

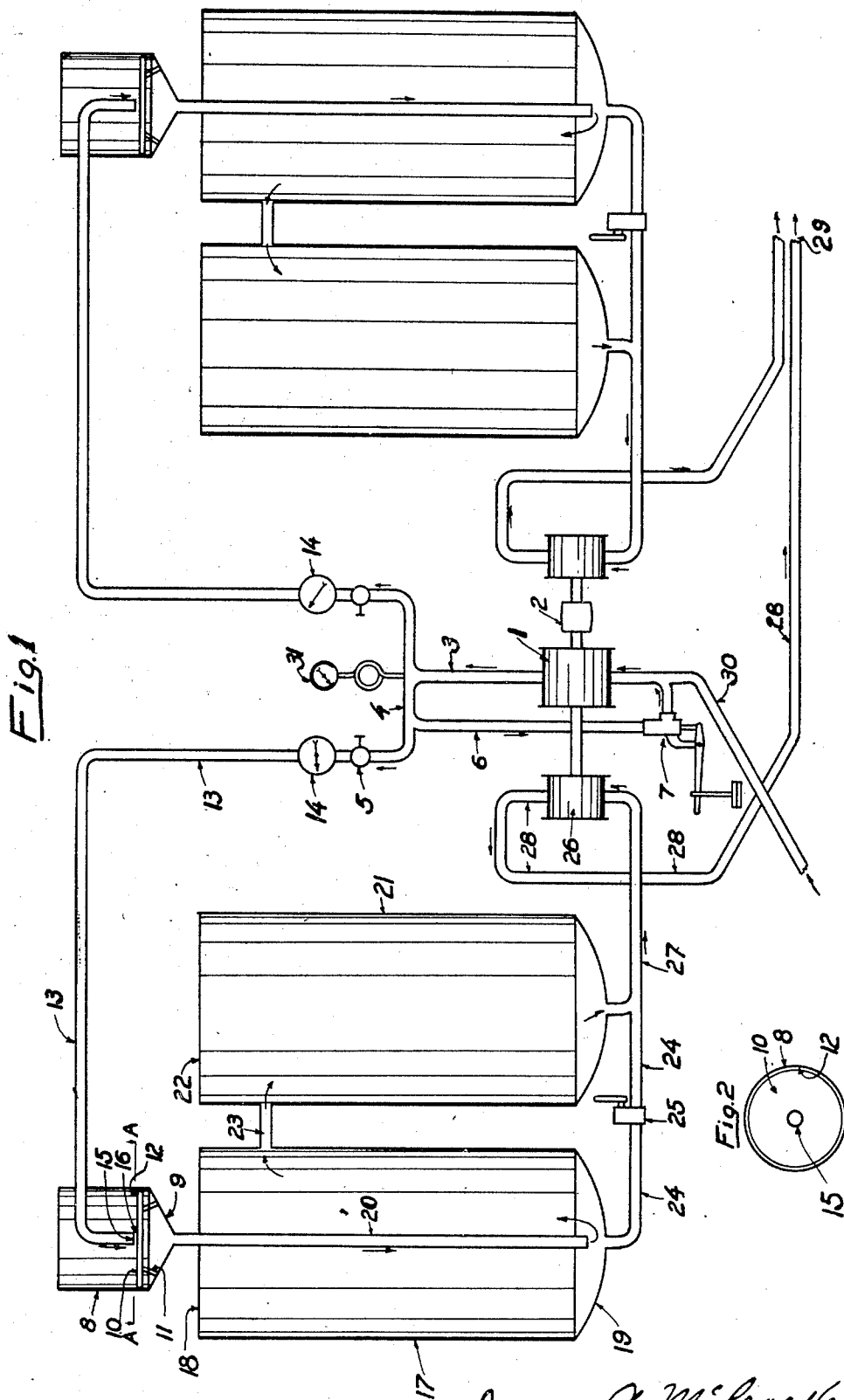
Nov. 11, 1930.

J. A. McCracken

1,781,295

METHOD AND MEANS OF CONTINUOUS PRODUCTION OF FIRE FOAM

Filed Sept. 28, 1927



James A. McCracken
INVENTOR

UNITED STATES PATENT OFFICE

JAMES A. McCracken, OF LOS ANGELES, CALIFORNIA

METHOD AND MEANS OF CONTINUOUS PRODUCTION OF FIRE FOAM

Application filed September 28, 1927. Serial No. 222,638.

My invention relates to the continuous production of solutions of the chemicals used to produce a fire extinguishing foam.

