

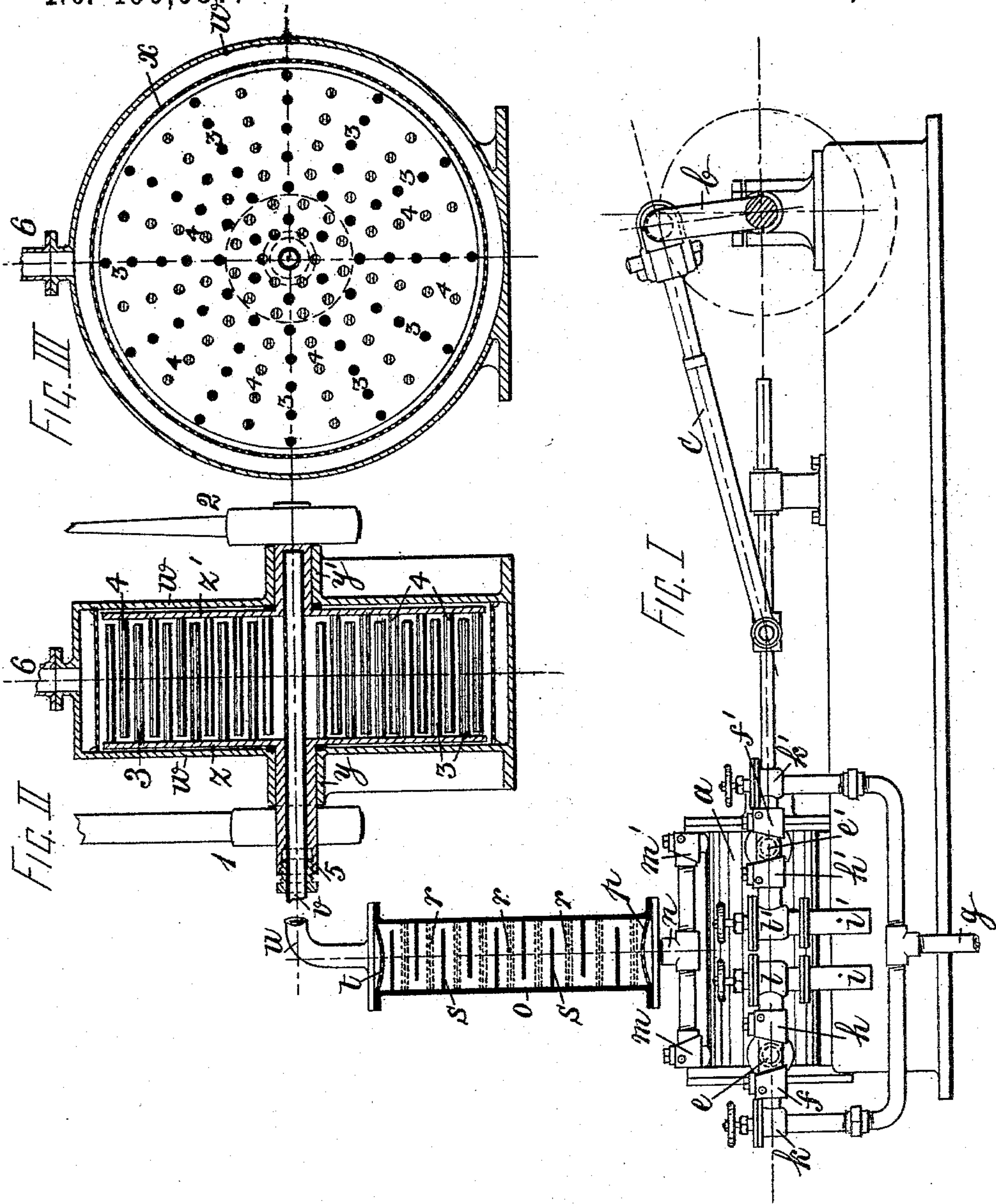
(No Model.)

2 Sheets—Sheet 1.

W. SMETHURST & J. WADE.  
APPARATUS FOR MIXING GAS AND AIR.

No. 490,087.

