as described.

8. A flue cutter comprising a barrel, a tapered pin reciprocating therein, radially moving carriages mounted in said barrel, revolving flue cutters mounted in said carriages, a tapered sleeve carried by said barrel and adapted to fit into the end of a flue and yielding means interposed between said sleeve and a stop provided on said barrel,

and permitting said cutters to adjust themselves to the position of the cut in the flue, substantially as described.

9. In a flue cutter, a barrel, radially moving carriages and means for operating the same, flue cutters mounted in said carriages, a tapered sleeve mounted on said barrel and adapted to fit into the open end of a flue, a cylinder connected with said barrel and a spring washer interposed between said sleeve and cylinder, substantially as described.

10. A flue cutter comprising a barrel, radially moving carriages therein, flue cutters mounted in said carriages, means for revolving said barrel and carriages and a fluid pressure actuated device for moving said carriages and cutters outwardly into working engagement with the flue, substantially as described, the means for revolving said barrel operating continuously and independently of the means for actuating said carriages.

11. A flue cutter comprising a barrel, radially moving carriages therein, cutters mounted in said carriages, a tapered pin having surfaces contacting with said carriages, a cylinder, a piston connected with said pin, a spring device for normally holding said piston in a retracted position, means for revolving said cylinder and barrel and means for simultaneously admitting fluid pressure to said cylinder to project said pin and separate said carriages, said cylinder revolving means operating continuously and independently of the means for projecting said pin.

12. A flue cutter, comprising a barrel, radially moving carriages therein, cutters mounted in said carriages, a tapered pin having surfaces contacting with said carriages, a cylinder, a piston therein connected with said pin, a spring normally holding said piston in a retracted position, a continuously revolving shaft geared to said cylinder and barrel for continuously revolving the same and means concentric with the longitudinal axis of said cylinder and barrel for admitting fluid pressure to said cylinder to project said pin.

In witness whereof, I have hereunto set my hand this 27th day of June 1908.

JOHN T. FUHRMANN.

Witnesses:

RICHARD PAUL,  
J. A. BYINGTON.