My invention relates more particularly to a method by which, water being available in the neighborhood of a fire, foam may be continuously generated on the spot by the use of light and simple machinery such as may readily be attached to a small high speed truck, obviating the requirement for storage or transportation of solutions or for pumping such solutions for any long distance.

The manner of extinguishing fires with foam is well known and understood. It consists in applying to the burning surface or liquid a froth produced by intermixing solutions of (a) aluminum sulfate (b) sodium bicarbonate and a stabilizing agent such as licorice. On mixing these solutions carbon dioxide is set free, aluminum hydrate is precipitated in gelatinous form, and the licorice acting to increase the surface tension of the liquid, a very dense and permanent froth consisting substantially of water and having a high value for extinguishing fires is produced. This foam is flowed or sprayed over surfaces of burning liquids, and is plastered over burning wood by ejection under pressure through a nozzle.

In a system of fire protection which has heretofore been much used the two solutions are prepared in advance, stored until required for use, and conducted to the seat of the fire through separate pipe lines under the pressure generated by pumps located near the storage tanks. The solution of aluminum sulfate is acid and corrosive to metal, and if left standing in lines will put them out of commission. Both solutions depreciate somewhat on standing and must be checked and restandardized, and the pumps tested at frequent intervals.

As the solutions are bulky a large amount of storage (half of which must be lead lined) must be provided for the protection of a risk such as an oil refinery. In addition there must be a complete system of double pipe lines extending to all parts of the area to be protected. Attempts to mix the solutions near the storage plant and conduct the foam

through a single line have not been successful, owing to the breaking down of the foam by pressure and friction in transit. The storage and pipe line system heretofore used, while in most cases quite efficient, has therefore proven extravagantly expensive to install and to keep in operating condition.

A type of portable extinguisher has heretofore been used which comprises tanks for the chemicals and pumps for forcing and mixing them. Such portable units, even when mounted on motor trucks, have had a very limited capacity, because of the great weight of water to be transported; the total solution consisting substantially of one part by weight of active chemical to eight parts by weight of water. Thus a portable unit having a net weight of ten tons (a very large size) would consist of about one ton machinery and tank, eight tons water and one ton actual fire extinguishing material.

Another type of portable extinguisher in which the solutions are prepared in advance, intermixed by inverting the container, and discharged by the pressure of the liberated carbon dioxide, have heretofore been used. This type has proven highly inefficient due to the extreme degeneration of the foam by the high pressure generated in the apparatus by the liberated gas.

By the application of my present invention all the advantages of the permanent storage system may be retained while the entire standing system of storage tanks and pipe lines may be dispensed with and an unlimited quantity of foam produced from a portable unit which, if a supply of water (not necessarily under pressure) is available, needs to be supplied only with chemicals to enable it to fight a fire of the first magnitude.

My invention consists in a method of fighting fires with foam continuously produced from dry chemicals and water brought into solution, at a point adjacent to the seat of the fire and intermixed at or in the fire itself, and of a suitable means for continuously bringing the chemicals into solution. A preferred means for carrying out my method

invention is diagrammatically illustrated in the attached drawings, in which

Figure 1 is a longitudinal section of a complete apparatus, and

Figure 2 is a plan section on the line A—A of Figure 1.

Referring to Figure 1, it will be noted that the drawing is symmetrical and represents duplicated apparatus, one side being adapted to the preparation of the acid, the other of the alkaline solution. Only one side of this apparatus will be described and it will be understood that this description applies equally to the other.

1 is any pump for lifting water, as for example a rotary gear pump driven by means of a pulley 2 from a source of power not shown. This pump takes suction from any supply of water through a pipe 30 and discharges through a pipe 3 into a branch bifurcated pipe 4 controlled by a valve 5. As the delivery of such a pump at constant speed might exceed the required water supply, it is desirable to provide the bypass line 6 controlled by a snifting valve 7 to return any excess delivery into the pump suction. It will be noted that while the balance of the apparatus is in duplicate, only a single water pump unit with its bypass is required.

8 is a vessel with an open top and having preferably a conical bottom 9. Inside this vessel and just above the upper end of the cone is placed a circular metallic plate 10, which may be supported by the studs 11 or otherwise, but which should be fixed in a horizontal position. This plate should be enough smaller than the circular section of vessel 8 to leave the narrow annular channel 12, which may be perhaps one-eighth inch in width, depending on the size of the vessel.

Water enters vessels 10 through leg delivery pipes 13 which communicate with valves 5. At a convenient point in these pipes are interposed watermeters 14 which are preferably so graduated that some convenient unit of measurement (as, for instance, one hundred gallons) is indicated by one complete revolution of the hand. If, then, the two meters 14—14 be exact duplicates in capacity, delivery of water to the two sides of the apparatus may be kept exactly equal by so regulating the control valves 5 as to keep the hands moving in unison.