Patented Jan. 17, 1893.



Witnesses:  
John C. Wilson,  
Roy C. Bowen

Inventors:  
William Smethurst &  
James Wade  
By Whitman & Wilkinson  
Attorneys.

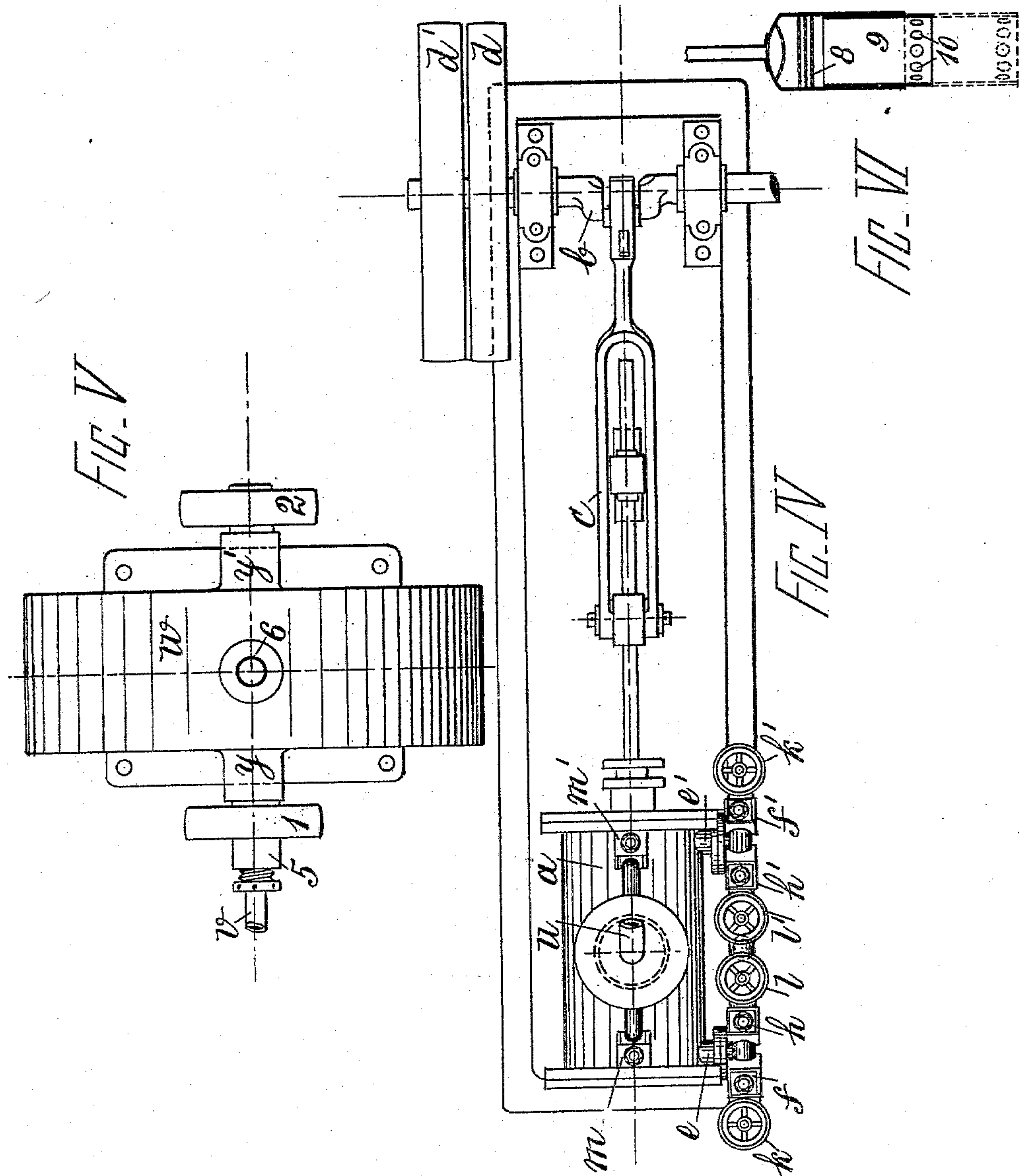
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# UNITED STATES PATENT OFFICE.