It is desirable but not essential that the water supply to the two sides of the apparatus be equal, but it is quite essential that the quantities of chemicals supplied to the two sides be properly proportioned, as set forth below, and that sufficient water be added to each side to bring each dose of chemical into complete solution.

The lower end 15 of the pipe 13 is approached somewhat closely to plate 10, leaving a gap 16 between the plate and the accurately squared end of the pipe. The free

area of this gap may be approximately one-half the internal area of the pipe.

Vessel 8 is supported in any manner, now shown, above a tank 17 which may be open at the top 18, and may have a conical or a sumped bottom as at 19. The vessel communicates with the tank through a pipe 20 which preferably extends nearly to the bottom of the tank and is open at both ends. Tank 17 communicates with a similar tank 21 in series, which is preferably open at the top as at 22, through a pipe 23 located, as shown, a short distance below the tops of the two tanks. The two tanks may also communicate at their lower ends through a pipe 24 in which is interposed a valve 25, preferably of the quick opening type.

A pump 26, which may be of the same type as pump 1 and of rather less than one-half the capacity at the same speed, takes suction on the bottom of tank 21 (if valve 25 is closed) or on both tanks 17 and 21 (if this valve is open) through the pipe 27. This pump discharges through the pipe 28, to the open end 29 of which is connected such conductor line as may be required for conveying the solution to the seat of the fire.

The operation of the above described apparatus is as follows. The suction pipe 30 of pump 1 being connected, as by a suction hose, with a pipe line, tank, pond or, in emergency, even with a tank wagon containing water, the three pumps are started, valves 5 being closed and the pump discharge returned to the suction through the bypass 6. The three pumps may conveniently be connected together as shown, and operated in unison. When the water pump is lifting properly, as indicated by a steady pressure on a pressure gauge 31, the valves 5 are opened and adjusted until the two meters indicate the same rate of flow, preferably a predetermined rate, as for example fifty gallons per minute. The water passing through the meter flows over plate 10 and through pipe 20 into vessel 17, from which it may be pumped onto the ground or back to the source of supply by opening valve 25 and making suitable connections to the open discharge end 29.

The proper rate of flow being established through each side of the apparatus, the dry powdered chemicals, which should be weighed out and packaged in advance, are dumped into the open vessels 8 without stopping the flow of water therethrough. The kinds and quantities of chemicals used are no part of my invention, but as an illustration I may suggest that one side of the apparatus be supplied with sixty pounds of aluminum sulfate, $(Al_2(SO_4)_3 \cdot 18H_2O)$ finely powdered and containing the water of crystallization, and the other side with a mixture consisting of thirty five pounds acid sodium carbonate $(NaHCO_3)$ with five pounds of dried and finely pulverized licorice extract

or other of the well known agents for increasing the surface tension of aqueous solutions. The first named body or its solution or equivalent is hereinafter known as "acid" agent, the second or its equivalent as "alkaline" agent. These agents are also referred to collectively as "foam producing agents" but it will be understood that the foam is actually produced only by intermixture of aqueous solutions of said agents, the water being an essential constituent of the foam.

The sheet of water emitted from the annular opening 16 spreads out laterally on and passes over plate or modulator 10 at a high velocity, and soluble powders dumped onto this moving sheet of water are rapidly cut away from beneath and brought into solution by the water, the solution passing over the edge of the plate through the annular opening 12 and thence through pipe 20 into tank 17. The powder as dissolved away at the bottom feeds down by gravity until all is dissolved, leaving vessel 8 empty. The rate of solution varies directly with the velocity of the water sheet, and by advancing or retracting the tip 15 of pipe 13 to or from plate 10 the rate of solution may be so controlled as to bring all the powder into solution by the time the corresponding quantity of water has been admitted. In the case illustrated, the quantities of each chemical would require one hundred gallons of water to produce a solution of standard strength so that at a water rate of fifty gallons per minute on each side two minutes would be allowed for dissolving a single charge.

Any powder remaining undissolved passes with the solution to the bottom of tank 17 where it is kept in constant agitation by the downflow through pipe 20 and the solution thus completed. Clear solution only flows through pipe 23 into tank 21, which acts solely as a storage or leeway tank and may, if preferred, be omitted, line 27 being then connected direct to line 23, which would in this case be extended downward inside tank 17 to approximately its center line.