WILLIAM SMETHURST AND JAMES WADE, OF LONDON, ENGLAND.

## APPARATUS FOR MIXING GAS AND AIR.

SPECIFICATION forming part of Letters Patent No. 490,087, dated January 17, 1893.

Application filed March 28, 1892. Serial No. 426,804. (No model.)

*To all whom it may concern:*

Be it known that we, WILLIAM SMETHURST and JAMES WADE, engineers, subjects of the Queen of Great Britain, residing at London, in the county of Middlesex, England, have invented a new and useful Improvement in Apparatus for Mixing Gas or Vapor and Air, of which the following is a specification.

Our invention relates to improvements in apparatus in which ordinary gas, or hydrocarbon vapor, is mixed with air, the mixture being used for heating and lighting, or other purposes in which gaseous or other fuel is ordinarily used. In making such mixtures it is necessary, in order that the full advantages may be obtained, that the mixture of the gas and vapor with air should be as intimate and complete as possible, in order that it may be permanent so that the combustible mixture may be conveyed to any desired distance by pipes or in vessels, and in order that when burned the combustion may be absolutely complete and without the necessity for the further addition of ordinary air.

The objects of our improvements are, first, to effect by simple and inexpensive means, the perfect and permanent mixture of gas or vapor with air, second to provide means for accurately regulating the relative proportions of gas or vapor and air in the mixture, third, to make the mixture more intimate, perfect and permanent, than has heretofore been the case, and fourth, to enable the mixture to be burned under water. We attain these objects by the apparatus illustrated in the accompanying drawings in which:—

Figure I is a side view, partly in section, of the mixing pump, regulating valves and mixing chamber, Figs. II III are longitudinal and transverse vertical sections of the mechanical mixer by which the most perfect mixture is obtained, Fig. IV is a plan of Fig. I, Fig. V is a plan of the mixing device shown in Figs. II and III and Fig. VI is a section of the device which we prefer to use for burning the mixture of gas or vapor and air under water.

Similar letters and figures of reference refer to similar parts throughout the several views.

*a* is a double acting pump consisting of a cylinder containing a piston which is made to reciprocate by a crank *b* and connecting rod

*c* set in revolution by the fast and loose pulleys *d, d'*, driven by steam or other power.

*e, e'*, are inlet openings to the cylinder *a*, provided with gas inlet valves *f, f'*, communicating with the gas supply pipe *g*, and air inlet valves *h, h'*, through which air is drawn from the pipes *i, i'*. Each of the gas and air inlet pipes is provided with a separate adjustable regulating valve *k, k'*, and *l, l'*, by which the relative proportions of the gas or vapor and air can be exactly determined and varied as may be desired.

*m, m'*, are outlet or delivery valves from the cylinder *a* by which the gas and air drawn together into the latter are delivered through the passage *n* into the mixing chamber *o*. The inlet into the chamber is covered by a perforated plate or wire gauze *p*, and the chamber *o* itself is provided with a number of transverse partitions *r, r, r*, each consisting of one, two, three, or more thicknesses of fine wire gauze or perforated plates. Between these partitions are arranged baffle plates *s, s, s*, each having an opening or openings through one edge only, the openings being arranged alternately as shown so that the opening through one plate is at the opposite edge to the openings through the plates above and below it. The mixed air and gas or vapor pass through a perforated plate or wire gauze *t* at the upper end of the chamber *o* and are delivered in a well mixed condition through the pipe *u*, shown broken off. The mixture then passes into the pipe *v* arranged in the center of the mechanical mixer shown in Figs. II, III, and V, which may be placed in any convenient position in relation to the mixing chamber *o*. This mixer consists of a cylindrical case *w*, within which is fixed a concentric cylinder *x*, of finely perforated plate or wire gauze, a space being left between them.