The flow being once established and regulated, the apparatus requires no further attention than to feed into each solution vessel an appropriate quantity of powder (in the above case 60# and 40# respectively) at appropriate intervals (in the above case, intervals of two minutes). Delivery of the two solutions may then be made continuously from the unit above described for an indefinite period, so long as the supply of chemicals is maintained.

The sizes of the various parts constituting the above apparatus are in part subject to calculation and in part a matter of judgment or preference. The size of the solution pumps will be determined solely by the maximum requirement for solutions, which is a matter solely for the judgment of the opera-

tor. This requirement having been arrived at, the water pump must obviously have a capacity at least equal to the combined capacities of the two solution pumps, there being no material alteration in volume due to addition of the chemicals.

The size of the solution vessels 8 may be calculated as follows. For a delivery of fifty gallons solution per minute the larger dose of chemical would be the aluminum sulfate, of which sixty pounds would be added at one time. This powder as dumped loosely occupies a space of about twenty three cubic inches per pound, or ten pounds per gallon of space, requiring a net six gallons, which with say four gallons outage gives a volumetric capacity for the dissolving vessel of say ten gallons.

The tank 17 can be depended on to complete the solution of the powder in not to exceed five minutes; usually the solution is instantaneous if the water is not too cold. A capacity of 250 gallons for this tank is therefore quite sufficient, and a materially less capacity is permissible. The size of tank 21, if it is used, depends solely on the operator's judgment as to the need for storage. A second tank of 250 gallons capacity would give ten minutes supply after exhaustion of the last dose of powder.

As the machinery above described is used only at intervals and for short periods, too short for corrosion of iron by aluminum sulfate to be appreciable, the entire unit may be constructed of iron and steel, without linings or other acid proofing.

It will be understood that the two solutions are separately conducted to the seat of the fire and then intermixed in any usual or preferred manner to produce the foam which is the actual fire extinguishing agent. With these steps my present invention is not concerned, such invention residing broadly in the simultaneous and continuous production of the two solutions, from dry powdered chemicals and water when and as required for intermixture to produce foam, and more specifically in an apparatus for dependably and cheaply putting the said method invention into practice.

I claim as my invention:

1. The continuous method of producing a foam for extinguishing fires which comprises: producing a flow stream of water under pressure; dividing said stream into two streams of substantially equal volume; continuously metering said streams and maintaining each at a substantially constant volume; converting said streams into flowing water sheets; introducing onto each of said sheets at atmospheric pressure a body of comminuted foam producing agent contacting said sheet, one such body being of acid, the other of alkaline agent; continuously washing away portions of each of said bodies by the contact

of each with its appropriate water sheet; replenishing each of said bodies without interrupting said water streams as the material of said bodies is washed away; collecting each said sheet and the agent contained therein
5 in a retarded flowing mass under atmospheric pressure to permit complete solution of the agent and to provide a reservoir of solution; creating a flow stream under superatmospheric pressure of each of said solutions, and
10 separately conducting each of said streams to a point of intermixture thereof, for the production of foam at said point of intermixture.

2. The continuous method of bringing a
15 foam producing agent into solution which comprises: creating a flow stream of water under superatmospheric pressure; converting said flow stream into a substantially horizontal sheet of flowing water under substantially atmospheric pressure, and superposing
20 on said water sheet a continually replenished body of said agent in comminuted form.

3. An apparatus for continuously producing a foam for extinguishing fires, which
25 comprises: a means for creating two parallel flow streams of water under superatmospheric pressure; valve means and metering means for controlling said streams; means for converting each of said flow streams into a
30 substantially horizontal flowing sheet of water under substantially atmospheric pressure; means for retaining bodies of foam producing agents in superposed contact with said water sheets for producing solution of
35 said agents in the lower portions of said bodies; means for collecting the solutions so formed into flow streams under substantially atmospheric pressure; means for retarding the velocities of said streams, and means for
40 continuously and separately raising said streams to superatmospheric pressure and for conveying said streams to a point of intermixture thereof.

4. An apparatus for continuously producing a foam for extinguishing fires, which
45 comprises: means for producing two flow streams of water; means for converting said streams into horizontally flowing sheets of water under substantially atmospheric pressure; means for feeding a comminuted foam
50 producing agent onto each of said water sheets for producing solution of said agent by contact with said water; means for collecting said solutions into separate flow
55 streams under substantially atmospheric pressure, and means for raising said streams to superatmospheric pressure and for separately conveying said streams to a point of intermixture thereof.

60 In witness that I claim the foregoing I have hereunto subscribed my name this 14th day of September, 1927.

JAMES A. McCracken.