In the ends of the cylindrical case *w* are formed bearings *y, y'*, in which revolve shafts or spindles upon disks *z, z'*, one of which revolves close to each of the ends of the case *w*. The disks are driven by pulleys and belts 1, 2, upon their spindles, so arranged that the disks revolve in opposite directions, and upon the face of each disk are formed or fixed a number of projecting arms or bars 3 and 4, those upon one disk being arranged so that as they revolve they pass between those



upon the other disk. The part of the pipe  $v$  between the disks  $z, z'$ , is perforated with numerous small holes, and its end passes out through a stuffing box 5 upon the spindle of one of the disks. A discharge pipe 6 is connected to any part of the circumference of the case  $w$ , through which the now perfectly mixed gas or vapor and air are conveyed away and burned in suitable burners. 10 The air and gas or vapor are so perfectly mixed that no further addition of air is necessary for perfect combustion, and the mixture will therefore burn, if at sufficient pressure, under water. For this purpose we use 15 the burner shown in Fig. VI, consisting of a chamber open at one end into which the mixture is admitted through the pipe 7 at the other end. A number of thicknesses of wire gauze 8 are arranged in the form of a diaphragm across the chamber, and the mixture 20 after passing through them can be ignited and burned, and being absolutely and perfectly combustible without further mixture of air, it will burn readily under water, which is thereby very rapidly heated. The wire gauze 25 8 forming the diaphragm prevents the flame from passing back into the pipe 7, in the event of the pressure under which the gas is forced out ceasing from any cause, and safety 30 is thus insured.

An adjustable inner tube 9 open at both ends is fitted into the open end of the chamber, and is provided with openings 10 near its lower edge, through which the hot products 35 of combustion escape and rise up through the water, the inner tube being raised or lowered to any desired position.

Instead of one pump  $a$ , two or more may be used, and they may be arranged vertically 40 or in any convenient position.

The chamber  $o$  may contain any desired number of porous partitions  $r$ , and baffle plates  $s$ , and where a less perfect mixture of the gas or vapor and air is required, the mixture 45 may be conducted directly from the chamber  $o$  to the burner where it is to be used without passing through the mechanical mixer shown in Figs. II, III, and V; or on the other hand the said mechanical mixer may be used 50 without the mixing chamber  $o$ .

In order to insure the more perfect rotation of the disks  $z, z'$ , the spindles upon them may be prolonged and additional bearings

provided for them outside the pulleys and belts 1, 2.

We are aware that apparatus has been used to perfect the mixture of gas and air, to form a combustible mixture, but such apparatus has been expensive, cumbrous, and only partially effective for the purpose required, and 50 we do not claim broadly the mechanical mixture of inflammable gas or vapor with air, but

What we claim as our invention, and desire to secure by Letters Patent is:—

1. In an apparatus of the character described, the combination with a pump having valves regulating the quantity and relative amounts of gas or vapor and air admitted to said pump, of a mixing chamber receiving 55 said gases from said pump, a mixer connected to said mixing chamber, the said mixer consisting essentially of a hollow cylinder inclosing a perforated cylinder, two disks revolving in opposite directions in said inner cylinder, and inter-penetrating arms oppositely 60 disposed connected to the said disks; and an eduction pipe from said mixer, substantially as and for the purposes described.

2. In an apparatus of the character described, the combination with a pump having valves regulating the quantity and relative amounts of gas or vapor and air admitted to said pump, of a mixing chamber  $o$  having perforated partitions  $r$  and baffle plates  $s$  65 between said perforated partitions, the said baffle plates having apertures at alternate ends, the said mixing chamber receiving said gases from said pump, a mixer connected to said mixing chamber, the said mixer consisting essentially of a hollow cylinder inclosing a perforated cylinder with two disks revolving 70 in opposite directions in said inner cylinder, and inter-penetrating arms oppositely disposed connected to the said disks; and an eduction pipe from said mixer, substantially as and for the purposes described.

In testimony whereof we have hereunto set our hands in the presence of two subscribing witnesses.

WILLIAM SMETHURST.  
JAMES WADE.

Witnesses:

ARTHUR E. EDWARDS,  
REGINALD POOLEY,